Finance Department
Fifty Raupp Blvd.
Buffalo Grove, IL 60089-2198
Phone 847-459-2525
Fax 847-459-7906

Design and Construction CAFT Facility Addendum #2

TO: Prospective Respondents and Other Interested Parties

FROM: The Village of Buffalo Grove Finance Department

ISSUE DATE: January 3, 2019

SUBJECT: ADDENDUM #2

Note: This Addendum is hereby declared a part of the original RFP documents and in case of conflict, the provisions in the following Addendum shall govern.

The following changes and clarifications shall be made to the RFP Documents for the Design and Construction CAFT Facility

Q1. Please provide the previous bid documents for the CAFT site. We are putting together a proposal and know that having this previous information will be beneficial in putting together a complete response to the RFP.

A1. See attached.

PROSPECTIVE RESPONDENTS ARE TO ACKNOWLEDGE RECEIPT OF ADDENDUM #2. PLEASE INCLUDE AND NOTE THIS ADDENDUM IN YOUR RESPONSE.

RESPONDENT: _____

SIGNED: _____ DATE: _____

TITLE : _____

Project Name: Village of Buffalo Grove CAFT

Commission No.: 173013
Date: 10-Aug-17
Time: 9:30 AM

BID TABULATION

Wold Architects and Engineers
110 N. Brockway St. - Suite 220
Palatine, Illinois 60067
847.241.6100 Fax: 847.241.6105

Bidders Name	Addendum Numbers	Bid Security	Base Bid			Remarks
Boller Construction 3045 W. Washington Street Waukegan, IL 60085 847-662-5566 847-662-7392	1	Y	$1,647,000.00			
Path Construction Central 125 E. Algonquin Road Arlington Heights, IL 60005 847-398-7100 847-398-7101	1	Y	$1,442,600.00			
R L Sohol General Contractor 14150 S. RT. 30 Ste 201 Plainfield, IL 60544 815-436-1177	1	Y	$1,401,000.00			
Schaefges Brothers 851 Seton Court Wheeling, IL 60090 847-537-3330 847-537-7439	1	Y	$1,579,000.00			
Stuckey Construction Co 2020 N. Lewis Ave Waukegan, IL 60087 847-336-8575						

Bidders Name	Addendum Numbers	Bid Security	Base Bid			Remarks
F.H. Paschen 5515 N East River Rd. Chicago, IL 60656 773-444-3474 773-693-0064						
Henry Bros. Co. 91 Christopher Way Fox Lake, IL 60020 847-973-0600						
JW Infrastructure 1600 West adam apartment 201 Chicago, IL 60612 812-212-9335 812-212-9333						
Reliable & Assoc. Construction 4106 S. Emerald Chicago, IL 60609 312-666-3626 312-666-1785						
Structures Construction LLC 2300 W Diversey Ave Chicago, IL 60647 773-598-8698 773-598-4780	1	Y	$1,372,597.00			
Tower Contracting 9500 Bormet Dr. Mokena, IL 60448 708-333-0903 708-339-7509						

Bidders Name	Addendum Numbers	Bid Security	Base Bid			Remarks

Wold Architects and Engineers
110 North Brockway Street, Suite 220
Palatine, IL 60067
woldae.com | 847 241 6100

Project Manual I

Divisions 00 - 13

Combined Area Fire Training Facility

Village of Buffalo Grove

Buffalo Grove, IL
July 7, 2017

Book 1 of 2

Set No: _____

Comm No: 173013

Wold Architects and Engineers
110 North Brockway Street, Suite 220
Palatine, IL 60067
woldae.com | 847 241 6100

Project Manual I

Divisions 00 - 13

Combined Area Fire Training Facility

Village of Buffalo Grove

Buffalo Grove, IL
July 7, 2017

Book 1 of 2

Set No: _____

Comm No: 173013

SECTION 00 01 01

PROJECT IDENTIFICATION PAGE

P R O J E C T M A N U A L

PROJECT IDENTIFICATION

BIDDING REQUIREMENTS

CONDITIONS OF THE CONTRACT

GENERAL REQUIREMENTS

AND SPECIFICATIONS FOR:

COMBINED AREA FIRE TRAINING FACILITY

851 KRAUS DRIVE
BUFFALO GROVE, ILLINOIS 60089

VILLAGE OF BUFFALO GROVE
BUFFALO GROVE, ILLINOIS 60089

Bid Time: 9:30 AM

Bid Date: Thursday, August 10, 2017

Bid Place: Buffalo Grove Village Hall
50 Raupp Boulevard
Buffalo Grove, Illinois 60089

SECTION 00 01 03

TITLE PAGE

PROJECT TITLE AND LOCATION:	COMBINED AREA FIRE TRAINING FACILITY 851 KRAUSE DRIVE BUFFALO GROVE, ILLINOIS 60089
OWNER:	VILLAGE OF BUFFALO GROVE
ARCHITECTS:	Wold Architects and Engineers 110 North Brockway, Suite 220 Palatine, Illinois 60067 Tel. (847) 241-6100
CIVIL ENGINEER:	Meritcorp Group 50 North Brockway, Suite 3-9 Palatine, Illinois 60067 Tel. (847) 496-4170
STRUCTURAL ENGINEER:	Johnson Wilbur Adams 175 North Washington Street Wheaton, Illinois 60187 Tel. (630) 653-9060
MECHANICAL ENGINEER:	Gage Consulting Engineers 1301 West 22nd Street, Suite 220 Oak Brook, Illinois 60523 Tel. (630) 472-0910
ELECTRICAL ENGINEER:	Gage Consulting Engineers 1301 West 22nd Street, Suite 220 Oak Brook, Illinois 60523 Tel. (630) 472-0910
DATE:	July 7, 2017

SECTION 00 01 05

PROFESSIONAL CERTIFICATIONS

COMBINED AREA FIRE TRAINING FACILITY

VILLAGE OF BUFFALO GROVE

Wold Architects and Engineers

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Architect under the laws of the State of Illinois.

July 7, 2017

Signature Date Registration

Matthew J Bickel

Typed Name

Meritcorp Group
Civil Engineer

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Illinois.

July 7, 2017

Signature Date Registration

James P. Meier

Typed Name

Johnson Wilbur Adams
Structural Engineer

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Illinois.

July 7, 2017

Signature Date Registration

Kent L. Adams

Typed Name

Gage Consulting Engineers
Mechanical Engineer

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Illinois.

July 7, 2017

Signature Date Registration

David P. McVey

Typed Name

Gage Consulting Engineers
Electrical Engineer

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Illinois.

July 7, 2017

Signature Date Registration

Eric Carlson

Typed Name

SECTION 00 01 10

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SECTION 00 11 13

BID AND CONTRACT DOCUMENTS

The Owner's Bid and Contract Documents are attached hereto.

Village of Buffalo Grove

Combined Area Fire Training Facility

Bid and Contract Documents

Finance Department
7/17/2017

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INVITATION TO BID

COMBINED AREA FIRE TRAINING FACILITY

The Village of Buffalo Grove (the "**Village**") herein invites you to submit a bid providing for a new Combined Area Fire Training(CAFT) facility at 851 Krause Dr. , Buffalo Grove Illinois, 60089 This project includes a new pre-engineered wood building, exterior aluminum windows and doors, hollow metal door frames, wood doors, decorative quartz floor coating, gypsum board and metal stud framing, insulation, painting, overhead doors, ceramic floor tile, plastic laminate millwork, site utilities, grading and excavating, paving, electrical power systems, lighting, plumbing, HVAC, etc..

PREVAILING WAGE ACT - The Village is an Illinois unit of local government and the Work hereunder is subject to the Illinois Prevailing Wage Act, 820 ILCS 130/0.01, et seq.

For information on how to receive a copy of the Bid Package and any addenda contact the Office of the Village Clerk at 847-459-2500 or visit the Village of Buffalo Grove procurement website at www.vbg.org/bids

Bidding documents, including the Proposal Form, Drawings and Specifications, will be on file at the McGraw Hill Construction Dodge Plan Room (St. Louis, MO) 314-781-2504; Reed Construction Market Data (Oak Brook, IL) (800) 699-8640; Illowa Builders Exchange (Rock Island) (309) 788-9260; Northern Illinois Building Contractor's Association (Rockford) (815) 229-5636; Greater Peoria Contractor's & Suppliers Association (Peoria) (309) 692-5710; Construction Resource Technology (888) 506-7613 and Master Builders of Iowa (DesMoines, IA) 1-800-362-2578.

American Reprographics Company, 640 North LaSalle Street, Suite 240, Chicago, Illinois 60654, phone (312) 372-8600 and fax (312) 337-2810, will provide complete sets of the Bidding Documents to prospective bidders and subcontractors. A non-refundable check in the amount of $50 made out to "Village of Buffalo Grove" for each set ordered are required. The following information must accompany the deposit: Company name, mailing address, street address, phone and facsimile numbers and type of bidder (i.e. General, Mechanical or Electrical Subcontractor to General, or other).

TIMELINE

9:30 AM local time Tuesday, August 1, 2017	Due date for all questions regarding the Work ("Question Due Date")
9:30 AM local time Thursday, August 10, 2017	Bid Proposals due to the Village ("Bid Due Date")

INSTRUCTIONS TO BIDDERS

QUESTIONS ON THE WORK

All comments, concerns and questions regarding the Work and these documents shall be addressed to Ben Bercher, Wold Architects via email at bbercher@woldae.com with the subject line "Combined Area Fire Training Facility". All comments, concerns and questions regarding the Work must be received by the 9:30 AM local time on the Question Due Date (defined above).

BID PROPOSAL DOCUMENTS

Each bidder must submit **three copies** of the following documents (collectively, the "**Bid Proposal**"):

1. Executed and notarized Public Contract Statement set forth on **Exhibit A**;
2. Completed Schedule of Prices set forth on **Exhibit B**;
3. Completed Reference List set forth on **Exhibit C**;
4. A list of the requested changes to the Contract citing the specific Article within the Contract and the specific change requested.

BID SECURITY

Along with the Bid Proposal, each bidder must submit with its Bid Proposal a bank draft, cashier's check, certified check or bid bond equal to at least five percent (5%) of the Total Contract Price, as set forth in their Schedule of Prices (the "**Bid Security**").

BID SUBMITTAL

Sealed Bid Proposals shall be delivered to the Village at the Office of the Village Clerk at 50 Raupp Boulevard, Buffalo Grove, Illinois 60089 on or before 9:30 AM local time on the Bid Due Date. Each bidder shall deliver their Bid Proposal along with their Bid Security in a sealed envelope or box. The envelope or box shall be marked or endorsed:

VoBG-2017-15 Bid for Village of Buffalo Grove, Illinois

COMBINED AREA FIRE TRAINING FACILITY

NO WITHDRAWAL OF BIDS

No Bid Proposal shall be withdrawn after the Bid Due Date without the consent of the Village for a period of sixty (60) calendar days after the Bid Due Date.

QUALIFICATION OF BIDDERS

It is the intention of the Village to award the Work only to a bidder who furnishes satisfactory evidence that they have the requisite qualifications, capital, experience, facilities and ability to complete the Work successfully, promptly, and within the time frame set forth in these documents.

The Village reserves to make such investigations as it deems necessary to determine the qualifications and ability of any bidder. To that extent, all bidders agrees to furnish to the Village any information and data requested by the Village in its investigation. Failure of a bidder to provide any information or data requested by the Village in its investigation will be grounds to reject that bidder from consideration for the Work.

INSTRUCTIONS TO BIDDERS

1. Bidders must inform themselves of all the conditions under which the Work is to be performed including, but not limited to, and where applicable, the structural integrity of the building, the conditions of the ground, building codes. No extra compensation will be given to any bidder who fails to apprise themselves of the conditions under which the Work is to be performed.
2. All changes requested by a bidder to the Contract must be submitted with their Bid Proposal.
3. Bidders shall be responsible, at their own expense, for all permits, business licenses and other licenses which may be required to complete the Work and required by local, county, state or federal government.

RESERVATION OF RIGHTS

The Village reserves the following rights regarding the bidding process:

1. The right to accept the Bid Proposal that is, in the Village's sole judgment, the best and most favorable to the interests of the Village and the public.
2. To reject the lowest bidder.
3. To accept any item or any portion in any Bid Proposal from any bidder.
4. To accept and incorporate corrections, clarifications or modifications following the Bid Due Date when doing so would not, in the Village's opinion, prejudice the procurement process or create any improper advantage to any bidder.
5. To waive irregularities and informalities in the procurement process or in any Bid Proposal; provided, however, that the waiver of any prior defect or informality shall not be considered a waiver of any future or similar defects or informalities, and bidders shall not rely upon, or anticipate, such waivers in submitting their Bid Proposal.
6. To disqualify any bidder that is found to have contacted the Village's personnel in any manner with regard to the Work.
7. The right to approve or disapprove of any or all subcontractors, or insist on no subcontractors, in connection with any Bid Proposal.
8. Reject any subcontractor from working on the Work if they are not listed in the Bid Proposal.
9. The Village shall hold the Bid Security, if any, from the two (2) lowest bidders until the Contract is signed for the Work.
10. Disqualify any bidder who requests changes to the Contract when such changes were not submitted with their Bid Proposal.

EXHIBIT A - PUBLIC CONTRACT STATEMENT

This Public Contract Statement (the "**Contract Statement**") has been executed by the below supplier, contractor or vendor (collectively the "**Contractor**") in order for the Village of Buffalo Grove to obtain certain information necessary prior to awarding a public contract. The Contract Statement shall be executed and notarized and submitted as part of the Bid Proposal.

CERTIFICATION OF CONTRACTOR/BIDDER

In order to comply with 720 Illinois Compiled Statutes 5/33 E-1 et seq., the Village of Buffalo Grove requires the following certification be acknowledged:

> The Contractor certifies that it is not barred from bidding or supplying any goods, services or construction let by the Village of Buffalo Grove with or without bid, due to any violation of either Section 5/33 E-3 or 5/33 E-4 of Article 33E, Public Contracts, of the Chapter 720 of the Illinois Compiled Statutes, as amended. This act relates to interference with public contracting, bid rigging and rotating, kickbacks, and bidding.

CERTIFICATION RELATIVE TO 65 ILCS 5/11-42.1.1

In order to comply with 65 Illinois Complied Statutes 5/11-42.1.1, the Village of Buffalo Grove requires the following certification:

> The Contractor does hereby swear and affirm that it is not delinquent in the payment of any tax administered by the Illinois Department of Revenue unless it is contesting such tax in accordance with the procedures established by the appropriate revenue act, its liability for the tax or the amount of the tax. The undersigned further understands that making a false statement herein: (1) is a Class A misdemeanor, and (2) voids the contract and allows the Village to recover all amounts paid to it under the contract.

CONFLICT OF INTEREST

The Village of Buffalo Grove Municipal Code requires the following verification relative to conflict of interest and compliance with general ethics requirements of the Village:

> The Contractor represents and warrants to the Village of Buffalo Grove as a term and condition of acceptance of their Bid Proposal that none of the following Village officials is either an officer or director of Contractor nor owns five percent (5%) or more of the Contractor: the Village President, the members of the Village Board of Trustees, the Village Clerk, the Village Treasurer, the members of the Zoning Board of Appeals and the Plan Commission, the Village Manager and his/her Assistant, or the heads of the various departments within the Village.

If the foregoing representation and warranty is inaccurate, state the name of the Village official who either is an officer or director of your business entity or owns five percent (5%) or more thereof:
_____.

IN WITNESS WHEREOF, the below Contractor has signed and sealed this Contract Statement as of this ____ day of _____, 20___.

_____
Print Name of Contractor

_____
Signature

_____
Print Title

Given under my hand and official seal, this _____ day of _____, 20___.

_____
Notary Public

EXHIBIT B - SCHEDULE OF PRICES

Name of Bidder:

_____

Address of Bidder:

_____

City _____ State _____ Zip _____ Telephone _____

Email Address: _____

The Bidder declares, represents and warrants that it has read and agrees to abide by the terms, conditions and obligations set forth in the Invitation to Bid. In particular, the Bidder declares, represents and warrants that it has informed itself of all the conditions under which the Work is to be performed including, but not limited to, and where applicable, the structural integrity of the building, the conditions of the ground, building codes. Bidder waives any right to additional compensation for failure to make itself aware of the afore-mentioned conditions.

Bidder further declares that if their Bid Proposal is accepted, that Bidder will enter into the Contract in the same form as set forth in the Bid and Contract Documents. However, Bidder may request changes to the Contract by submitting with this Schedule of Price a list of requested changes to the Contract.

If this bid is accepted, and the undersigned fails to (**i**) contract as aforesaid, (**ii**) provide the Performance Bond required by the Contract, and (**iii**) provide all insurance required under the Contract within fifteen (15) calendar days after the date of the award of the Contract then the Village, at its option, may determine that the bidder has abandoned this Bid, and thereupon this Bid and the acceptance thereof shall be null and void, and such security accompanying this Bid shall be forfeited and shall be the property of the Village of Buffalo Grove not as penalty, but as liquidated damages.

BID SECURITY

Accompanying this Bid is a _____

in the amount of _____ Dollars

($_____).

Note: (a) Insert the words "Bank Draft", "Cashier's Check", "Certified Check" or "Bid Bond", as the case may be.

(b) Amount must be equal to at least five percent (5%) of the Total Base Bid.

EXHIBIT B - SCHEDULE OF PRICES (cont.)

A. BASE BID

_____

_____Dollars ($_____).

Each Bidder shall attach a Schedule of Values showing bid breakdown and estimated itemized costs of base bid total costs. An example of which is shown on the following page

EXHIBIT B - SCHEDULE OF PRICES (cont.)

SCHEDULE OF VALUES

Scope					Base Price
Site Grading / Earthwork					
Site Utilities					
Concrete and Paving					
Fencing					
Building Concrete					
Carpentry					
Pre-Engineered Wood Bldg					
Masonry Veneer					
Exterior Doors					
Interior Walls and Framing					
Interior Doors and Hardware					
Acoustic Ceilings					
Decorative Quartz Flooring					
Painting					
Tile					
Millwork and Countertops					
Toilet Room Accessories					
Plumbing					
HVAC					
Fire Protection					
Electrical					
General Conditions					
Overhead and Profit					
Insurance					
Bonds					
A. BASE BID					

EXHIBIT B - SCHEDULE OF PRICES (cont.)

SUBCONTRACTOR LISTING

Bidder, to employ the following listed subcontractors for the following enumerated classes of work and is not to alter or add to such list without the written consent of the Village.

	SUBCONTRACTOR	CLASS OF WORK
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____

ACKNOWLEDGEMENT OF ADDENDA

Acknowledgement of receipt of Addenda(s)_____(list each addendum number)

Attach each signed addendum, if any, to the bid packet as part of your submittal.

CONTRACTOR SIGNATURE and CONTACT INFORMATION

_____ _____
Date Phone

_____ _____
Legal Entity E-mail

_____
(Sign here)

_____
(Print Name)

EXHIBIT C – REFERENCE LIST

Contact Name: _____

Municipality/Business: _____

Dates Employed: _____ to _____

Phone Number or E-mail address: _____

Contact Name: _____

Municipality/Business: _____

Dates Employed: _____ to _____

Phone Number or E-mail address: _____

Contact Name: _____

Municipality/Business: _____

Dates Employed: _____ to _____

Phone Number or E-mail address: _____

Contact Name: _____

Municipality/Business: _____

Dates Employed: _____ to _____

Phone Number or E-mail address: _____

COMBINED AREA FIRE TRAINING FACILITY CONTRACT

COMBINED AREA FIRE TRAINING FACILITY CONTRACT (the "**Contract**") is entered between the Village of Buffalo Grove (hereinafter the "**Village**"), an Illinois home-rule unit of government, and _____ an [_____] (hereinafter the "**Contractor**") on this _____ day of _____, 2017 (the "**Effective Date**"). The Village and the Contractor are hereinafter sometimes collectively referred to as the "**Parties**" and individually as a "**Party**".

RECITALS

WHEREAS, the Village has solicited bids for the Work (defined below), Contractor has submitted a bid for the Work and Village has selected Contractor for the Work based on their bid; and

WHEREAS, the Contractor wishes to enter into this Contract with the Village and the Village wishes to enter into this Contract with the Contractor for the Work;

NOW THEREFORE, for and in consideration of the mutual covenants and promises herein contained, the adequacy and sufficiency of which are hereby acknowledged by the Parties, it is agreed as follows:

ARTICLE I - WORK TO BE DONE BY THE CONTRACTOR

The Village does hereby hire and contract with the Contractor to provide all the labor, equipment, materials and/or services described more thoroughly on Contract **Exhibit A** (the "**Work**") which is incorporated into the Contract by this reference.

ARTICLE II - CONTRACT DOCUMENTS

The following exhibits are attached hereto and incorporated herein by this reference:

Contract Exhibit A – Description of the Work
Contract Exhibit B – Schedule of Prices
Contract Exhibit C – Performance Bond
Contract Exhibit D – Partial Lien Waiver
Contract Exhibit E – Final Lien Waiver

If any term or provision of this Contract shall conflict with any term or provision of the exhibits referenced above, the terms and provisions of the exhibit shall control.

ARTICLE III - CONTRACT AMOUNT

The Village agrees to pay the Contractor for the proper and timely performance of the Work in strict accordance with this Contract as detailed in **Contract Exhibit B (**the **"Schedule of Prices")** Unless explicitly provided otherwise in the Contract, the detailed sums shall be the full and exclusive compensation owed to the Contractor for the Work; and Contractor may not seek additional payments from the Village.

ARTICLE IV – APPLICATION FOR PAYMENT

The Contractor shall be paid at most once a month and only after providing the Village the following:

1. An executed and notarized Contractor's Sworn Statement in a form similar to AIA G702 or AIA G703;
2. Either a partial or final lien waiver from every subcontractor, sub-subcontractor, or materialman in substantially the same form as attached here as **Contract Exhibit D** and **Contract Exhibit E**;
3. If applicable, a certified payroll necessary for the Prevailing Wage Act; and

All payments under this Contract must be approved by the Village's Board at regularly scheduled meetings. The Village reserves the right to request any receipts, invoices, proof of payments as the Village, in its sole discretion, may deem necessary to justify the payment requested *prior* to paying the requested payment. The Contractor shall furnish with his final application for payment a Final Lien Waiver from itself and, if not already provided, from every subcontractor and materialman of the Work.

The Contractor acknowledges that the Village is a unit of local government and that all payments under the Contract are subject to the Local Government Prompt Payment Act, 50 ILCS 505 et seq. To that extent, the Village shall have forty-five (45) days from receipt of a bill or invoice to pay the same before it is considered late under the Contract. Interest, if any, charged for any late payments will be subject to the interest rate caps specified in the Prompt Payment Act.

ARTICLE V – CONTRACT TIME

The Contractor shall fully, and not substantially, complete all the Work and the Work shall be accepted by the Director of Public Works, provided that acceptance by the Director of Public Works shall not be unreasonably delayed, on or before Saturday, December 30, 2017.

If the Contractor shall fail to complete the work within the Contract Time which shall include any proper extension granted by the Village, the Contractor shall pay to the Village an amount equal to Seven Hundred Fifty dollars ($750) per calendar day for each day past the Contract Time until final acceptance by the Village.

ARTICLE VI – PERFORMANCE BOND

The Contractor shall provide the Village with a performance bond in substantially the same form as on **Contract Exhibit C** (the "**Performance Bond**") prior to Contractor beginning any Work and within 10 calendar days of the Notice of Award sent to the Contractor.

ARTICLE VII – ACCIDENT PREVENTION

The Contractor shall exercise every precaution at all times to protect itself, the property of the Village and the property of others. The safety provision of all applicable laws and ordinances shall be strictly observed by the Contractor at all times. Any practice deemed hazardous or dangerous by the Director of Public Works or his authorized representatives shall be immediately discontinued by the Contractor upon receipt of instructions from the Director of Public Works or his authorized representatives. To the fullest extent permitted by law, the Contractor shall be solely responsible for all safety-related matters.

ARTICLE VIII – INDEMNIFICATION

To the fullest extent permitted by law, the Contractor agrees to defend, pay on behalf of, indemnify, and hold harmless the Village, its elected and appointed officials, agents, employees and volunteers and others working on behalf of the Village against any and all claims, demands, suits or loss, including all costs connected therewith, and for any damages which may be asserted, claimed or recovered against or from the Village, its elected and appointed officials, agents, employees and volunteers and others working on behalf of the Village, by reason of personal injury, including bodily injury and death, and/or property damage, whether damage to property of the Village or of a third party, including loss of use thereof, which arises out of or is in any way connected or associated with the Contract and the Work.

ARTICLE IX – INSURANCE

A. LIMITS OF INSURANCE – For the entire duration of this Contract, Contractor shall maintain insurance against claims for injuries to persons or damages to property which may arise in connection with the performance of the Work as follows:

1. **Commercial General Liability Insurance –** The Contractor shall maintain commercial general liability insurance on an "occurrence basis" with limits of liability not less than $3,000,000 per occurrence and/or aggregate combined single limit, personal injury, bodily injury and property damage. Coverage shall include the followings: (A) Contractual Liability; (B) Products and Completed Operations; (C) Independent Contractors Coverage; (D) Board Form General Liability Extensions or Equivalent; (E) Deletion of all Explosion, Collapse, and Underground (XCU) Exclusions; and (F) Per contract aggregate. All general liability coverage shall be provided on an occurrence policy form, claims-made general liability policies will not be accepted.
2. **Motor Vehicle Liability Insurance –** The Contractor shall maintain motor vehicle liability insurance with limits of liability of not less than $3,000,000 per accident combined single limit Bodily Injury and Property Damage. Coverage shall include all owned vehicles, all non-owned vehicles and all hired vehicles.
3. **Workers Compensation –** The Contractor shall maintain workers compensation insurance as required by the Labor Code up to the statutory limits and employer's liability limits of $500,000 per accident.
4. **Environmental Impairment/Pollution Liability –** The Contractor shall maintain environmental impairment/pollution liability insurance of not less than $1,000,000 combined single limit per occurrence for bodily injury, property damage and remediation costs.
5. **Builders Risk Property Coverage –** The Contractor shall maintain builders risk property coverage insurance in an amount equal to the sum of payments under Article III owed to the Contractor.

B. REQUIREMENTS FOR ALL INSURANCE – All insurance required under this Article IX shall be placed with an insurance carrier licensed and admitted to do business in the State of Illinois with an A.M. Best Ratings of at least A- and size of VII. Further, all insurance required under this Article IX shall name the Village, its elected and appointed officials, agents, employees and volunteers as an additional insured and shall contain a Severability of Interests/Cross Liability clause stating that the Contractor's insurance shall apply separately to each insured against whom a claim is made or suit is brought, except with respect to the limits of the insurer's liability.

C. SELF INSURANCE DEDUCTIBLES - Any deductibles or self-insured retentions must be declared to and approved by the Village. At the option of the Village, either: the insurer shall reduce or eliminate such deductibles or self-insured retentions as it respects the Village, its officials, agents, employees and volunteers; or the Contractor shall procure a bond guaranteeing payment of losses and related investigation, claim administration and defense expenses.

D. PRIMARY COVERAGE AND NO CONTRIBUTION – All insurance provided by the Contractor under this Article IX shall be primary insurance with respect to any other insurance or self-insurance afforded to the Village. Any insurance or self-insurance maintained by the Village, its officials, agents, employees and volunteers shall be excess of Contractor's insurance and shall not contribute with it. This primary, non-contributory additional insured coverage shall be confirmed through the following required policy endorsements: ISO Additional Insured Endorsement CG 20 10 or CG 20 26 and CG 20 01 04 13.

E. INDEMNIFICATION AND KOTECKI CAP WAIVER – To the fullest extent permitted by law the Contractor shall indemnify, defend and hold the Village, and its elected and appointed officers, directors, members, employees, agents, and representatives, harmless from all claims and suits for damages arising from personal injuries, including death to persons or damage to property and from all expenses for defending such claim or suit, including court costs and reasonable attorney's fees, arising out of the acts, omission or negligence of the Contractor, a subcontractor, anyone directly or indirectly employed by them or anyone whose acts they may be liable. The Contractor shall have no duty to indemnify the Village hereunder against claims arising as a result of the Village's sole negligence. To the maximum extent permitted by law, in claims against any person or entity indemnified under this section by an employee of the Contractor, a subcontractor, anyone directly or indirectly employed by them or anyone whose acts they may be liable, the indemnification obligations under this section shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a subcontractor under any workers' compensation acts, disability benefit acts or other employee benefit acts.

F. INSURANCE OF SUBCONTRACTORS – The Village reserves the right to require all major subcontractors, as determined by the Village in its sole discretion, to carry the same insurance outlined in this Article IX. All contracts with any subcontractor must include a provision that the subcontractor waive its Kotecki Cap limits.

G. CANCELLATION CLAUSE WITHIN INSURANCE – All insurance required under this Article IX will provide that the Village receive at least thirty (30) calendar days notice prior to any modification, cancellation, suspension or expiration of the policy.

H. CERTIFICATES OF INSURANCE – The Contractor, and any applicable subcontractor, must provide to the Village certificates of insurance providing for all the insurance required by this Article IX *prior* to the Contractor, and any applicable subcontractor, performing any of the Work. Notwithstanding, the Village reserves the right to request fully certified copies of all insurance policies and endorsements. Insurance Services Office Commercial General Liability occurrence form CG 0001 with the Village named as additional insured, on a form at least as broad as the ISO Additional Insured Endorsement CG 2010 or CG 2026.

I. RETENTION OF PAYMENTS – The Contractor and the Village agree that the Village may withhold payments due to the Contractor by virtue of this Contract if, in the Village's sole discretion, such amounts are necessary to protect the Village from any loss from any claim, suit, loss, or judgment until such claim, suit, loss, or judgment has been settled or discharged to the satisfaction of the Village.

ARTICLE X – CERTIFICATE OF AUTHORITY AND SURETY CERTIFICATE

The Contractor shall furnish the Village with a current Certificate of Authority or Surety Certificate issued by the Illinois Department of Insurance for the bonding company and insurance company they are using. In lieu of a Certificate of Authority of Surety Certificate, the Contractor may provide certificate of good standing from the Illinois Department of Insurance's website.

ARTICLE XI – COPYRIGHTS AND LICENSES

The Contractor agrees that all documents of any kind whatsoever, and in whatever medium expressed, prepared by the Contractor and the Contractor's consultants in connection with the Work (collectively, the "**Documents**") or otherwise pursuant to this Contract and all rights therein (including trademarks, trade names, rights or use, copyrights and/or other proprietary rights) shall be and remain the sole property of the Village (regardless of whether the Village or the Contractor terminates this Contract for any reason whatsoever). The Contractor hereby agrees that the Documents are or shall be deemed to be "Works for Hire" within the meaning of Section 101 of the Copyright Act, and the Contractor hereby assigns to the Village all right, title and interest therein. Notwithstanding, the Contractor shall indemnify and hold harmless the Village, its appointed and elected officials, employees, agents and volunteers from and against all claims, damages, losses, and expenses (including attorneys' fees and court and arbitration costs) arising out of any infringement of patent rights or copyrights incident to the Documents and the Work.

ARTICLE XII – NOTICE

All notices, demands, requests, consents, approvals and other communications required or permitted to be given hereunder (a "**Notice**") shall be in writing and shall be deemed effective three (3) business days after mailing if mailed by certified mail with return receipt requested and immediately if served personally, and shall be addressed to the following:

IF TO THE VILLAGE: Village of Buffalo Grove
51 Raupp Blvd
Buffalo Grove, IL 60089
ATTN: Director of Public Works

IF TO THE CONTRACTOR: _____
_____
_____
ATTN: _____

ARTICLE XIII – CHANGE ORDERS

If the Village requests any change to the Work the Village shall do so by delivering Notice of the same to the Contractor and the change requested by the Village shall be effective upon receipt of the Notice by the Contractor. The Contractor may propose a change to the Work by delivering Notice of the proposed change along with a description of the changes full effect on the Work to the Village; provided, such requested change shall not be deemed accepted until the Village has delivered to the Contractor Notice of the same. Prior to approving a proposed change to the Work by the Contractor, the Village may request such additional documentation as it deems necessary to investigate the proposed change. The Contractor shall be responsible for informing all its employees and subcontractors of any changes to the Work, whether such change is requested by the Contractor or the Village.

ARTICLE XIV – NOTICE OF STARTING WORK

The Contractor shall provide Notice to the Village prior to the Contractor, or its employees or subcontractors, starting the Work or any phase of the Work.

ARTICLE XV – SEQUENCE OF THE WORK

The Director of Public Works shall have the power to direct the order and sequence of the Work. On any major portion of the Work, all accessories shall be set coincident with the main construction. Payment for major portions of the Work may be withheld until proper completion of accessories.

ARTICLE XVI – SUPERVISION

The Director of Public Works shall have override power to superintend and direct the Work, and the Contractor shall perform all of the Work herein specified to the satisfaction, approval and acceptance of the Director of Public Works. The Contractor shall have at all times a competent foreman or superintendent at the Work's site, who shall have full authority to act for the Contractor and to receive and execute orders from the Director of Public Works, and any instructions given to such superintendant or person, executing work for the Contractor, shall be binding on the Contractor as though it was personally given to the Contractor.

ARTICLE XVII – STANDARD OF WORK AND WORKERS

The Contractor shall employ competent staff and shall discharge, at the request of the Director of Public Works, any incompetent, unfaithful, abusive or disorderly workers in its employ. Where experts or skilled workers must be employed, only expert or skilled workers shall be employed.

ARTICLE XVIII – CONDITIONS OF THE WORK SITE

The Contractor shall provide and maintain such sanitary accommodations for the use of its employees as may be necessary to comply with the State and local Board of Health requirements. Public nuisances will not be permitted. The Contractor shall leave said Work's site(s) in the best possible condition to the complete satisfaction of the Director of Public Works. No vehicles of any kind shall be placed, parked, or operated upon any grass areas at any time except as authorized by the Director of Public Works or his authorized representative. Further, the Contractor shall exercise every precaution for the protection of all persons and all property. The safety provisions of all-applicable laws and ordinances shall be strictly observed. Any practice hazardous in the opinion of the Director of Public Works or his authorized representatives shall be immediately discontinued by the Contractor upon his receipt of instructions from the Director of Public Works or his authorized representative. To the maximum extent permitted by law, the Contractor shall be responsible for all safety-related matters.

ARTICLE XIX – WARRANTY PERIOD

All material and workmanship shall be warranted and guaranteed according to manufacturer's recommendation after inspection and approval by the Director of Public Works or his designated representative. All work performed by the Contractor shall be warranted by the Contractor following completion and final acceptance of the Work for a period of twelve (12) months from the date of final, and not substantial, completion.

ARTICLE XX – ACCIDENTS

In the event of any accident of any kind that involves the general public or property of the Village or a third party, the Contractor shall immediately notify the Director of Public Works by phone as well as provide Notice of the same. The Notice shall include a full accounting of all details of the accident. The Contractor shall furnish the Village with copies of all reports of such accidents at the same time that the reports are forwarded to any other interested parties.

ARTICLE XXI – NO ASSIGNMENT

If the Contractor sublets or assigns any part of the Work then the Contractor shall not under any circumstances be relieved of its liabilities hereunder. All transactions of the Village shall be with the Contractor. Subcontractors shall be recognized only in the capacity of employees or workmen and shall be subject to the same requirements as to character and competence. The Contractor shall not assign, transfer, convey, sell or otherwise dispose of the whole or any part of this Contract to any person, firm or corporation without written consent of the Director of Public Works or his authorized representative.

ARTICLE XXII – DEFAULT

The following shall constitute a default an "**Event of Default**" by the Contractor under this Contract:

A. If the Contractor shall fail to strictly observe or perform one or more of the terms, conditions, covenants and agreements of this Contract;

B. If there shall be placed on any property owned by the Village any mechanics', materialmens' or suppliers' lien;

C. If there shall be instituted any proceeding against the Contractor seeking liquidation, dissolution or similar relief and the same shall not be dismissed within forty-five (45) calendar days;

D. If there shall be appointed any trustee, receiver or liquidator of the Contractor and such appointment shall not have been vacated within forty-five (45) calendar days; and

E. If the Contractor fails to maintain or obtain any and all permits, licenses and the like, if any, required by the Village, State or Federal governments for the Work.

Upon any Event of Default the Village shall have the option of (**i**) terminating the Contract; (**ii**) pursuing any remedy available to it at law or in equity; or (**iii**) pursuing both simultaneously. In addition, upon an Event of Default, the Village may withhold payments due to the Contractor until it has hired a replacement of the Contractor and deducted all costs of hiring a replacement.

ARTICLE XXIII – DELAYS

The Contractor shall not be liable in damages for delays in performance when such delay is the result of fire, flood, strike, acts of God, or by any other circumstances which are beyond the control of the Contractor; provided, however, under such circumstances the Village may, at its option, cancel the Contract.

ARTICLE XXIV – COMPLIANCE WITH LAWS

The Contractor shall comply with all applicable laws, regulations and rules promulgated by any federal, state, local, or other governmental authority or regulatory body pertaining to all aspects of the Work, now in effect, or which may become in effect during the performance of the Work. The scope of the laws, regulations, and rules referred to in this paragraph includes, but is in no way limited to, the Illinois Human Rights Act, Illinois Equal Pay Act of 2003, Occupational Safety & Health Act along with the standards and regulations promulgated pursuant thereto (including but not limited to those safety requirements involving work on elevated platforms), all forms of traffic regulations, public utility, Interstate and Intrastate Commerce Commission regulations, Workers' Compensation Laws, Public Construction Bond Act, Public Works Preference Act, Employment of Illinois Workers on Public Works Act, USA Security Act, federal Social Security Act (and any of its titles), and any other law, rule or regulation of the Illinois Department of Labor, Department of Transportation, Illinois Environmental Protection Act, Illinois Department of Natural Resources, Illinois Department of Human Rights, Human Rights Commission, EEOC, and the Village of Buffalo Grove. Notwithstanding the following, the Contractor shall particularly note that:

A. NO DISCRIMINATION – The Contractor shall comply with the provisions of the Illinois Public Works Employment Discrimination Act and the Illinois Human Rights Act/Equal Opportunity Clause which, pursuant to Illinois law, are deemed to be part of this Contract.

B. FREEDOM OF INFORMATION - The Contractor agrees to furnish all documentation related to the Contract, the Work and any documentation related to the Village required under an Illinois Freedom of Information Act (ILCS 140/1 et. seq.) ("**FOIA**") request within five (5) calendar days after the Village issues Notice of such request to the Contractor. The Contractor agrees to defend, indemnify and hold harmless the Village, and agrees to pay all reasonable costs connected therewith (including, but not limited to attorney's and witness fees, filing fees and any other expenses) for the Village to defend any and all causes, actions, causes of action, disputes, prosecutions, or conflicts arising from Contractor's actual or alleged violation of FOIA or the Contractor's failure to furnish all documentation related to a FOIA request within five (5) calendar days after Notice from the Village for the same. Furthermore, should the Contractor request that the Village utilize a lawful exemption under FOIA in relation to any FOIA request thereby denying that request, Contractor agrees to pay all costs connected therewith (such as attorneys' and witness fees, filing fees and any other expenses) to defend the denial of the request. This defense shall include, but not be limited to, any challenged or appealed denials of FOIA requests to either the Illinois Attorney General or a court of competent jurisdiction.

C. ILLINOIS WORKERS ON PUBLIC WORKS ACT - To the extent applicable, the Contractor shall comply with the Illinois Workers on Public Works Act, 30 ILCS 570/1 et seq., and shall provide to the Village any supporting documentation necessary to show such compliance.

D. NOT A BLOCKED PERSON - The Contractor affirms and covenants that neither the Contractor nor any individual employed by the Contractor for this Work or under this Contract is a person forbidden from doing business with a unit of local government under Executive Order No. 13224 (Sept 23, 2001), 66 Fed.Reg. 49,079 (Sept 23, 2001) or is a person registered on the Specially Designated Nationals and Blocked Persons List. The Contractor shall indemnify the Village from all costs associated with failure to comply with this paragraph.

E. SUBSTANCE ABUSE PREVENTION ON PUBLIC WORKS ACT - The Contractor knows, understands and acknowledges its obligations under the Substance Abuse Prevention on Public Works Act (820 ILCS 265/1 et seq.), and shall comply and require all subcontractors and lower tiered contractors to comply with the requirements and provisions thereof.

F. PREVAILING WAGE ACT - The Village is an Illinois unit of local government and the Work hereunder is subject to the Illinois Prevailing Wage Act, 820 ILCS 130/0.01, et seq. Consequently, the Contract and each subcontractor shall submit monthly with their application for payment a certified payroll along with a signed statement attesting that: (**i**) such payroll is true and accurate; (**ii**) the hourly rate paid to each worker is at least equal to the prevailing wage for such work; and (**iii**) the Contractor or subcontractor is aware that filing a falsely certified payroll is a Class B Misdemeanor. Any delay in processing the payments due to a lack of certified payroll shall not be an event of default by the Village and shall not excuse any delay by the Contractor who shall proceed with the Work as if no delay in payment has occurred. The Contractor and Village shall agree to take any further steps not outlined above to ensure compliance with the Prevailing Wage Act. Upon two business day's Notice, the Contractor and each subcontractor shall make available to the Village their records to confirm compliance with the Prevailing Wage Act. Finally, to ensure compliance with Prevailing Wage Act, the Contractor and each subcontractor shall keep for a period of not less than 5 years after the Work has been completed records of all laborers, mechanics, and other workers employed by them for the Work; the records shall include each worker's name, address, telephone number, classification or classifications, the hourly wages paid in each period, the number of hours worked each day, the starting and ending times of work each day and, when available, last four digits of the social security number. The Contractor shall provide a list of every name, address, phone number and email of every sub-contractor for the Work.

Current rates can be located on the Illinois Department of Labor website.
https://www.illinois.gov/idol/Laws-Rules/CONMED/Pages/Rates.aspx

ARTICLE XXV – NO WAIVER OF RIGHTS

A waiver by the Village of any Event of Default or any term of provision of this Contract shall not be a waiver of the same Event of Default, another Event of Default or any other term or provision of this Contract.

ARTICLE XXVI – CONTROLLING LAW AND VENUE

This Contract is entered into in the State of Illinois, for work to be performed in the State of Illinois and shall be governed by and construed in accordance with the laws of the State of Illinois. Any legal matters or dispute shall be resolved in the Circuit Court of Cook County and the Parties hereby submit to the jurisdiction of such Circuit Court. This Contract shall be construed without regard to any presumption or other rule requiring construction against the Party causing the Contract to be drafted.

ARTICLE XXVII – MISCELLANEOUS

A. AMENDMENT – This Contract may be amended only in writing executed by both Parties.

B. NO RECORDING – This Contract, or a memorandum thereof, may not be recorded in any form by either Party. If either Party records this Contract, or a memorandum thereof, they shall immediately file a release of the same.

C. COUNTERPARTS – This Contract may be executed by the Parties in any any number of counterparts, each of which shall be deemed an original, but all of which together shall constitute an original instrument.

D. SECTION HEADINGS – The headings in the Contract are intended for convenience only and shall not be taken into consideration in any construction or interpretation of the Contract.

E. NO THIRD PARTY BENEFICIARIES – This Contract does not confer any rights or benefits on any third party.

F. BINDING EFFECT – This Contract shall be binding and inure to the benefit of the Parties hereto, their respective legal representatives, heirs and successors-in-interest.

G. ENTIRE AGREEMENT – This Contract supersedes all prior agreements and understandings and constitutes the entire understanding between the Parties relating to the subject matter hereof.

H. SEVERABILITY - If any term, condition or provision of the Contract is adjudicated invalid or unenforceable, the remainder of the Contract shall not be affected and shall remain in full force and effect, to the fullest extent permitted by law.

I. TORT IMMUNITY DEFENSES - Nothing contained in this Contract is intended to constitute nor shall constitute a waiver of the rights, defenses, and immunities provided or available to the Village under the Local Governmental and Governmental Employees Tort Immunity Act, 745 ILCS 10 *et seq*.

* * * *

Signatures to follow on the next page

* * * *

IN WITNESS WHEREOF, the Parties hereto have caused the Contract to be executed as of the Effective Date.

Village of Buffalo Grove,
an Illinois home-rule unit of government

By:_____
Name: Beverly Sussman
Title: Village President

Company
[An Illinois _____ company]

By:_____
Name: _____
Title: _____

CONTRACT EXHIBIT A

[Description of the Work]

CONTRACT EXHIBIT B

[Schedule of Prices]

CONTRACT EXHIBIT C
FORM OF PERFORMANCE BOND

Bond Number: _____

KNOW ALL MEN BY THESE PRESENTS, That _____ (the "**Principal**") and _____ _____ (the "**Surety**"), are held and firmly bound unto the Village of Buffalo Grove, an Illinois home-rule unit of government (the "**Village**"), the full and just sum of _____ Dollars ($_____) in lawful money of the UNITED STATES OF AMERICA as herein provided.

THE CONDITION OF THIS OBLIGATION is such that the Principal and Surety agree to bind themselves, their successors, assigns, executors, heirs and administrators, jointly and severally, for the full and faithful performance of the Work as defined in that particular Combine Area Fire Training Contract between Principal and the Village dated __ day of _____, 20__, (hereinafter referred to as the "**Contract**"), a copy of which is attached and incorporated by reference as though fully set forth herein.

NOW THE CONDITIONS OF THIS OBLIGATION ARE SUCH that if the said Principal (**i**) shall in all respects keep and perform all the undertakings, covenants, terms, conditions and agreements of the Contract; (**ii**) shall pay all sums of money due or to become due, for any labor, materials, apparatus, fixtures or equipment furnished for the Work provided in said Contract; and (**iii**) shall remove and replace any defects in workmanship or materials which may be apparent or may develop within the ARTICLE XIX – WARRANTY PERIOD of the Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

And the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or the Work thereunder shall in any way affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the Work.

IN WITNESS WHEREOF, we have hereunto set our hands and sea ___ day of _____, 20__.

SURETY	**PRINCIPAL**
By: _____	**By:** _____
Name: _____	**Name:** _____
Title: _____	**Title:** _____
ATTEST	**ATTEST**
By: _____	**By:** _____

NOTE: Date of Bond must not be prior to date of Contract.
If Contractor is Partnership, all partners should execute Bond.
IMPORTANT: Surety companies executing Bonds must appear on the Treasury Departments most current list (Circular 570 as amended) and be authorized to transact business in the state where the Work is located.

CONTRACT EXHIBIT D

PARTIAL LIEN WAIVER

STATE OF ILLINOIS

COUNTY OF _____

TO WHOM IT MAY CONCERN:
WHEREAS the undersigned has been employed by _____
to furnish _____
for the premises known as _____
of which _____ is the owner.
THE undersigned, for and in consideration of _____
($_____
_____
) Dollars, and other good and valuable considerations, the receipt whereof is hereby acknowledged, do(es) hereby waive and release any and all lien or claim of, or right to, lien, under the statutes of the State of Illinois, relating to mechanics' liens, with respect to and on said above-described premises, and the improvements thereon, and on the material, fixtures, apparatus or machinery furnished, and on the moneys, funds or other considerations due or to become due from the owner, on account of all labor, services, material, fixtures, apparatus or machinery, furnished to this date by the undersigned for the above-described premises, INCLUDING EXTRAS.*
DATE _____ COMPANY NAME _____
ADDRESS _____
SIGNATURE AND TITLE _____

*EXTRAS INCLUDE BUT ARE NOT LIMITED TO CHANGE ORDERS, BOTH ORAL AND WRITTEN, TO THE CONTRACT

CONTRACTOR'S AFFIDAVIT

STATE OF ILLINOIS

COUNTY OF _____

TO WHOM IT MAY CONCERN:
THE UNDERSIGNED, (NAME) _____ BEING DULY SWORN, DEPOSES AND SAYS THAT HE OR SHE IS (POSITION) _____ OF (COMPANY NAME) _____ WHO IS THE CONTRACTOR FURNISHING _____ WORK ON THE BUILDING LOCATED AT _____
OWNED BY _____
That the total amount of the contract including extras* is $ _____ on which he or she has received payment of $ _____ prior to this payment. That all waivers are true, correct and genuine and delivered unconditionally and that there is no claim either legal or equitable to defeat the validity of said waivers. That the following are the names and addresses of all parties who have furnished or delivered material or labor, or both, for said work and all parties having contracts or sub contracts for specific portions of said work or for material entering into the construction thereof and the amount due or to become due to each, and that the items mentioned include all labor and material required to complete said work according to plans and specifications:

NAMES AND ADDRESSES	WHAT FOR	CONTRACT PRICE INCLDG EXTRAS*	AMOUNT PAID	THIS PAYMENT	BALANCE DUE
TOTAL LABOR AND MATERIAL INCLUDING EXTRAS* TO COMPLETE.					

That there are no other contracts for said work outstanding, and that there is nothing due or to become due to any person for material, labor or other work of any kind done or to be done upon or in connection with said work other than above stated.

DATE _____ SIGNATURE: _____

SUBSCRIBED AND SWORN TO BEFORE ME THIS _____ DAY OF _____, _____

*EXTRAS INCLUDE BUT ARE NOT LIMITED TO CHANGE ORDERS, BOTH ORAL AND WRITTEN, TO THE CONTRACT.

_____
NOTARY PUBLIC

CONTRACT EXHIBIT E

FINAL WAIVER OF LIEN

STATE OF ILLINOIS

COUNTY OF _____

TO WHOM IT MAY CONCERN:
WHEREAS the undersigned has been employed by _____
to furnish _____
for the premises known as _____
of which _____ is the owner.

THE undersigned, for and in consideration of _____
($_____) Dollars, and other good and valuable considerations, the receipt whereof is hereby acknowledged, do(es) hereby waive and release any and all lien or claim of, or right to, lien, under the statutes of the State of Illinois, relating to mechanics' liens, with respect to and on said above-described premises, and the improvements thereon, and on the material, fixtures, apparatus or machinery furnished, and on the moneys, funds or other considerations due or to become due from the owner, on account of all labor, services, material, fixtures, apparatus or machinery, heretofore furnished, or which may be furnished at any time hereafter, by the undersigned for the above-described premises, INCLUDING EXTRAS.*

DATE _____ COMPANY NAME _____
ADDRESS _____
SIGNATURE AND TITLE _____

*EXTRAS INCLUDE BUT ARE NOT LIMITED TO CHANGE ORDERS, BOTH ORAL AND WRITTEN, TO THE CONTRACT

CONTRACTOR'S AFFIDAVIT

STATE OF ILLINOIS

COUNTY OF _____

TO WHOM IT MAY CONCERN:

THE UNDERSIGNED, (NAME) _____ BEING DULY SWORN, DEPOSES AND SAYS THAT HE OR SHE IS (POSITION) _____ OF (COMPANY NAME) _____ WHO IS THE CONTRACTOR FURNISHING _____ WORK ON THE BUILDING LOCATED AT _____
OWNED BY _____
That the total amount of the contract including extras* is $ _____ on which he or she has received payment of $ _____ prior to this payment. That all waivers are true, correct and genuine and delivered unconditionally and that there is no claim either legal or equitable to defeat the validity of said waivers. That the following are the names and addresses of all parties who have furnished or delivered material or labor, or both, for said work and all parties having contracts or sub contracts for specific portions of said work or for material entering into the construction thereof and the amount due or to become due to each, and that the items mentioned include all labor and material required to complete said work according to plans and specifications:

NAMES AND ADDRESSES	WHAT FOR	CONTRACT PRICE INCLDG	AMOUNT PAID	THIS PAYMENT	BALANCE DUE
TOTAL LABOR AND MATERIAL INCLUDING EXTRAS*					

That there are no other contracts for said work outstanding, and that there is nothing due or to become due to any person for material, labor or other work of any kind done or to be done upon or in connection with said work other than above stated.

DATE _____ SIGNATURE: _____

SUBSCRIBED AND SWORN TO BEFORE ME THIS _____ DAY OF _____, _____

*EXTRAS INCLUDE BUT ARE NOT LIMITED TO CHANGE ORDERS, BOTH ORAL AND WRITTEN, TO THE CONTRACT.

_____
NOTARY PUBLIC

SECTION 00 31 32

GEOTECHNICAL DATA

COMBINED AREA FIRE TRAINING FACILITY

PART 1: GENERAL

1.01 SCOPE

A. The information on soil data was obtained primarily for use in preparing the foundation design. However, each Contractor shall draw their own conclusions therefrom. No responsibility is assumed by the Owner or the Architect for subsoil quality or conditions.

1.02 INVESTIGATIONS

A. A subsurface investigation has been made and reports prepared by Rubino Engineering, Inc., Report No. G17.097.

B. A copy of the test boring locations and a log of test borings is attached after this Section.

1.03 CONDITIONS

A. Boring information is provided in good faith solely for the purpose of placing each Bidder in receipt of information available to the Owner, and each Bidder is responsible for any conclusions which he draws therefrom, since the Owner does not guarantee continuity of the conditions indicated at the boring locations.

B. Each Bidder is expected to make their own investigations, to examine the site and record of the Owner's investigations, and then decide for themselves the character of materials to be encountered. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions but such subsurface investigations shall be performed only under arrangements approved in advance by the Architect.

END OF SECTION 00 31 32

REPORT TRANSMITTAL

June 30th, 2017

To: Michael K. Skibbe
Village of Buffalo Grove
51 Raupp Boulevard
Buffalo Grove, IL 60089
Phone: 847.459.2545
Fax: 847.537.1742

Re: **Geotechnical Engineering Services Report**
Proposed CAFT Building and Parking Lot
SEC of Deerfield Parkway and Krause Drive
Buffalo Grove, Illinois

Rubino Report No. G17.097

Via email: MSkibbe@vbg.org

Dear Mr Skibbe,

Rubino Engineering, Inc. (Rubino) is pleased to submit our Geotechnical Engineering Services Report for the Proposed CAFT Building and Parking Lot in Buffalo Grove, Illinois.

Report Description

Enclosed is the Geotechnical Services Report including results of field and laboratory testing, as well as recommendations for foundation design, pavement design, and general site development.

Authorization and Correspondence History

- *Rubino Proposal Q17.230g dated May 16th, 2017; Signed and authorized by Purchase Order 2017-00001536*

Closing

Rubino appreciates the opportunity to provide geotechnical services for this project and we look forward to continued participation during the design and in future construction phases of this project.

If you have questions pertaining to this report, or if Rubino may be of further service, please contact our office at (847) 931-1555.

Respectfully submitted,
RUBINO ENGINEERING, INC.

Michelle A. Lipinski, PE
President

michelle.lipinski@rubinoeng.com

MAL/file/ Enclosures

Geotechnical Engineering Services Report

Drilling
Laboratory Testing
Geotechnical Analysis

PROPOSED CAFT BUILDING AND PARKING LOT

SEC OF DEERFIELD PARKWAY AND KRAUSE DRIVE

BUFFALO GROVE, ILLINOIS

RUBINO PROJECT NO. G17.097

PREPARED BY:

rubino ENGINEERING INC.

Michelle A. Lipinski, PE
President
IL No. 062-061241, Exp. 11/30/17

PREPARED FOR:

VILLAGE OF BUFFALO GROVE

51 RAUPP BOULEVARD

BUFFALO GROVE, IL 60089

JUNE 30TH, 2017

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APPENDIX J – SITE VICINITY MAP & BORING LOCATION PLAN
APPENDIX K – BORING LOGS
APPENDIX L – LABORATORY REPORTS

PROJECT INFORMATION

Rubino understands that The Village of Buffalo Grove is planning to construct a new building and parking lot located at the southeast corner of Deerfield Parkway and Krause Drive in Buffalo Grove, Illinois. The building will be a single story, slab-on-grade structure (no basement), approximately 6,250 square feet in plan area, and is anticipated to be lightly loaded.

Site Grading and Pavement Design Criteria were not received but are based on the following:

- Individual column loads not exceeding 70 kips
- Bearing wall loads not exceeding 4.0 kips per lineal foot (klf)
- Grade-supported slab live loads not exceeding 150 psf.
- Site grading including cuts and fills being less than 2 feet
- Light Duty Pavement 18-kip ESALS: 30,000
- Heavy Duty Pavement 18-kip ESALS: 60,000
- Pavement Life Expectancy: 15 years

Structural Loads: this report is based on the following Email from Kent Adams of JWA Structural Engineering dated June 19th, 2017:

Maximum Wall Loads:	2.5 Kips / Lineal Foot
Maximum concentrated load:	25 Kips (Column)

Documents received:

- "Proposed Borings for CFTA Building and Parking Lot" – prepared by MeritCorp Group, LLC.

Project Correspondence:

- RFP Email from James P. Meier of MeritCorp Group, LLC. on May 15th, 2017.

The geotechnical recommendations presented in this report are based on the available project information and the subsurface materials described in this report. If any of the information on which this report is based is incorrect, please inform Rubino in writing so that we may amend the recommendations presented in this report (if appropriate, and if desired by the client). Rubino will not be responsible for the implementation of our recommendations if we are not notified of changes in the project.

Purpose / Scope of Services

The purpose of this study was to explore the subsurface conditions at the site in order to prepare geotechnical recommendations for shallow foundations, pavement design, and general site development for the proposed construction.

Rubino's scope of services included the following drilling program:

Table 1: Drilling Scope

Boring Number	DEPTH (FEET BEG*)	LOCATION
B-01	15 feet	Proposed CAFT Building
B-02	15 feet	Proposed CAFT Building
B-03	15 feet	Proposed CAFT Building
B-04	15 feet	Proposed CAFT Building
B-05	15 feet	Proposed CAFT Building
P-01	10 feet	Proposed Parking Lot
P-02	10 feet	Proposed Parking Lot

*BEG = below existing grade

Representative soil samples obtained during the field exploration program were transported to the laboratory for additional classification and laboratory testing.

This report briefly outlines the following:

- *Summary of client-provided project information and report basis.*
- *Overview of encountered subsurface conditions.*
- *Overview of field and laboratory tests performed including results.*
- *Geotechnical recommendations pertaining to:*
  - *Subgrade preparation and cut / fill recommendations.*
  - *Foundations, including suitable foundation type(s), allowable bearing pressure(s), and estimated settlement.*
  - *Pavements, including subgrade pavement sections for bituminous and Portland Cement Concrete (PCC) pavements.*
  - *Seismic design site classification parameters.*
- *Construction considerations, including temporary excavation and construction control of water.*

DRILLING, FIELD, AND LABORATORY TEST PROCEDURES

The Village of Buffalo Grove selected the number of borings and the boring depths. Rubino located the borings in the field using a Garmin GPSMap 64s. The borings were advanced utilizing 3 ¼ inch inside-diameter, hollow stem auger drilling methods and soil samples were routinely obtained during the drilling process.

Selected soil samples were tested in the laboratory to determine material properties for this report. Drilling, sampling, and laboratory tests were accomplished in general accordance with ASTM procedures. The following items are further described in the Appendix of this report.

- *Field Penetration Tests and Split-Barrel Sampling of Soils (ASTM D1586)*
- *Laboratory Determination of Water (Moisture) Content of Soil by Mass (ASTM D2216)*
- *Laboratory Determination of Atterberg Limits (ASTM D4318)*
- *Laboratory Organic Content by Loss on Ignition (ASTM D2974)*

The laboratory testing program was conducted in general accordance with applicable ASTM specifications. The results of these tests are to be found on the accompanying boring logs located in the Appendix.

EXECUTIVE SUMMARY OF GEOTECHNICAL CONSIDERATIONS

The main geotechnical design and construction considerations at this site are:

- **Possible Undocumented fill soils** were observed within the borings. The primary risk of supporting structures on undocumented/uncontrolled fill materials is the potential for excessive and/or non-uniform settlement. See *Undocumented Fill Soils Discussion* section for more information.
- **Subgrade soils** generally consisted of brown and gray, silty clay soils. See *Subsurface Conditions* section for more detailed information.
    - Silty clay soils with **lower blow counts and moderate to high moisture contents** were encountered near the existing surface grade. These soils will likely need to be stabilized during construction. See the *Subgrade Stability* section for more recommendations.
- **Intermediate Foundations such as helical piers** are a possible foundation design option at this site as long as the soils at bearing depth are stabilized (undercut). See *Foundation Recommendations* section for more information.
- During subgrade preparation, Rubino recommends that one of our representatives be onsite for typical observations and documentation of foundation excavations, and reworking of the unsuitable fill materials, if applicable.

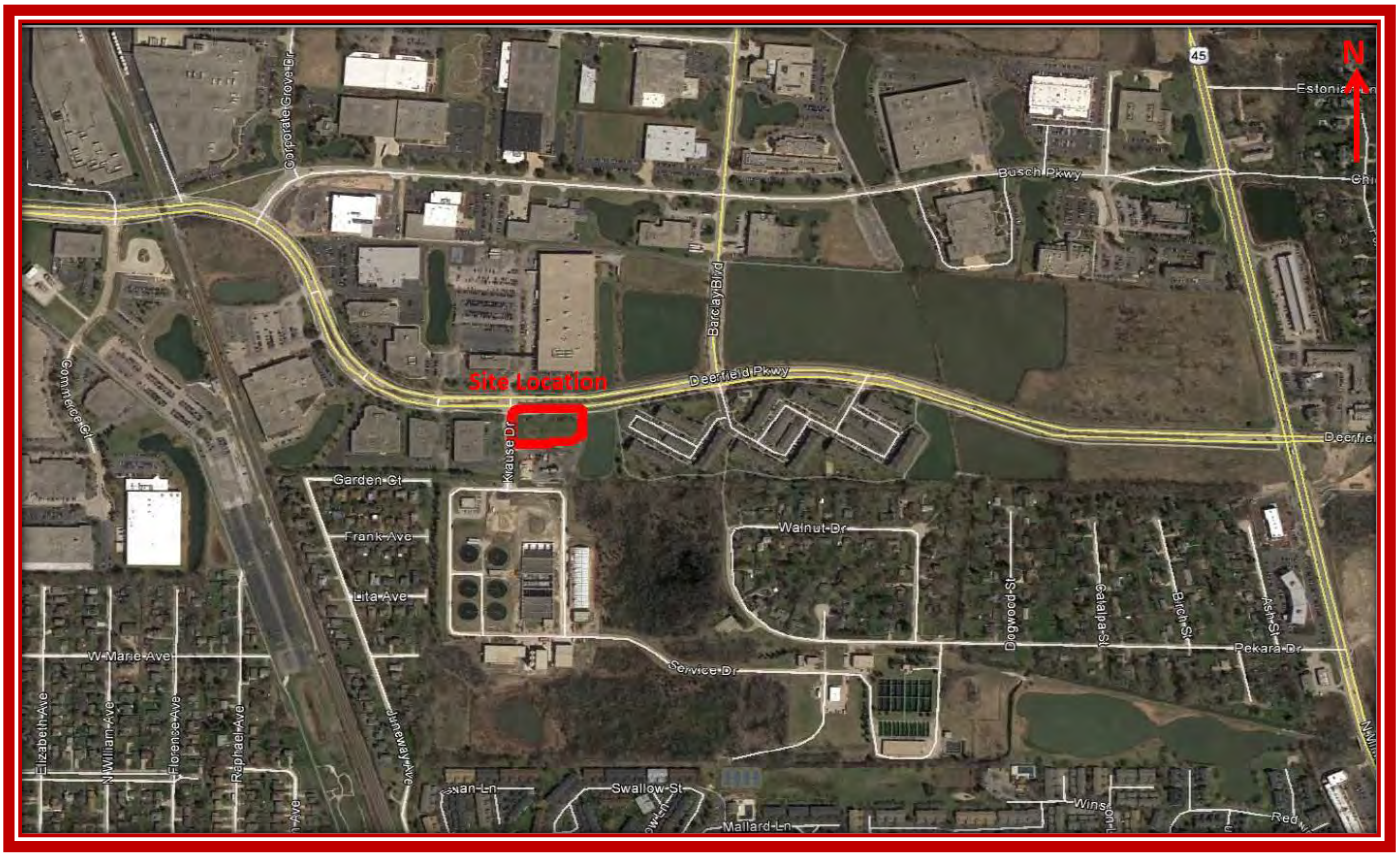
The geotechnical-related recommendations in this report are presented based on the subsurface conditions encountered and Rubino's understanding of the project. Should changes in the project criteria occur, a review must be made by Rubino to determine if modifications to our recommendations will be necessary.

SITE AND SUBSURFACE CONDITIONS

Site Location and Description

The general site location of exploration was the Southeast Corner of Deerfield Parkway and Krause Drive in Buffalo Grove, Illinois. The site has an approximate latitude and longitude of 42°10'4.18" N and 87°56'6.72" W respectively.

The map below shows the general site location of where the soil borings were taken:



Subsurface Conditions

Beneath the existing undocumented fill soils or gravel, subsurface conditions generally consisted of brown, black, and/or gray silty clay soils and brown gravelly sands.

- The **topsoil** thicknesses were approximately 3 to 8 inches.
- The native **silty clay** soils were generally Medium stiff to very stiff in consistency

Table 2: Subsurface Conditions Summary

DEPTH RANGE (FT)	SOIL DESCRIPTION	SPT N-VALUES (BLOWS PER FOOT)	MOISTURE CONTENT (%)	ESTIMATED SHEAR STRENGTH (PSF)
Proposed CAFT Building / Borings B-01 through B-05				
¼ – 15 feet	Medium stiff to very stiff silty CLAY	5 - 15	11 – 33 %	750 – 2,250 psf
Proposed Parking Lot / Borings P-01 & P-02				
0 – 8 ½ ft	UNDOCUMENTED FILL: Silty clay with sand and gravel	7 – 11	14 – 25	N/A
6 - 10	Medium stiff to stiff silty CLAY	8 – 13	18 – 21	1,200 – 1,950 psf

The native soils were visually classified as silty clay (CL) according to the Unified Soil Classification System (USCS). The above table is a general summary of subsurface conditions. Please refer to the boring logs for more detailed information.

Estimated shear strength of clay soils is based on empirical correlations using N-values, moisture content, and unconfined compressive strength.

Groundwater Conditions

Groundwater was encountered in some of the borings during drilling operations. The moisture contents of the soils indicate that the soils are at or near saturation. Based on the saturation of soils, and the color change of the soils from brown to gray, Rubino anticipates that **seasonal high groundwater levels may be encountered at shallower depths than at the time of drilling operations.** The following table summarizes groundwater observations from the field and Rubino's estimates for potential seasonal high groundwater tables:

Table 3: Groundwater Observation Summary

Boring Number	Boring Location	Groundwater Level during drilling (feet*)	Groundwater Level upon auger removal (feet*)	Estimated Seasonal High Groundwater Level (Feet*)
B-01	Proposed CAFT Building	N/A	N/A	≥ 15 ft
B-02		N/A	N/A	≥ 15 ft
B-03		N/A	N/A	≥ 15 ft
B-04		N/A	N/A	≥ 15 ft
B-05		13 ft	12 ft	12 ft
P-01	Proposed Parking Lot	N/A	N/A	6 ft
P-02		N/A	N/A	6 ft

*Depth below existing grade

It should be noted that fluctuations in the groundwater level should be anticipated throughout the year depending on variations in climatological conditions and other factors not apparent at the time the borings were performed. Additionally, discontinuous zones of perched water may exist within the soils. The possibility of groundwater level fluctuation should be considered when developing the design and construction plans for the project.

Evaluation and Recommendations

The geotechnical-related recommendations in this report are presented based on the subsurface conditions encountered and Rubino's understanding of the project. Should changes in the project criteria occur, a review must be made by Rubino to determine if modifications to our recommendations will be necessary.

Undocumented Fill Discussion

Undocumented fill was observed in the borings to depths exceeding 10 feet below existing grade.

Where existing fill is encountered, Rubino recommends that structure foundations extend through the fill materials and be supported on the a stiffer soil stratum. In this case, intermediate foundations are the recommended option due to the depth of fill encountered.

Undocumented fill is defined as fill that has been placed without being documented as to its placed density and moisture content.

Deleterious materials could include, but are not limited to, bricks, asphalt, concrete, metal, wood, or other building debris.

If documentation of fill placement can be produced, Rubino can review the quality of the fill placement and provide alternative recommendations if there is sufficient documentation.

Based on the boring information, it is anticipated that most of these existing undocumented clayey fill soils should be suitable for support of floor slabs and pavements unless otherwise noted in this report. However, undocumented fill materials should be carefully evaluated by proof-rolling and subgrade stability testing (as recommended herein) at the time of construction to document the in-place consistency of these materials.

Deleterious materials were not observed within the undocumented fill materials during the drilling operations. Although deleterious materials were not encountered in all the undocumented fill materials, this does not eliminate the possibility that deleterious materials could be present within the undocumented fill materials at other locations along the project.

Dewatering Recommendations

Groundwater was encountered in the borings. Therefore, dewatering may be necessary during excavation of saturated soils due to presence of sand seams or other conditions not apparent at the time of drilling. Shoring or trench boxes may be required where the soils are saturated. Please reference the groundwater elevations on the attached boring logs and in the *Groundwater Conditions* section of this report.

Subgrade Preparation and Testing

The following comments are considered site-specific. To reference general subgrade preparation recommendations for proofrolling and compaction, **please refer to the Appendix** of this report.

- During construction, the site should be **stripped of existing concrete, abandoned utilities, and pavement sections including asphalt, subbase, and curbs**.
- Prior to paving, the soils should be stabilized as follows:
  - **Parking Area:** Soils must pass a proofroll prior to placing structural fill. This may require stabilization at least 12 inches below bottom of the topsoil elevation in most areas. See *Subgrade Stability Recommendation* for more detailed information.
- During subgrade preparation, Rubino recommends that one of our representatives be onsite for **typical observations and documentation** of proofrolling of the subgrade areas, foundation excavations, and stabilizing the unsuitable soils.
- Construction traffic should be minimized to prevent unnecessary disturbance of the subgrade. Disturbed areas, as documented in the field by Rubino, should be treated as recommended below.

Subgrade Stability Recommendations

Subgrade soils may be **stabilized** by one of the following **options**:

- **Remove and replace** with non-woven filter fabric and 3-inch stone capped with CA-06 stone.
  - The contractor can also attempt to stabilize the existing subgrade in place by "losing" 3-inch stone into the subgrade until the until the voids of the 3-inch stone are filled with the soft soil and the subgrade "locks up," showing minimal deflection under a proofroll.
  - A layer of non-woven filter geotextile should be placed between silty clay soil and an open-graded stone.
  - Please be aware that large amounts of open-graded stone placed on the site will attract groundwater. Please notify the Civil engineer of record if this option is chosen.
- **Geogrid and a stone mat** placed across the building pad per manufacturer's installation specifications could reduce the amount of stone required and provide additional lateral support for foundation loads in service.
- Scarifying and re-compacting the existing subgrade soil to at least 95% compaction per ASTM D698 Standard Proctor (12 inch depth).
- **Lime or other chemical additive** stabilization (12 to 14 inches). This can be done as part of a lift structure. Compaction requirements still apply.

Intermediate Foundation Option (Helical Piers)

Due to the presence of undocumented fill soils, Rubino recommends that the proposed CAFT building may be supported by intermediate foundations such as helical piers. **The helical piers should be planned to be anchored within t stiff silty clay soils underlying possible fill soils. The contractor is able to measure the torque of the helical anchors during installation.**

There are many possibilities for helical pier design. The spacing of the helicals on the shaft and the diameters of the helicals is variable and should be selected based on design loading and suitable soil depth. The helical pier installer or manufacturer should be consulted for design of the helical piers for each specific location on site.

The piles should be designed to support the applied loads without undergoing unacceptable deflection. Because there are softer soils to a depth of approximately 18 ½ feet below existing grade, there is a possibility of shaft buckling in this range which should be considered when designing the helical pier. Factors that determine the buckling load include the pile shaft diameter, length, flexural stiffness and strength, the soil stiffness and strength profile, lateral shear and/or moment applied at the pile head, and pile head fixity conditions.

If the required amount of torque is not encountered at the anticipated depth in the field, the following modifications can be made to increase the capacity:

- Decrease the spacing between the helical piers.
- Increase the number of helicals on the pier.

If the helical piers are planned to be socketed into concrete, the concrete should be placed at frost depth. If the structures will be constructed during winter months or if the concrete will likely

be subjected to freezing temperatures after construction is completed, then the concrete should be protected from freezing.

The connections between the helical piers and structural elements should be designed by the structural engineer and the load transfer characteristics of the existing foundations should be considered in selecting the helical pier spacing. Helical pier design and installation should be performed by qualified personnel.

Shallow Foundation Discussion

Geotechnical Risk

The primary risk of supporting structures on undocumented/uncontrolled fill materials is the potential for excessive and/or non-uniform settlement. The non-uniformity concern is based on the lack of information regarding how the fill was originally placed. Without documentation, Rubino cannot make an assessment as to whether or not the fill materials between the boring are consistent with what was explored. Risk of fill settlement can be reduced if the existing fill is removed and replaced with a controlled and compacted structural fill, or if records documenting the placement and compaction of the fill can be located.

The owner may choose to accept the risk of settlement and select a shallow foundation system with a max net allowable bearing capacity of 1,000 psf.

In this case, Rubino recommends increasing reinforcing steel in concrete foundations and designing construction joints to allow for some movement.

Settlement Estimate

The loads on which this report are based are considered to be relatively light. A settlement analysis modeling the undocumented fill soils using the data obtained only from the soil borings performed for this project resulted in total and differential settlements between 0.5 inch and 1.5 inches.

Although soft or loose fill materials were not encountered in all of the borings, this does not eliminate the possibility that soft or loose pockets or layers are present between and/or beyond the borings.

Floor Slab Recommendations

Based on the site grading information provided by the client and the encountered subsurface conditions, the anticipated floor slab bearing soil is compacted and documented structural fill or undocumented fill soils that pass a proofroll as recommended herein.

Subgrade soils should be proofrolled and documented by the geotechnical engineer of record prior to placing the floor slab, or inspected and approved newly placed, properly compacted and documented structural fill which extends to original soils as described herein.

Provided that the subgrade and/or properly compacted and documented structural fill, a modulus of subgrade reaction, *k* value, of 110 pounds per cubic inch (psi/inch) may be used in the grade slab design. This value is calculated using empirical correlations based on a 1 ft. x 1 ft. plate load test. However, depending on how the slab load is applied, the value will have to be geometrically modified as outlined in the Appendix of this report

Floor slab subgrade preparation should be in accordance with the recommendations outlined in the in the Appendix of this report.

Pavement Section Recommendations

Based on the boring information in the proposed pavement areas, Rubino believes the existing soils at this site will have a subgrade pavement bearing characteristic typical of soil with an IBR value of 3. Subgrade stability should be checked during construction by performing a proofroll on the soils prior to placing subbase stone. Based on this value, it is possible to use a locally typical "standard" pavement section consisting of the following:

Recommended Minimum Thicknesses (Inches) based on a CBR of 3		
Pavement Materials	**Car Parking**	**Drive Lanes**
Asphaltic Surface Course	1 ½	1½
Asphaltic Binder Course	2 ½	3½
Base Aggregate	8	8
Or		
Portland Cement Concrete	5	6
Base Aggregate	8	8

Rigid concrete pavement is recommended where trash dumpsters or semi-trailers are to be parked on the pavement or where a considerable load is transferred from relatively small steel wheels.

- Trash dumpster pads should be at least 8-inches thick and properly reinforced.

In large areas of pavement, or where pavements are subject to significant traffic, a more detailed analysis of the subgrade and traffic conditions should be made. The results of such a study will provide information necessary to design an economical and serviceable pavement. Additional pavement considerations are located in Appendix of this report.

Pavement Drainage and Maintenance

Fine-grained soils can be sensitive to remolding in the presence of water. In the areas of surficial clays, the surface should be maintained in a graded condition to prevent standing water on the subgrade. Appropriate measures may include, but are not limited to:

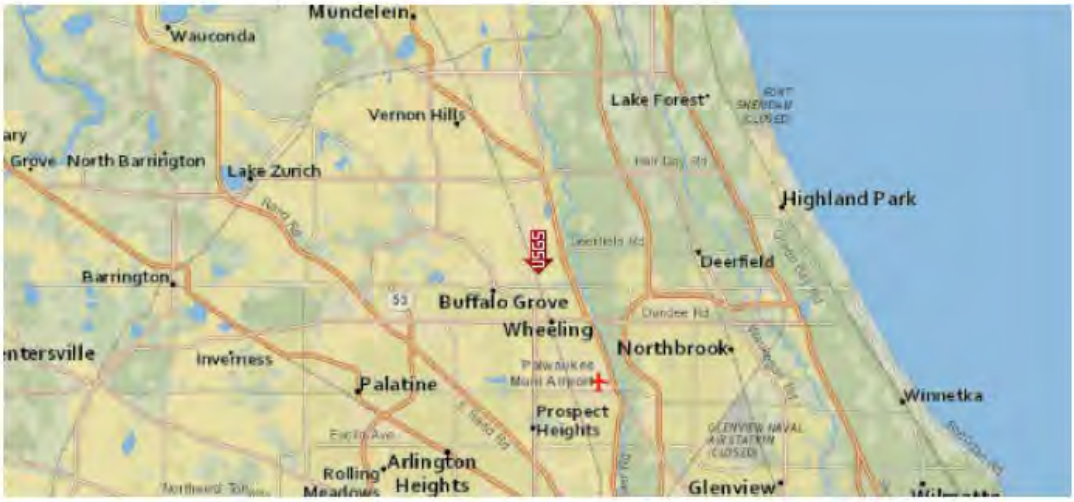
1. **Shaping/pitching the sub-grade to drain toward side drainage ditch along the pavement.**
2. Providing proper filtration for runoff waters. Proper drainage of the pavement is mandated by Article 202.05 of the IDOT Standard Specifications.
3. Rubino recommends placing CA-6 as the fill at the interface of clay and the new pavement. If open-graded stone is used, a geotextile should be placed between the fine-grained soil and the stone.
4. Rubino recommends pavements be sloped to provide rapid surface drainage. Water allowed to pond on or adjacent to the pavement could saturate the subgrade and cause premature deterioration of pavements, and removal and replacement may be required.
5. Consideration should be given to the use of an interceptor drain to collect and remove water collecting in the granular base. The interceptor drains could be incorporated with the storm drains of other utilities located in the pavement areas.

Seismicity

USGS Design Maps Summary Report

User-Specified Input

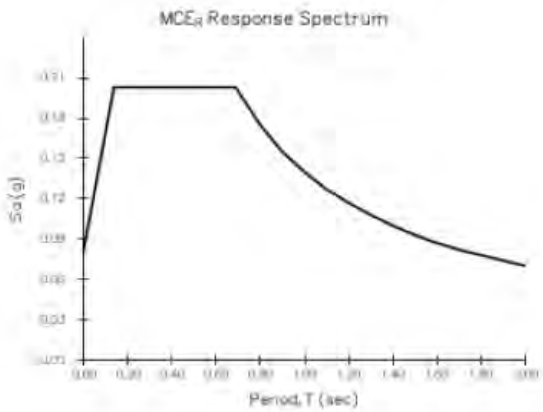
Building Code Reference Document	2012/2015 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	42.16783°N, 87.9352°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

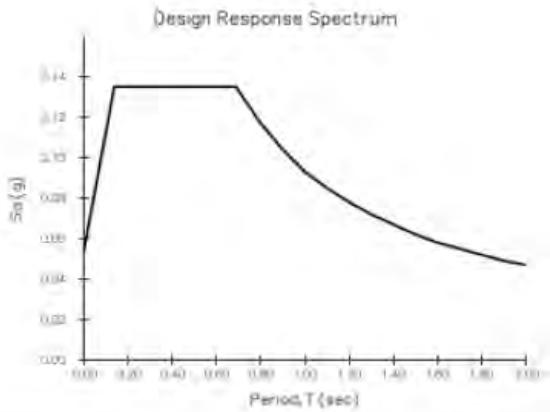


USGS-Provided Output

S_S =	0.127 g	S_{MS} =	0.203 g	S_{DS} =	0.135 g
S_1 =	0.058 g	S_{M1} =	0.140 g	S_{D1} =	0.093 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.

CLOSING

The recommendations submitted are based on the available subsurface information obtained by Rubino Engineering, Inc. and design details furnished by The Village of Buffalo Grove for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, Rubino should be notified immediately to determine if changes in the foundation recommendations are required. If Rubino is not retained to perform these functions, we will not be responsible for the impact of those conditions on the project.

The scope of services did not include an environmental assessment to determine the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater or air, on, or below or around this site. Any statements in this report and/or on the boring logs regarding odors, colors, and/or unusual or suspicious items or conditions are strictly for informational purposes.

After the plans and specifications are more complete, the geotechnical engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At this time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of the Village of Buffalo Grove and their consultants for the specific application to the Proposed CAFT Building and Parking Lot in Buffalo Grove, Illinois.

APPENDIX A - *DRILLING, FIELD, AND LABORATORY TEST PROCEDURES*

ASTM D1586 Penetration Tests and Split-Barrel Sampling of Soils

During the sampling procedure, Standard Penetration Tests (SPT's) were performed at regular intervals to obtain the standard penetration (N-value) of the soil. The results of the standard penetration test are used to estimate the relative strength and compressibility of the soil profile components through empirical correlations to the soils' relative density and consistency. The split-barrel sampler obtains a soil sample for classification purposes and laboratory testing, as appropriate for the type of soil obtained.

Water Level Measurements

Water level observations were attempted during and upon completion of the drilling operation using a 100-foot tape measure. The depths of observed water levels in the boreholes are noted on the boring logs presented in the appendix of this report. In the borings where water is unable to be observed during the field activities, in relatively impervious soils, the accurate determination of the groundwater elevation may not be possible even after several days of observation. Seasonal variations, temperature and recent rainfall conditions may influence the levels of the groundwater table and volumes of water will depend on the permeability of the soils.

Ground Surface Elevations

At this time, no site-specific elevations were available to Rubino. The depths indicated on the attached boring logs are relative to the existing ground surface for each individual boring at the time of the exploration. Copies of the boring logs are located in the Appendix of this report.

ASTM D2216 Water (Moisture) Content of Soil by Mass (Laboratory)

The water content is an important index property used in expressing the phase relationship of solids, water, and air in a given volume of material and can be used to correlate soil behavior with its index properties. In fine grained cohesive soils, the behavior of a given soil type often depends on its natural water content. The water content of a cohesive soil along with its liquid and plastic limits as determined by Atterberg Limit testing are used to express the soil's relative consistency or liquidity index.

ASTM D2974 Standard Test Method for Organic Soils using Loss on Ignition (Laboratory)

These test methods cover the measurement of moisture content, ash content, and organic matter in peats and other organic soils, such as organic clays, silts, and mucks. Ash content of a peat or organic soil sample is determined by igniting the oven-dried sample from the moisture content determination in a muffle furnace at 440°C (Method C) or 750°C (Method D). The substance remaining after ignition is the ash. The ash content is expressed as a percentage of the mass of the oven-dried sample. 2.4 Organic matter is determined by subtracting percent ash content from 100.

ASTM D4318 Atterberg Limits (Laboratory)

Atterberg limit testing defines the liquid limit (LL) and plastic limit (PL) states of a given soil. These limits are used to determine the moisture content limits where the soil characteristics changes from behaving more like a fluid on the liquid limit end to where the soil behaves more like individual soil particles on the plastic limit end. The liquid limit is often used to determine if a soil is a low or high plasticity soil.

The plasticity index (PI) is difference between the liquid limit and the plastic limit. The plasticity index is used in conjunction with the liquid limit to determine if the material will behave like a silt or clay.

ASTM D422 Particle Size Analysis (Laboratory)

The Particle Size Analysis of Soils determines the distribution of particle sizes in order to further classify the soil. The distribution of particle sizes larger than 75µm (retained on the No. 200 sieve) is determined by sieving, while the distribution of particle sizes smaller than 75µm is determined by a sedimentation process, using a hydrometer to secure the necessary data. These soils are then classified more accurately based on the distribution information.

APPENDIX B - SITE PREPARATION – CLEARING & GRUBBING

Rubino recommends that unsuitable soils or fill be removed from the site, as applicable. Unsuitable soils or fills can be described as, but are not limited to:

- organic soil / topsoil / plants / trees / shrubs / grass
- frozen soil
- existing asphalt or concrete pavement sections
- existing foundations
- building debris
- existing curbs

Stripping operations should extend a minimum of: **5** feet beyond proposed pavement limits

Exceptions: where property limits allow. Notify geotechnical engineer if there are property boundary limitations. Stripping operations should be monitored and documented by a representative of the geotechnical engineer at the time of construction.

Proofrolling:

After stripping and excavating to the proposed subgrade level, as required, the paved parking area should be proof-rolled and scarified and compacted to at least 95 percent of the standard Proctor maximum dry density ASTM D 698 for a depth of at least 8 inches below the surface during a period of dry weather.

Proofrolling Equipment:

Tandem-axle dump truck or similar rubber-tired vehicles are acceptable and should be loaded with at least 9 tons per axle.

Benefits of Proofrolling:

- Aids in providing a firm base for compaction of fill soils
- Helps to delineate soft, loose, or disturbed areas that may exist below subgrade level.

Soils which are observed to rut or deflect excessively (typically greater than 1 inch) under the moving load should either be scarified and re-compacted, or undercut and replaced.

- Scarify and re-compact to 95% with a smooth drum vibratory roller for granular soils, a sheepsfoot roller for cohesive soils or
- Undercut in 6 to 12 inch increments and replace with properly compacted and documented structural fill.
    - Clean, 3-inch stone should be worked and incorporated into soft soils to bridge soft areas due to high moisture content. The fine-grained soils should occupy the void spaces of the 3-inch stone.
    - The 3-inch stone should then be capped with a well-graded granular fill (3/4" with fines or CA-6 in Illinois) or compacted and documented fill soils as described in the Fill Placement section of the Appendix.
- The site may require another proofroll and rework when the subgrade becomes either desiccated, wet, or frozen.

APPENDIX C - *FILL RECOMMENDATIONS*

In general, fill materials should meet the following:

- Standard Proctor maximum dry density >100 pcf
- Free of organic or other deleterious materials
- Have a maximum particle size no greater than 3 inches
- Have a liquid limit <45 and plasticity index <25
- Testing should include areas at least 5 feet outside the parking area perimeters, if applicable
- Each lift of compacted, engineered fill should be tested and documented by a representative of the geotechnical engineer prior to placement of subsequent lifts
- If a fine-grained silt or clay soil is used for fill (CL or ML), close moisture content control will be essential to achieve the recommended degree of compaction
- If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying

Suitable Soil Classifications:

CL, ML, SM, SC-SM, and SW will generally be suitable for use as structural fill.

Unsuitable Soil Classifications:

OL, OH, MH, CH and PT should be considered unsuitable.

Each lift of structural fill added to the site shall be tested and documented under the supervision of a geotechnical engineer in accordance with the following table:

MATERIAL TESTED	PROCTOR TYPE*-1	MIN % DRY DENSITY	PLACEMENT MOISTURE CONTENT RANGE	FREQUENCY OF TESTING*-2	MAXIMUM LOOSE LIFT HEIGHT
Structural Fill (Cohesive & Well-graded Granular) – Building Pad	Standard	98%	-2 to +2 %	1 per 2,500 yd^2 of fill placed	8 inches
Structural Fill (Cohesive & Well-graded Granular) – Parking	Standard	98%	-2 to +3 %	1 per 2,500 yd^2 of fill placed	8 inches
Random Fill (non-load bearing)	Standard	95%	-3 to +3 %	1 per 5,000 yd^2 of fill placed	8 inches
Utility Trench Backfill	Standard	95%	-2 to +2 %	1 per 50 LF of fill placed	6 inches

*-1 The test frequency for the laboratory reference shall be one laboratory Proctor or Relative Density test for each material used on the site. If the borrow or source of fill material changes, a new reference moisture/density test should be performed.

*-2A minimum of one test per lift is recommended unless otherwise specified.

Tested fill materials that do not achieve either the required dry density or moisture content range shall be recorded, the location noted, and reported to the Contractor and Owner. A re-test of that area should be performed after the Contractor performs remedial measures. The above test frequencies should be discussed with the contractor prior to starting the work.

The geotechnical engineer of record can only certify work that was performed under their direct observation, or under the observation of a competent person under their specific direction.

APPENDIX D - *FOUNDATION CONSTRUCTION RECOMMENDATIONS*

Rubino recommends that soils at the bottom of the footing design elevation be observed, documented, and tested by a representative of Rubino prior to concrete placement to evaluate the consistency of the soils in the field with the geotechnical report findings. The remedial procedures described in the following paragraph can be used to provide suitable foundation support where unsuitable material such as soft or loose soils, existing fill, or organic soils are encountered.

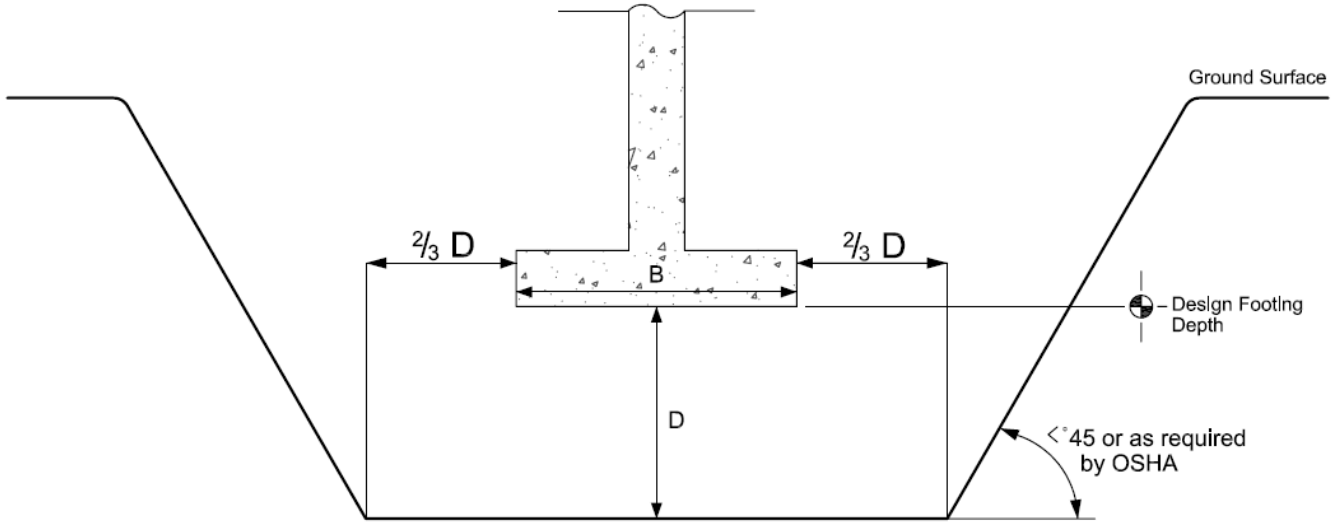
After opening, footing excavations should be observed and concrete placed as quickly as possible to avoid exposure of the footing bottoms to wetting and drying. Surface runoff water should be drained away from the excavations and not be allowed to pond. If possible, the foundation concrete should be placed during the same day the excavation is made. If it is required that footing excavations be left open for more than one day, the soils in the excavation should be protected to reduce evaporation or entry of moisture.

If unsuitable bearing soils are encountered in a footing excavation, the footing should be deepened to competent bearing soil and the footing could be lowered, or an over excavation and backfill procedure could be performed. If an over excavation and backfill procedure will be utilized, it would require widening the deepened excavation in all directions at least 8 inches beyond the edges of the footing for each 12 inches of over excavation depth (See "Over Excavation and Backfill Procedure" diagram below).

The over excavation should then be backfilled in a maximum of 8-inches thick loose lifts with suitable granular fill material, such as ¾ -inch stone with fines (CA-6), compacted to at least 98% of the maximum Standard Proctor dry density (ASTM D 698).

Another alternative is to undercut and refill the unsuitable area with flowable mortar up to the design elevation of the footings. The flowable mortar would serve as a protection to the subgrade during construction of the foundations. In this case, widening the footings is not necessary.

Over Excavation and Backfill Procedure



* Drawing not to scale

APPENDIX E - *SLAB-ON-GRADE CONSIDERATIONS*

The subgrade modulus provided in the main report should be adjusted for larger areas of loading using the following expression for cohesive and cohesionless soil:

Modulus of Subgrade Reaction, $k_s = (\frac{k}{B})$ for cohesive soil and

$$k_s = k\,(\frac{B+1}{2B})^2 \text{ for cohesionless soil}$$

where: k_s = coefficient of vertical subgrade reaction for loaded area,
k = coefficient of vertical subgrade reaction for 1x1 square foot area, and
B = width of area loaded, in feet

The precautions listed below should be followed for construction of slab-on-grade pads.

- Cracking of slab-on-grade concrete is normal and should be expected.
- Cracking can occur not only as a result of heaving or compression of the supporting soil and/or fill material, but also as a result of concrete curing stresses.
- The occurrence of concrete shrinkage cracks and problems associated with concrete curing may be reduced and/or controlled by:
  - Limiting the slump of the concrete
  - Proper concrete placement, finishing, and curing
  - The placement of crack control joints at frequent intervals, particularly where re-entrance slab corners occur.
    - The American Concrete Institute (ACI) recommends a maximum panel size (in feet) equal to approximately three times the thickness of the slab (in inches) in both directions.
- The floor slab should be independent of the foundation walls.
- Areas supporting slabs should be properly moisture conditioned and compacted. Backfill in all interior and exterior water and sewer line trenches should be carefully compacted to reduce the shear stress in the concrete extending over these areas.
- Exterior slabs should be isolated from the building. These slabs should be reinforced to function as independent units. Movement of these slabs should not be transmitted to the building foundation or superstructure.
- Rubino recommends that a minimum 4-inch thick, free-draining granular mat be placed beneath the floor slab to enhance drainage. The floor slabs should have an adequate number of joints to reduce cracking resulting from differential movement and shrinkage. Floor slabs should not be rigidly connected to columns, walls, or foundations.
- A vapor retarder should be considered in areas of tile, carpet, or other moisture sensitive floor finishes. Appropriate curing procedures should be followed to reduce the risk of slab “curling” if a vapor retarder is used.

These details will not reduce the amount of movement, but are intended to reduce potential damage should some settlement of the supporting subgrade take place. Some increase in moisture content in the floor slab is inevitable as a result of development and associated landscaping. However, extreme moisture content increases can be largely controlled by proper and responsible site drainage, building maintenance and irrigation practices.

Appendix F – *Pavement Considerations*

Pavement Design Criteria

Pavement sections were evaluated using Pavement Assessment Software (PAS) which is based on the 1993 AASHTO Design equations; a reliability of 80%; and a 20-year 18-kip single axle load (ESAL) of 30,000 for light duty and 60,000 for drive areas.

Flexible Pavements were evaluated based on an initial serviceability of 4.2 and a terminal service of 2.0.

Rigid Pavements were evaluated based on an initial serviceability of 4.5 and a terminal service of 2.0; an unreinforced concrete mix with a 28 day modulus of rupture of 550 psi.

Pavement Drainage & Maintenance

Rubino recommends pavements be sloped to provide rapid surface drainage. Water allowed to pond on or adjacent to the pavement could saturate the subgrade and cause premature deterioration of pavements. In this case, removal and replacement may be required.

Consideration should be given to the use of an interceptor drain to remove water collecting in the granular base. The interceptor drains could be incorporated with the storm drains of other utilities located in the pavement areas.

Periodic maintenance of the pavement should be anticipated. This should include sealing of cracks and joints and maintenance of proper surface drainage to avoid ponding of water on or near the pavement area.

Asphalt Pavement Planning Guidelines	***Concrete Pavement Planning Guidelines***
The granular base course should be built at least 2 feet wider than the pavement on each side to support the tracks of the slipform paver. This extra width is structurally beneficial for wheel loads applied at pavement edge. The asphalt base course should comply with **IL-19.0L N-50** binder and be compacted to a minimum of 93.0% of the Maximum Theoretical Density as determined by ASTM D2041. Asphaltic surface mixture should comply with **IL-9.5L N-50** surface and be compacted to a minimum of 92.5% of the Maximum Theoretical Density as determined by ASTM D2041. Asphaltic concrete mix designs should be reviewed to determine if they are consistent with the recommendations given in this report.	Because the pavement at this site will be subjected to freeze-thaw cycles, Rubino recommends that an air entrainment admixture be added to the concrete mix to achieve an air content in the range of 5% to 7% to provide freeze-thaw durability in the concrete. Concrete with a 28-day specified compressive strength of 4,000 psi is typically adequate. Pavement for the dumpster area should be planned to be constructed of Portland cement concrete with load transfer device installed where construction joints are required. A thickened edge is recommended on the outside of slabs subjected to wheel loads. This thickened edge usually takes the form of an integral curb. Fill material should be compacted behind the curb or thicken edge of the outside slabs.

Pavement may be placed after the subgrade has been properly compacted, fine graded and proofrolled. The work should be done in accordance with State Department of Transportation guidelines. Pavement materials should conform to local and state guidelines, if applicable.

APPENDIX G - *REPORT LIMITATIONS*

Subsurface Conditions:

The subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in the appendix should be reviewed for specific information at individual boring locations. These records include soil descriptions, stratifications, penetration resistances, locations of the samples and laboratory test data as well as water level information. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur, and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition between layers may be gradual. The samples, which were not altered by laboratory testing, will be retained for up to 60 days from the date of this report and then will be discarded.

Geotechnical Risk:

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools that geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free, and more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The engineering recommendations, presented in the preceding section, constitute Rubino's professional estimate of the necessary measures for the proposed structure to perform according to the proposed design based on the information generated and reference during this evaluation, and Rubino's experience in working with these conditions.

Warranty:

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

Federal Excavation Regulations:

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better insure the safety of workmen entering trenches or excavations. This federal regulation mandates that all excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person," as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. Rubino is providing this information solely as a service to our client. Rubino is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

APPENDIX H - *SOIL CLASSIFICATION GENERAL NOTES*

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1 3/8" I.D., 2" O.D., unless otherwise noted	PS:	Piston Sample
ST:	Thin-Walled Tube - 3" O.D., Unless otherwise noted	WS:	Wash Sample
PM:	Pressuremeter	HA:	Hand Auger
RB:	Rock Bit	HS:	Hollow Stem Auger
DB:	Diamond Bit - 4", N, B	BS:	Bulk Sample

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler (SS), except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:
Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of ground water levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATION:
Soil Classification is based on the Unified Soil Classification System as defined in ASTM D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS:

Unconfined Compressive Strength, Qu (tsf)			N-Blows/ft.			Consistency
	<	0.25	< 2			Very Soft
0.25	-	0.5	2	-	4	Soft
0.5	-	1	4	-	8	Medium Stiff
1	-	2	8	-	15	Stiff
2	-	4	15	-	30	Very Stiff
4	-	8	30	-	50	Hard
>	-	8	> 50			Very Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

N-Blows/ft.			Relative Density
0	-	3	Very Loose
4	-	9	Loose
10	-	29	Medium Dense
30	-	49	Dense
50	-	80	Very Dense
		80+	Extremely Dense

RELATIVE PROPORTIONS OF SAND & GRAVEL

Descriptive Term	% of Dry Weight		
Trace		<	15
With	15	-	29
Modifier		>	30

RELATIVE PROPORTIONS OF FINES

Descriptive Term	% of Dry Weight		
Trace		<	5
With	5	-	12
Modifier		>	12

*Descriptive Terms apply to components also present in sample

GRAIN SIZE TERMINOLOGY

Major Component	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. To 3 in. (300mm to 75mm)
Gravel	3 in. To #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75mm to 0.75mm)

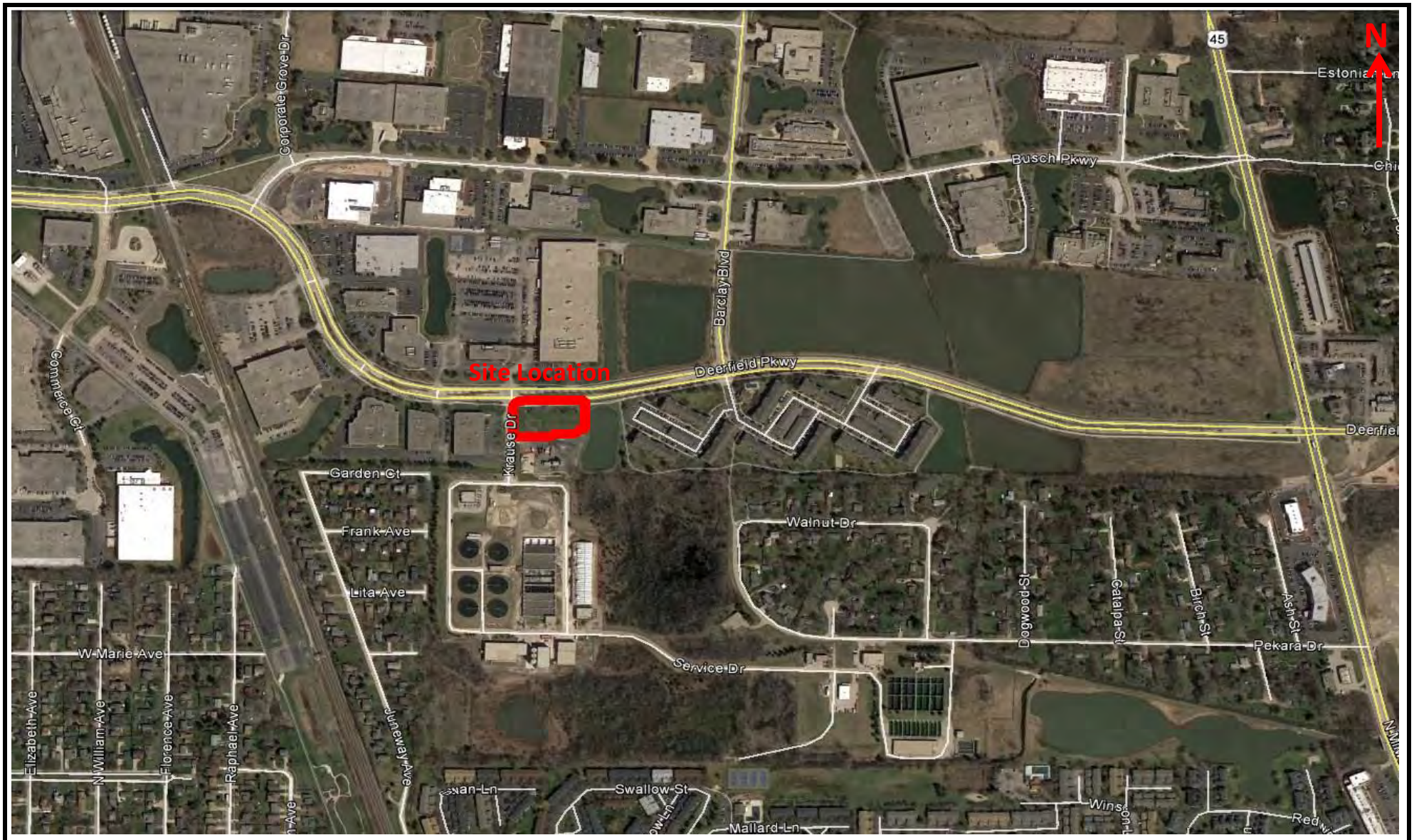
APPENDIX I - *SOIL CLASSIFICATION CHART*

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

APPENDIX J – *SITE VICINITY MAP & BORING LOCATION PLAN*



rubino
ENGINEERING INC.

665 Tollgate Rd. Unit H
Elgin, Illinois 60123

Project Name:	Proposed CAFT Building and Parking Lot
Project Location:	SEC of Deerfield Parkway and Krause Drive Buffalo Grove, Illinois
Client:	Village of Buffalo Grove
Rubino Project # :	G17.0097

Site Vicinity Map

rubino ENGINEERING INC.

665 Tollgate Rd. Unit H
Elgin, Illinois 60123

Project Name:	Proposed CAFT Building and Parking Lot
Project Location:	SEC of Deerfield Parkway and Krause Drive Buffalo Grove, Illinois
Client:	Village of Buffalo Grove
Rubino Project # :	G17.0097

Boring Location Plan

APPENDIX K – *BORING LOGS*

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-01

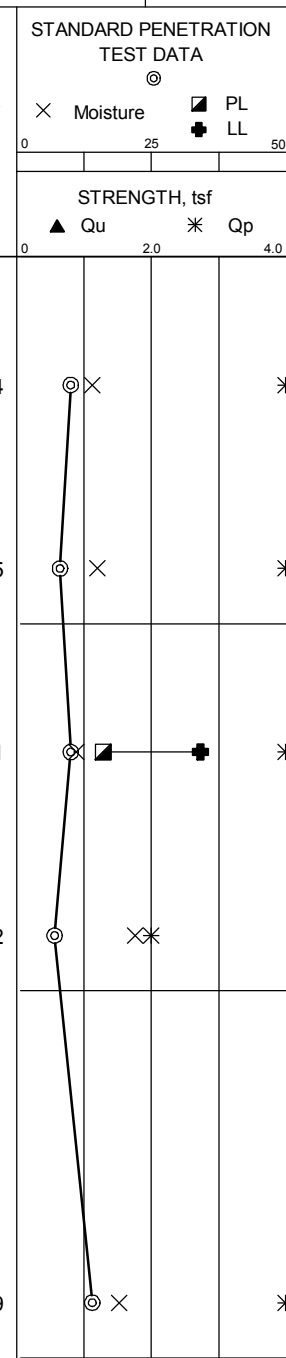
Rubino Job No.:	G17.097	Drilling Method:	3 ¼" Hollow Stem Auger
Project:	Proposed CAFT Building and Parking Lot	Sampling Method:	Split Spoon
Location:	SEC of Deefield Parkway and Krause Drive	Hammer Type:	Automatic
City, State:	Buffalo Grove, Illinois	Boring Location:	Proposed CAFT Building
Client:	Village of Buffalo Grove		Buffalo Grove, Illinois

WATER LEVELS

While Drilling	N/A FT
Upon Completion	N/A FT
Delay	N/A FT

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 3 inches of TOPSOIL				
						Brown and gray mottled with black silty CLAY, trace sand and gravel, oxidation staining; Medium stiff to stiff (Possible fill)				
				1	16			4,5,5 N=10	14	Qp=4.0 tsf
				2	10			3,4,4 N=8	15	Qp=4.0 tsf
	5									
				3	18		CL	2,4,6 N=10	11	Qp=4.0 tsf LL = 34 PL = 16
				4	16			2,3,4 N=7	22	Qp=2.0 tsf
	10									
				5	18			2,6,8 N=14	19	Qp=4.0 tsf
	15					End of boring at approximately 15 feet below existing grade. No free groundwater encountered during drilling operations.				



Completion Depth:	15.0 ft
Date Boring Started:	6/1/17
Date Boring Completed:	6/1/17
Logged By:	J.W.
Drilling Contractor:	Rubino Engineerng, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude: 42.167889°
Longitude: -87.935421°
Drill Rig: Geoprobe 7822DT
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-02

Rubino Job No.:	G17.097	Drilling Method:	3 ¼" Hollow Stem Auger
Project:	Proposed CAFT Building and Parking Lot	Sampling Method:	Split Spoon
Location:	SEC of Deefield Parkway and Krause Drive	Hammer Type:	Automatic
City, State:	Buffalo Grove, Illinois	Boring Location:	Proposed CAFT Building
Client:	Village of Buffalo Grove		Buffalo Grove, Illinois

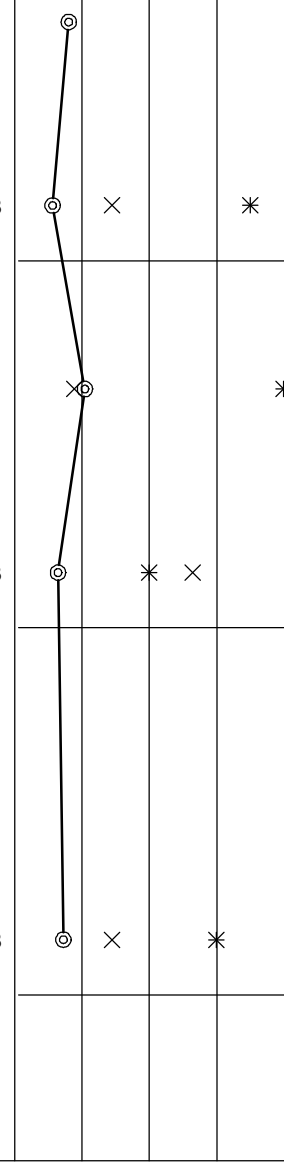
WATER LEVELS

While Drilling	N/A FT
Upon Completion	N/A FT
Delay	N/A FT

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 3 inches of TOPSOIL				
						Brown and gray mottled with black silty CLAY, trace sand and gravel, oxidation staining; Medium stiff to stiff (Possible fill)				
				1	0			6,4,6 N=10		
				2	4		CL	3,3,4 N=7	18	Qp=3.5 tsf
	5									
				3	16			3,5,8 N=13	11	Qp=4.0 tsf
				4	16			3,3,5 N=8	33	Qp=2.0 tsf 9% Organic Content
	10					Black silty CLAY, trace sand and gravel; Medium stiff to stiff (Possible fill)	CL			
				5	16	Brown and gray silty CLAY, trace sand and gravel; Stiff (Possible fill)	CL	3,4,5 N=9	18	Qp=3.0 tsf
	15					End of boring at approximately 15 feet below existing grade. No free groundwater encountered during drilling operations.				

STANDARD PENETRATION TEST DATA
Moisture, PL, LL (0, 25, 50)
STRENGTH, tsf
Qu, Qp (0, 2.0, 4.0)



Completion Depth:	15.0 ft	Sample Types:	Latitude: 42.167757°
Date Boring Started:	6/1/17	Auger Cutting, Shelby Tube	Longitude: -87.935419°
Date Boring Completed:	6/1/17	Split-Spoon, Hand Auger	Drill Rig: Geoprobe 7822DT
Logged By:	J.W.	Rock Core, Texas Cone	Remarks:
Drilling Contractor:	Rubino Engineerng, Inc.		

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

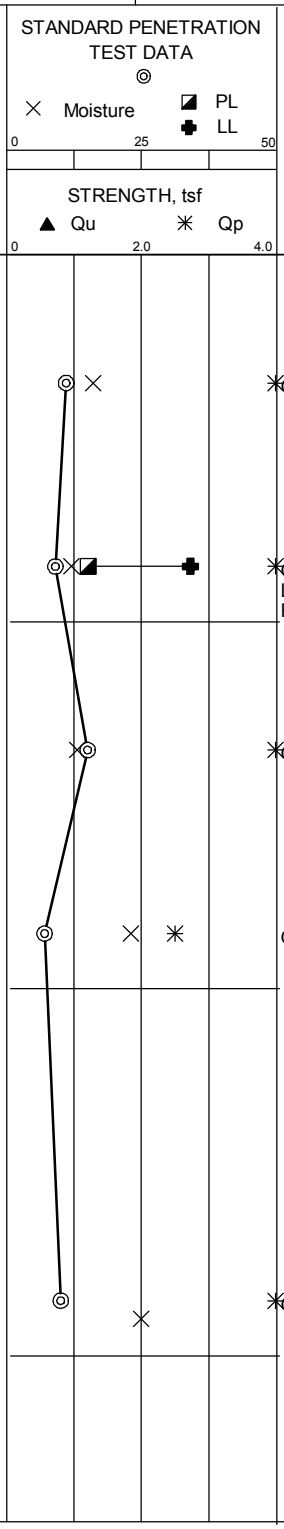
LOG OF BORING B-03

Rubino Job No.:	G17.097	Drilling Method:	3 ¼" Hollow Stem Auger
Project:	Proposed CAFT Building and Parking Lot	Sampling Method:	Split Spoon
Location:	SEC of Deefield Parkway and Krause Drive	Hammer Type:	Automatic
City, State:	Buffalo Grove, Illinois	Boring Location:	Proposed CAFT Building, Buffalo Grove, Illinois
Client:	Village of Buffalo Grove		

WATER LEVELS	
While Drilling	N/A FT
Upon Completion	N/A FT
Delay	N/A FT

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 3 inches of TOPSOIL				
				1	16	Brown and gray mottled with black silty CLAY, trace sand and gravel, oxidation staining; Medium stiff to very stiff (Possible fill)	CL	4,6,5 N=11	16	Qp=4.0 tsf
				2	14			1,3,6 N=9	12	Qp=4.0 tsf LL = 34 PL = 15
	5			3	14			4,7,8 N=15	13	Qp=4.0 tsf
				4	14			2,3,4 N=7	23	Qp=2.5 tsf
	10									
				6	16			2,4,6 N=10	25	Qp=4.0 tsf
	15					End of boring at approximately 15 feet below existing grade. No free groundwater encountered during drilling operations.				



Completion Depth:	15.0 ft
Date Boring Started:	6/1/17
Date Boring Completed:	6/1/17
Logged By:	J.W.
Drilling Contractor:	Rubino Engineerng, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude: 42.167828°
Longitude: -87.935199°
Drill Rig: Geoprobe 7822DT
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-04

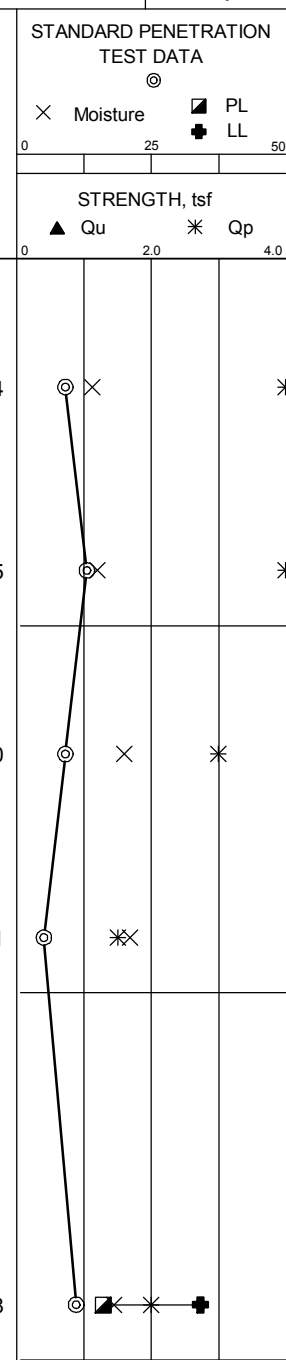
Rubino Job No.:	G17.097	Drilling Method:	3 ¼" Hollow Stem Auger
Project:	Proposed CAFT Building and Parking Lot	Sampling Method:	Split Spoon
Location:	SEC of Deefield Parkway and Krause Drive	Hammer Type:	Automatic
City, State:	Buffalo Grove, Illinois	Boring Location:	Proposed CAFT Building
Client:	Village of Buffalo Grove		Buffalo Grove, Illinois

WATER LEVELS

While Drilling	N/A FT
Upon Completion	N/A FT
Delay	N/A FT

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 3 inches of TOPSOIL				
						Brown and gray mottled with black silty CLAY, trace sand and gravel, oxidation staining; Medium stiff to stiff (Possible fill)				
				1	14			4,4,5 N=9	14	Qp=4.0 tsf
				2	16			4,7,6 N=13	15	Qp=4.0 tsf
	5									
				3	14			5,4,5 N=9	20	Qp=3.0 tsf
							CL			
				4	16			2,2,3 N=5	21	Qp=1.5 tsf
	10									
				5	12			2,5,6 N=11	18	Qp=2.0 tsf LL = 34 PL = 16
	15					End of boring at approximately 15 feet below existing grade. No free groundwater encountered during drilling operations.				



Completion Depth:	15.0 ft
Date Boring Started:	6/1/17
Date Boring Completed:	6/1/17
Logged By:	J.W.
Drilling Contractor:	Rubino Engineerng, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude: 42.167893°
Longitude: -87.934972°
Drill Rig: Geoprobe 7822DT
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-05

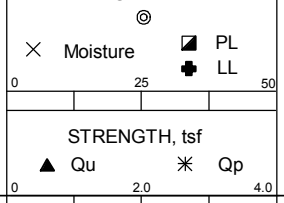
Rubino Job No.:	G17.097	Drilling Method:	3 ¼" Hollow Stem Auger
Project:	Proposed CAFT Building and Parking Lot	Sampling Method:	Split Spoon
Location:	SEC of Deefield Parkway and Krause Drive	Hammer Type:	Automatic
City, State:	Buffalo Grove, Illinois	Boring Location:	Proposed CAFT Building, Buffalo Grove, Illinois
Client:	Village of Buffalo Grove		

WATER LEVELS

While Drilling	13 FT
Upon Completion	12 FT
Delay	N/A FT

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 3 inches of TOPSOIL				
				1	12	Brown and gray mottled with black silty CLAY, trace sand and gravel, oxidation staining; Medium stiff to stiff (Possible fill)		4,4,6 N=10	13	Qp=2.5 tsf
				2	14			5,6,7 N=13	12	Qp=4.0 tsf
	5			3	14		CL	2,3,3 N=6	21	Qp=1.5 tsf
				4	18			3,6,7 N=13	18	Qp=4.0 tsf
	10									
				5	6			3,5,5 N=10	18	Qp=2.0 tsf
	15					End of boring at approximately 15 feet below existing grade.				



Completion Depth:	15.0 ft
Date Boring Started:	6/1/17
Date Boring Completed:	6/1/17
Logged By:	J.W.
Drilling Contractor:	Rubino Engineerng, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude: 42.167757°
Longitude: -87.934972°
Drill Rig: Geoprobe 7822DT
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING P-01

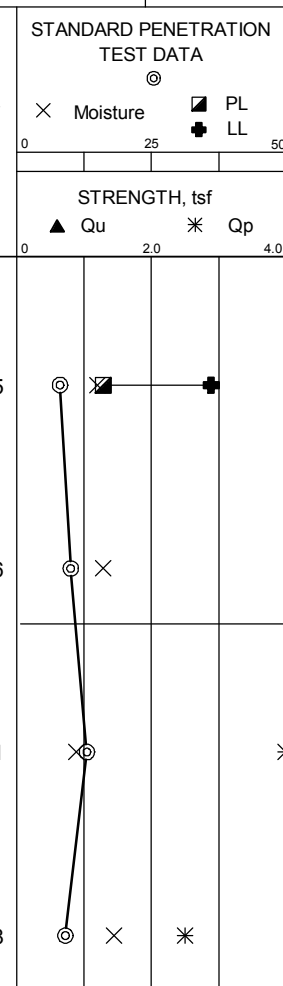
Rubino Job No.:	G17.097	Drilling Method:	3 ¼" Hollow Stem Auger
Project:	Proposed CAFT Building and Parking Lot	Sampling Method:	Split Spoon
Location:	SEC of Deefield Parkway and Krause Drive	Hammer Type:	Automatic
City, State:	Buffalo Grove, Illinois	Boring Location:	Proposed Parking Lot
Client:	Village of Buffalo Grove		Buffalo Grove, Illinois

WATER LEVELS

While Drilling	N/A FT
Upon Completion	N/A FT
Delay	N/A FT

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					UNDOCUMENTED FILL: Black, brown and gray silty clay with sand and gravel				
				1	2			4,3,5 N=8	15	LL = 36 PL = 16
				2	14			3,5,5 N=10	16	
	5									
				3	12	Brown and gray silty CLAY, trace sand and gravel; Stiff (Possible fill)	CL	5,6,7 N=13	11	Qp=4.0 tsf
				4	14			3,4,5 N=9	18	Qp=2.5 tsf
	10					End of boring at approximately 10 feet below existing grade. No free groundwater encountered during drilling operations.				



Completion Depth:	10.0 ft
Date Boring Started:	6/1/17
Date Boring Completed:	6/1/17
Logged By:	J.W.
Drilling Contractor:	Rubino Engineerng, Inc.

Sample Types:
- Auger Cutting
- Split-Spoon
- Rock Core
- Shelby Tube
- Hand Auger
- Texas Cone

Latitude: 42.167824°
Longitude: -87.935608°
Drill Rig: Geoprobe 7822DT
Remarks: Boring performed in reported demolition area of previously existing building

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING P-02

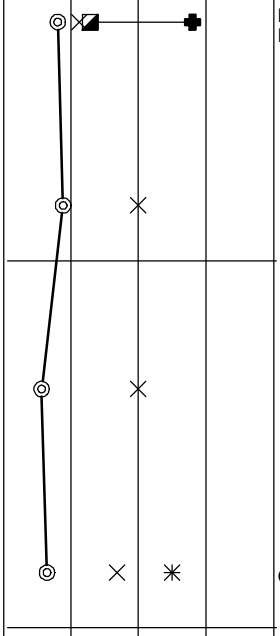
Rubino Job No.:	G17.097	Drilling Method:	3 ¼" Hollow Stem Auger
Project:	Proposed CAFT Building and Parking Lot	Sampling Method:	Split Spoon
Location:	SEC of Deefield Parkway and Krause Drive	Hammer Type:	Automatic
City, State:	Buffalo Grove, Illinois	Boring Location:	Proposed Parking Lot Buffalo Grove, Illinois
Client:	Village of Buffalo Grove		

WATER LEVELS	
While Drilling	N/A FT
Upon Completion	N/A FT
Delay	N/A FT

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 8 inches of TOPSOIL				
						UNDOCUMENTED FILL: Black, brown and gray silty clay with sand and gravel				
				1	3			3,4,6 N=10	14	LL = 35 PL = 16
				2	16			2,2,9 N=11	25	
	5									
				3	16			2,3,4 N=7	25	
				4	14	Brown and gray silty CLAY, trace sand and gravel; Medium stiff to stiff (Possible fill)	CL	2,3,5 N=8	21	Qp=2.5 tsf
	10					End of boring at approximately 10 feet below existing grade. No free groundwater encountered during drilling operations.				

STANDARD PENETRATION TEST DATA
Moisture (0 – 25 – 50); PL; LL
STRENGTH, tsf: Qu; Qp (0 – 2.0 – 4.0)



Completion Depth:	10.0 ft
Date Boring Started:	6/1/17
Date Boring Completed:	6/1/17
Logged By:	J.W.
Drilling Contractor:	Rubino Engineerng, Inc.

Sample Types: Auger Cutting; Split-Spoon; Rock Core; Shelby Tube; Hand Auger; Texas Cone

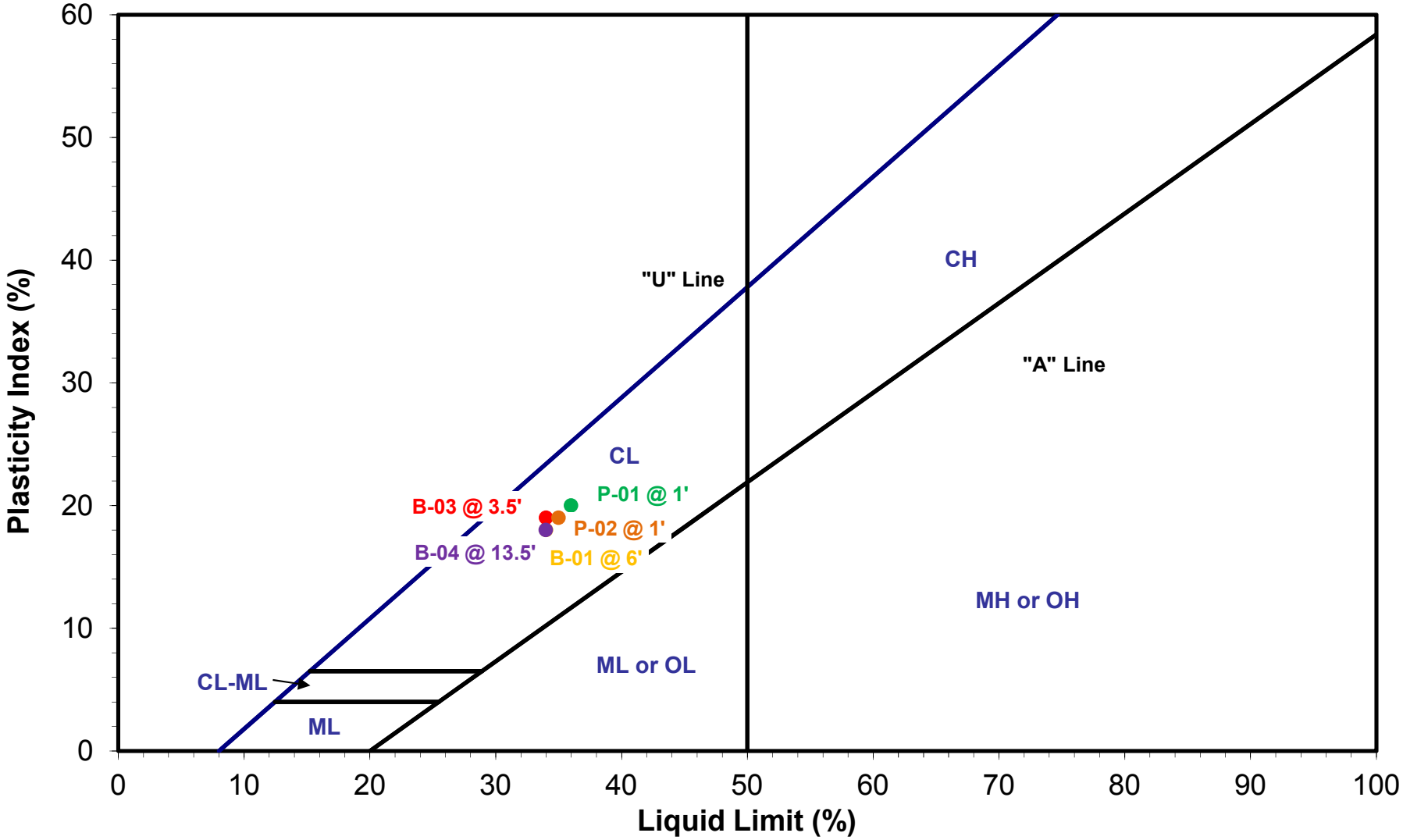
Latitude: 42.167686°
Longitude: -87.935605°
Drill Rig: Geoprobe 7822DT
Remarks: Boring performed in reported demolition area of previously existing building

The stratification lines represent approximate boundaries. The transition may be gradual.

APPENDIX L – *LABORATORY RESULTS*

rubino ENGINEERING INC.

Report of Atterberg Limits Test (ASTM D4318 / AASHTO T89 / AASHTO T90)



Boring #	B-01 @ 6'	B-03 @ 3.5'	B-04 @ 13.5'	P-01 @ 1'	P-02 @ 1'
LL	34	34	34	36	35
PL	16	15	16	16	16
PI	18	19	18	20	19

Project: Propsoed CFTA Building and Parking Lot
Location: Buffalo Grove, Illinois
Client: The Village of Buffalo Grove
Project #: G17.097

SECTION 00 73 43

PREVAILING WAGES

Illinois Department of Labor (IDOL) Prevailing Wages for Lake County with an effective date of June 5, 2017 is attached after this section.

END OF SECTION 00 73 43

This schedule contains the prevailing wage rates required to be paid for work performed on or after Monday, June 5, 2017 on public works projects in this County. Pursuant to 820 ILCS 130/4, public bodies in this County that have active public works projects are responsible for notifying all contractors and subcontractors working on those public works projects of the change (if any) to rates that were previously in effect. The failure of a public body to provide such notice does not relieve contractors or subcontractors of their obligations under the Prevailing Wage Act, including the duty to pay the relevant prevailing wage in effect at the time work subject to the Act is performed.

LAKE COUNTY
PREVAILING WAGE
RATES EFFECTIVE JUNE
5, 2017

TradeTitle	Region	Type	Class	Base Wage	Foreman Wage	M-F OT	OSA	OSH	H/W	Pension	Vacation	Training
ASBESTOS ABT-GEN	All	All		40.40	40.95	1.5	1.5	2.0	14.23	11.57	0.00	0.50
ASBESTOS ABT-MEC	All	BLD		37.46	39.96	1.5	1.5	2.0	11.62	11.06	0.00	0.72
BOILERMAKER	All	BLD		47.07	51.30	2.0	2.0	2.0	6.97	18.13	0.00	0.40
BRICK MASON	All	BLD		44.88	49.37	1.5	1.5	2.0	10.25	15.30	0.00	0.85
CARPENTER	All	All		45.35	47.35	1.5	1.5	2.0	11.79	17.60	0.00	0.63
CEMENT MASON	All	All		43.25	45.25	2.0	1.5	2.0	10.00	20.38	0.00	0.50
CERAMIC TILE FNSHER	All	BLD		37.81	37.81	1.5	1.5	2.0	10.55	10.12	0.00	0.65
COMMUNICATION TECH	All	BLD		35.85	37.95	1.5	1.5	2.0	11.43	12.38	2.13	0.54
ELECTRIC PWR EQMT OP	All	ALL		0.00	0.00	0.0	0.0	0.0	0.00	0.00	0.00	0.00
ELECTRIC PWR EQMT OP	All	HWY		40.59	55.15	1.5	1.5	2.0	5.25	12.59	0.00	0.71
ELECTRIC PWR GRNDMAN	All	All		30.33	53.29	1.5	1.5	2.0	5.00	9.40	0.00	0.30
ELECTRIC PWR GRNDMAN	All	HWY		32.50	55.15	1.5	1.5	2.0	5.25	10.09	0.00	0.58
ELECTRIC PWR LINEMAN	All	All		45.36	51.48	1.5	1.5	2.0	5.00	14.06	0.00	0.45
ELECTRIC PWR LINEMAN	All	HWY		48.59	55.15	1.5	1.5	2.0	5.25	15.07	0.00	0.85

ELECTRIC PWR TRK DRV	All	All		30.34	51.48	1.5	1.5	2.0	5.00	9.40	0.00	0.30
ELECTRIC PWR TRK DRV	All	HWY		31.40	53.29	1.5	1.5	2.0	5.00	9.73	0.00	0.31
ELECTRICIAN	All	BLD		40.00	44.00	1.5	1.5	2.0	14.10	17.49	4.00	0.65
ELEVATOR CONSTRUCTOR	All	BLD		51.94	58.43	2.0	2.0	2.0	14.43	14.96	4.16	0.90
FENCE ERECTOR	All	All		38.34	40.34	1.5	1.5	2.0	13.15	13.10	0.00	0.40
GLAZIER	All	BLD		41.70	43.20	1.5	2.0	2.0	13.94	18.99	0.00	0.94
HT/FROST INSULATOR	All	BLD		49.95	52.45	1.5	1.5	2.0	11.62	12.26	0.00	0.72
IRON WORKER	All	All		44.20	46.20	2.0	2.0	2.0	13.65	21.14	0.00	0.35
LABORER	All	All		40.20	40.95	1.5	1.5	2.0	14.23	11.57	0.00	0.50
LATHER	All	All		44.35	46.35	1.5	1.5	2.0	16.39	13.75	0.00	0.63
MACHINIST	All	BLD		45.35	47.85	1.5	1.5	2.0	7.26	8.95	1.85	0.00
MARBLE FINISHERS	All	All		33.45	33.45	1.5	1.5	2.0	10.25	14.44	0.00	0.46
MARBLE MASON	All	BLD		44.13	48.54	1.5	1.5	2.0	10.25	14.97	0.00	0.59
MATERIAL TESTER I	All	All		30.20	30.20	1.5	1.5	2.0	14.23	11.57	0.00	0.50
MATERIALS TESTER II	All	All		35.20	35.20	1.5	1.5	2.0	14.23	11.57	0.00	0.50
MILLWRIGHT	All	All		45.35	47.35	1.5	1.5	2.0	11.79	17.60	0.00	0.63
OPERATING ENGINEER	All	BLD	1	49.10	53.10	2.0	2.0	2.0	18.05	13.60	1.90	1.30
OPERATING ENGINEER	All	BLD	2	47.80	53.10	2.0	2.0	2.0	18.05	13.60	1.90	1.30
OPERATING ENGINEER	All	BLD	3	45.25	53.10	2.0	2.0	2.0	18.05	13.60	1.90	1.30
OPERATING ENGINEER	All	BLD	4	43.50	53.10	2.0	2.0	2.0	18.05	13.60	1.90	1.30
OPERATING ENGINEER	All	BLD	5	52.85	53.10	2.0	2.0	2.0	18.05	13.60	1.90	1.30
OPERATING ENGINEER	All	BLD	6	50.10	53.10	2.0	2.0	2.0	18.05	13.60	1.90	1.30
OPERATING ENGINEER	All	BLD	7	52.10	53.10	2.0	2.0	2.0	18.05	13.60	1.90	1.30
OPERATING ENGINEER	All	FLT	1	54.75	51.30	1.5	1.5	2.0	17.65	12.65	1.90	1.35
OPERATING ENGINEER	All	FLT	2	53.25	54.75	1.5	1.5	2.0	17.65	12.65	1.90	1.35
OPERATING ENGINEER	All	FLT	3	47.40	51.30	1.5	1.5	2.0	17.65	12.65	1.90	1.35
OPERATING ENGINEER	All	FLT	4	39.40	54.75	1.5	1.5	2.0	17.65	12.65	1.90	1.35
OPERATING ENGINEER	All	FLT	5	56.25	54.75	1.5	1.5	2.0	17.65	12.65	1.90	1.35

OPERATING ENGINEER	All	FLT	6	37.00	54.75	1.5	1.5	2.0	17.65	12.65	1.90	1.35
OPERATING ENGINEER	All	HWY	1	47.30	51.30	1.5	1.5	2.0	18.05	13.60	1.90	1.30
OPERATING ENGINEER	All	HWY	2	46.75	51.30	1.5	1.5	2.0	18.05	13.60	1.90	1.30
OPERATING ENGINEER	All	HWY	3	44.70	51.30	1.5	1.5	2.0	18.05	13.60	1.90	1.30
OPERATING ENGINEER	All	HWY	4	43.30	51.30	1.5	1.5	2.0	18.05	13.60	1.90	1.30
OPERATING ENGINEER	All	HWY	5	42.10	51.30	1.5	1.5	2.0	18.05	13.60	1.90	1.30
OPERATING ENGINEER	All	HWY	6	50.30	51.30	1.5	1.5	2.0	18.05	13.60	1.90	1.30
OPERATING ENGINEER	All	HWY	7	48.30	51.30	1.5	1.5	2.0	18.05	13.60	1.90	1.30
ORNAMNTL IRON WORKER	All	All		45.75	48.25	2.0	2.0	2.0	13.65	18.99	0.00	0.75
PAINTER	All	All		44.55	49.30	1.5	1.5	1.5	11.50	11.10	0.00	1.27
PAINTER SIGNS	All	BLD		33.92	38.09	1.5	1.5	1.5	2.60	2.71	0.00	0.00
PILEDRIVER	All	All		45.35	47.35	1.5	1.5	2.0	11.79	17.60	0.00	0.63
PIPEFITTER	All	BLD		47.50	50.50	1.5	1.5	2.0	9.55	17.85	0.00	2.07
PLASTERER	All	BLD		43.12	45.71	1.5	1.5	2.0	10.00	20.68	0.00	0.50
PLUMBER	All	BLD		48.25	50.25	1.5	1.5	2.0	14.09	12.65	0.00	1.18
ROOFER	All	BLD		41.70	44.70	1.5	1.5	2.0	8.28	11.59	0.00	0.53
SHEETMETAL WORKER	All	BLD		43.03	46.47	1.5	1.5	2.0	10.73	21.87	0.00	0.75
SIGN HANGER	All	BLD		31.31	33.81	1.5	1.5	2.0	4.85	3.28	0.00	0.00
SPRINKLER FITTER	All	BLD		47.20	49.20	1.5	1.5	2.0	12.25	11.55	0.00	0.55
STEEL ERECTOR	All	All		42.07	44.07	2.0	2.0	2.0	13.45	19.59	0.00	0.35
STONE MASON	All	BLD		44.88	49.37	1.5	1.5	2.0	10.25	15.30	0.00	0.85
TERRAZZO FINISHER	All	BLD		39.54	39.54	1.5	1.5	2.0	10.55	11.79	0.00	0.67
TERRAZZO MASON	All	BLD		43.38	43.38	1.5	1.5	2.0	10.55	13.13	0.00	0.79
TILE MASON	All	BLD		43.84	47.84	1.5	1.5	2.0	10.55	11.40	0.00	0.99
TRAFFIC SAFETY WRKR	All	HWY		32.75	34.35	1.5	1.5	2.0	8.45	6.05	0.00	0.50
TRUCK DRIVER	All	All	1	37.05	37.60	1.5	1.5	2.0	9.50	7.50	0.00	0.15
TRUCK DRIVER	All	All	2	37.20	37.60	1.5	1.5	2.0	9.50	7.50	0.00	0.15
TRUCK DRIVER	All	All	3	37.40	37.60	1.5	1.5	2.0	9.50	7.50	0.00	0.15
TRUCK DRIVER	All	All	4	37.60	37.60	1.5	1.5	2.0	9.50	7.50	0.00	0.15
TUCKPOINTER	All	BLD		44.90	45.90	1.5	1.5	2.0	8.30	14.29	0.00	0.48

Explanations

LAKE COUNTY

The following list is considered as those days for which holiday rates of wages for work performed apply: New Years Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Christmas Day and Veterans Day in some classifications/counties. Generally, any of these holidays which fall on a Sunday is celebrated on the following Monday. This then makes work performed on that Monday payable at the appropriate overtime rate for holiday pay. Common practice in a given local may alter certain days of celebration. If in doubt, please check with IDOL.

EXPLANATION OF CLASSES

ASBESTOS - GENERAL - removal of asbestos material/mold and hazardous materials from any place in a building, including mechanical systems where those mechanical systems are to be removed. This includes the removal of asbestos materials/mold and hazardous materials from ductwork or pipes in a building when the building is to be demolished

at the time or at some close future date.

ASBESTOS - MECHANICAL - removal of asbestos material from mechanical systems, such as pipes, ducts, and boilers, where the mechanical systems are to remain.

CERAMIC TILE FINISHER

The grouting, cleaning, and polishing of all classes of tile, whether for interior or exterior purposes, all burned, glazed or unglazed products; all composition materials, granite tiles, warning detectable tiles, cement tiles, epoxy composite materials, pavers, glass, mosaics, fiberglass, and all substitute materials, for tile made in tile-like units; all mixtures in tile like form of cement, metals, and other materials that are for and intended for use as a finished floor surface, stair treads, promenade roofs, walks, walls, ceilings, swimming pools, and all other places where tile is to form a finished interior or exterior. The mixing of all setting mortars including but not limited to thin-set mortars, epoxies, wall mud, and any other sand and cement mixtures or adhesives when used in the preparation, installation, repair, or maintenance of tile and/or similar materials.

The handling and unloading of all sand, cement, lime, tile, fixtures, equipment, adhesives, or any other materials to be used in the preparation, installation, repair, or maintenance of tile and/or similar materials. Ceramic Tile Finishers shall fill all joints and voids regardless of method on all tile work, particularly and especially after installation of said tile work. Application of any and all protective coverings to all types of tile installations including, but not be limited to, all soap compounds, paper products, tapes, and all polyethylene coverings, plywood, masonite, cardboard, and any new type of products that may be used to protect tile installations, Blastrac equipment, and all floor scarifying equipment used in preparing floors to receive tile. The clean up and removal of all waste and materials. All demolition of existing tile floors and walls to be re-tiled.

COMMUNICATION TECHNICIAN

Low voltage construction, installation, maintenance and removal of telecommunication facilities (voice, sound, data and video) including outside plant, telephone, security systems and data inside wire, interconnect, terminal equipment, central offices, PABX, fiber optic

cable and equipment, micro waves, V-SAT, bypass, CATV, WAN (wide area network), LAN (local area networks), and ISDN (integrated system digital network), pulling of wire in raceways, but not the installation of raceways.

MARBLE FINISHER

Loading and unloading trucks, distribution of all materials (all stone, sand, etc.), stocking of floors with material, performing all rigging for heavy work, the handling of all material that may be needed for the installation of such materials, building of scaffolding, polishing if needed, patching, waxing of material if damaged, pointing up, caulking, grouting and cleaning of marble, holding water on diamond or Carborundum blade or saw for setters cutting, use of tub saw or any other saw needed for preparation of material, drilling of holes for wires that anchor material set by setters, mixing up of molding plaster for installation of material, mixing up thin set for the installation of material, mixing up of sand to cement for the installation of material and such other work as may be required in helping a Marble Setter in the handling of all material in the erection or installation of interior marble, slate,

travertine, art marble, serpentine, alberene stone, blue stone, granite and other stones (meaning as to stone any foreign or domestic materials as are specified and used in building interiors and exteriors and customarily known as stone in the trade), carrara, sanionyx, vitrolite and similar opaque glass and the laying of all marble tile, terrazzo tile, slate tile and precast tile, steps, risers treads, base, or any other materials that may be used as substitutes for any of the aforementioned materials and which are used on interior and exterior which are installed in a similar manner.

MATERIAL TESTER I: Hand coring and drilling for testing of materials; field inspection of uncured concrete and asphalt.

MATERIAL TESTER II: Field inspection of welds, structural steel, fireproofing, masonry, soil, facade, reinforcing steel, formwork, cured concrete, and concrete and asphalt batch plants; adjusting proportions of bituminous mixtures.

OPERATING ENGINEER - BUILDING

Class 1. Asphalt Plant; Asphalt Spreader; Autograde; Backhoes with Caisson Attachment; Batch Plant; Benoto (requires Two Engineers); Boiler and Throttle Valve; Caisson Rigs; Central Redi-Mix Plant; Combination Back Hoe Front End-loader Machine; Compressor and Throttle Valve; Concrete Breaker (Truck Mounted); Concrete Conveyor; Concrete Conveyor (Truck Mounted); Concrete Paver Over 27E cu. ft; Concrete Paver 27E cu. ft. and Under: Concrete Placer; Concrete Placing Boom; Concrete Pump (Truck Mounted); Concrete Tower; Cranes, All; Cranes, Hammerhead; Cranes, (GCI and similar Type); Creter Crane; Spider Crane; Crusher, Stone, etc.; Derricks, All; Derricks, Traveling; Formless Curb and Gutter Machine; Grader, Elevating; Grouting Machines; Heavy Duty Self-Propelled Transporter or Prime Mover; Highlift Shovels or Front Endloader 2-1/4 yd. and over; Hoists, Elevators, outside type rack and pinion and similar machines; Hoists, One, Two and Three Drum; Hoists, Two Tugger One Floor; Hydraulic Backhoes; Hydraulic Boom Trucks; Hydro Vac (and similar equipment); Locomotives, All; Motor Patrol; Lubrication Technician; Manipulators; Pile Drivers and Skid Rig; Post Hole Digger; Pre-Stress Machine; Pump Cretes Dual Ram; Pump Cretes: Squeeze Cretes-Screw Type Pumps; Gypsum Bulker and Pump; Raised and Blind Hole Drill; Roto Mill Grinder; Scoops - Tractor Drawn; Slip-Form Paver; Straddle Buggies; Operation

of Tie Back Machine; Tournapull; Tractor with Boom and Side Boom; Trenching Machines.

Class 2. Boilers; Broom, All Power Propelled; Bulldozers; Concrete Mixer (Two Bag and Over); Conveyor, Portable; Forklift Trucks; Highlift Shovels or Front Endloaders under 2-1/4 yd.; Hoists, Automatic; Hoists, Inside Elevators; Hoists, Sewer Dragging Machine; Hoists, Tugger Single Drum; Laser Screed; Rock Drill (Self-Propelled); Rock Drill (Truck Mounted); Rollers, All; Steam Generators; Tractors, All; Tractor Drawn Vibratory Roller; Winch Trucks with "A" Frame.

Class 3. Air Compressor; Combination Small Equipment Operator; Generators; Heaters, Mechanical; Hoists, Inside Elevators (remodeling or renovation work); Hydraulic Power Units (Pile Driving, Extracting, and Drilling); Pumps, over 3" (1 to 3 not to exceed a total of 300 ft.); Low Boys; Pumps, Well Points; Welding Machines (2 through 5); Winches, 4 Small Electric Drill Winches.

Class 4. Bobcats and/or other Skid Steer Loaders; Oilers; and Brick Forklift.

Class 5. Assistant Craft Foreman.

Class 6. Gradall.

Class 7. Mechanics; Welders.

OPERATING ENGINEERS - HIGHWAY CONSTRUCTION

Class 1. Asphalt Plant; Asphalt Heater and Planer Combination; Asphalt Heater Scarfire; Asphalt Spreader; Autograder/GOMACO or other similar type machines: ABG Paver; Backhoes with Caisson Attachment; Ballast Regulator; Belt Loader; Caisson Rigs; Car Dumper; Central Redi-Mix Plant; Combination Backhoe Front Endloader Machine, (1 cu. yd. Backhoe Bucket or over or with attachments); Concrete Breaker (Truck Mounted); Concrete Conveyor; Concrete Paver over 27E cu. ft.; Concrete Placer; Concrete Tube Float; Cranes, all attachments; Cranes, Tower Cranes of all types: Creter Crane: Spider Crane; Crusher, Stone, etc.; Derricks, All; Derrick Boats; Derricks, Traveling; Dredges; Elevators, Outside type Rack & Pinion and Similar Machines; Formless Curb and Gutter Machine; Grader, Elevating; Grader, Motor Grader,

Motor Patrol, Auto Patrol, Form Grader, Pull Grader, Subgrader; Guard Rail Post Driver Truck Mounted; Hoists, One, Two and Three Drum; Heavy Duty Self-Propelled Transporter or Prime Mover; Hydraulic Backhoes; Backhoes with shear attachments up to 40' of boom reach; Lubrication Technician; Manipulators; Mucking Machine; Pile Drivers and Skid Rig; Pre-Stress Machine; Pump Cretes Dual Ram; Rock Drill - Crawler or Skid Rig; Rock Drill - Truck Mounted; Rock/Track Tamper; Roto Mill Grinder; Slip-Form Paver; Snow Melters; Soil Test Drill Rig (Truck Mounted); Straddle Buggies; Hydraulic Telescoping Form (Tunnel); Operation of Tieback Machine; Tractor Drawn Belt Loader; Tractor Drawn Belt Loader (with attached pusher - two engineers); Tractor with Boom; Tractaire with Attachments; Traffic Barrier Transfer Machine; Trenching; Truck Mounted Concrete Pump with Boom; Raised or Blind Hole Drills (Tunnel Shaft); Underground Boring and/or Mining Machines 5 ft. in diameter and over tunnel, etc; Underground Boring and/or Mining Machines under 5 ft. in diameter; Wheel Excavator; Widener (APSCO).

Class 2. Batch Plant; Bituminous Mixer; Boiler and Throttle Valve; Bulldozers; Car Loader Trailing Conveyors; Combination Backhoe Front Endloader Machine (Less than 1 cu. yd. Backhoe Bucket or over or with attachments); Compressor and Throttle Valve; Compressor, Common

Receiver (3); Concrete Breaker or Hydro Hammer; Concrete Grinding Machine; Concrete Mixer or Paver 7S Series to and including 27 cu. ft.; Concrete Spreader; Concrete Curing Machine, Burlap Machine, Belting Machine and Sealing Machine; Concrete Wheel Saw; Conveyor Muck Cars (Haglund or Similar Type); Drills, All; Finishing Machine - Concrete; Highlift Shovels or Front Endloader; Hoist - Sewer Dragging Machine; Hydraulic Boom Trucks (All Attachments); Hydro-Blaster; Hydro Excavating (excluding hose work); Laser Screed; All Locomotives, Dinky; Off-Road Hauling Units (including articulating) Non Self-Loading Ejection Dump; Pump Cretes: Squeeze Cretes - Screw Type Pumps, Gypsum Bulker and Pump; Roller, Asphalt; Rotary Snow Plows; Rototiller, Seaman, etc., self-propelled; Self-Propelled Compactor; Spreader - Chip - Stone, etc.; Scraper - Single/Twin Engine/Push and Pull; Scraper - Prime Mover in Tandem (Regardless of Size); Tractors pulling attachments, Sheeps Foot, Disc, Compactor, etc.; Tug Boats.

Class 3. Boilers; Brooms, All Power Propelled; Cement Supply Tender; Compressor, Common Receiver (2); Concrete Mixer (Two Bag and Over); Conveyor, Portable; Farm-Type Tractors Used for Mowing, Seeding, etc.; Forklift Trucks; Grouting Machine; Hoists, Automatic; Hoists, All Elevators; Hoists, Tugger Single Drum; Jeep Diggers; Low Boys; Pipe

Jacking Machines; Post-Hole Digger; Power Saw, Concrete Power Driven; Pug Mills; Rollers, other than Asphalt; Seed and Straw Blower; Steam Generators; Stump Machine; Winch Trucks with "A" Frame; Work Boats; Tamper-Form-Motor Driven.

Class 4. Air Compressor; Combination - Small Equipment Operator; Directional Boring Machine; Generators; Heaters, Mechanical; Hydraulic Power Unit (Pile Driving, Extracting, or Drilling); Light Plants, All (1 through 5); Pumps, over 3" (1 to 3 not to exceed a total of 300 ft.); Pumps, Well Points; Vacuum Trucks (excluding hose work); Welding Machines (2 through 5); Winches, 4 Small Electric Drill Winches.

Class 5. SkidSteer Loader (all); Brick Forklifts; Oilers.

Class 6. Field Mechanics and Field Welders

Class 7. Dowell Machine with Air Compressor; Gradall and machines of like nature.

OPERATING ENGINEER - FLOATING

Class 1. Craft Foreman; Master Mechanic; Diver/Wet Tender; Engineer; Engineer (Hydraulic Dredge).

Class 2. Crane/Backhoe Operator; Boat Operator with towing endorsement; Mechanic/Welder; Assistant Engineer (Hydraulic Dredge); Leverman (Hydraulic Dredge); Diver Tender.

Class 3. Deck Equipment Operator, Machineryman, Maintenance of Crane (over 50 ton capacity) or Backhoe (115,000 lbs. or more); Tug/Launch Operator; Loader/Dozer and like equipment on Barge, Breakwater Wall, Slip/Dock, or Scow, Deck Machinery, etc.

Class 4. Deck Equipment Operator, Machineryman/Fireman (4 Equipment Units or More); Off Road Trucks; Deck Hand, Tug Engineer, Crane Maintenance (50 Ton Capacity and Under) or Backhoe Weighing (115,000 pounds or less); Assistant Tug Operator.

Class 5. Friction or Lattice Boom Cranes.

Class 6. ROV Pilot, ROV Tender

TRAFFIC SAFETY - work associated with barricades, horses and drums used to reduce lane usage on highway work, the installation and removal of temporary lane markings, and the installation and removal of temporary road signs.

TRUCK DRIVER - BUILDING, HEAVY AND HIGHWAY CONSTRUCTION

Class 1. Two or three Axle Trucks. A-frame Truck when used for transportation purposes; Air Compressors and Welding Machines, including those pulled by cars, pick-up trucks and tractors; Ambulances; Batch Gate Lockers; Batch Hopperman; Car and Truck Washers; Carry-alls; Fork Lifts and Hoisters; Helpers; Mechanics Helpers and Greasers; Oil Distributors 2-man operation; Pavement Breakers; Pole Trailer, up to 40 feet; Power Mower Tractors; Self-propelled Chip Spreader; Skipman; Slurry Trucks, 2-man operation; Slurry Truck Conveyor Operation, 2 or 3 man; Teamsters; Unskilled Dumpman; and Truck Drivers hauling warning lights, barricades, and portable toilets on the job site.

Class 2. Four axle trucks; Dump Crets and Adgetors under 7 yards; Dumpsters, Track Trucks, Euclids, Hug Bottom Dump Turnapulls or

Turnatrailers when pulling other than self-loading equipment or similar equipment under 16 cubic yards; Mixer Trucks under 7 yards; Ready-mix Plant Hopper Operator, and Winch Trucks, 2 Axles.

Class 3. Five axle trucks; Dump Crets and Adgetors 7 yards and over; Dumpsters, Track Trucks, Euclids, Hug Bottom Dump Turnatrailers or turnapulls when pulling other than self-loading equipment or similar equipment over 16 cubic yards; Explosives and/or Fission Material Trucks; Mixer Trucks 7 yards or over; Mobile Cranes while in transit; Oil Distributors, 1-man operation; Pole Trailer, over 40 feet; Pole and Expandable Trailers hauling material over 50 feet long; Slurry trucks, 1-man operation; Winch trucks, 3 axles or more; Mechanic--Truck Welder and Truck Painter.

Class 4. Six axle trucks; Dual-purpose vehicles, such as mounted crane trucks with hoist and accessories; Foreman; Master Mechanic; Self-loading equipment like P.B. and trucks with scoops on the front.

TERRAZZO FINISHER

The handling of sand, cement, marble chips, and all other materials that may be used by the Mosaic Terrazzo Mechanic, and the mixing, grinding, grouting, cleaning and sealing of all Marble, Mosaic, and Terrazzo work, floors, base, stairs, and wainscoting by hand or machine, and in addition, assisting and aiding Marble, Masonic, and Terrazzo Mechanics.

Other Classifications of Work:

For definitions of classifications not otherwise set out, the Department generally has on file such definitions which are available. If a task to be performed is not subject to one of the classifications of pay set out, the Department will upon being contacted state which neighboring county has such a classification and provide such rate, such rate being deemed to exist by reference in this document. If no neighboring county rate applies to the task, the Department shall undertake a special determination, such special determination being then deemed to have existed under this determination. If a project requires these, or any classification not listed, please contact IDOL at 217-782-1710 for wage rates or clarifications.

LANDSCAPING

Landscaping work falls under the existing classifications for laborer, operating engineer and truck driver. The work performed by landscape plantsman and landscape laborer is covered by the existing classification of laborer. The work performed by landscape operators (regardless of equipment used or its size) is covered by the classifications of operating engineer. The work performed by landscape truck drivers (regardless of size of truck driven) is covered by the classifications of truck driver.

MATERIAL TESTER & MATERIAL TESTER/INSPECTOR I AND II

Notwithstanding the difference in the classification title, the classification entitled "Material Tester I" involves the same job duties as the classification entitled "Material Tester/Inspector I". Likewise, the classification entitled "Material Tester II" involves the same job duties as the classification entitled "Material Tester/Inspector II".

SECTION 01 11 00

SUMMARY OF THE WORK

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents.
2. Use of premises.
3. Owner's occupancy requirements.
4. Work restrictions.
5. Specification formats and conventions.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.03 PROJECT IDENTIFICATION

A.	Project Name:	Combined Area Fire Training Facility Buffalo Grove, Illinois
B.	Owner:	Village of Buffalo Grove 50 Raupp Boulevard Buffalo Grove, Illinois 60089
C.	Architect:	Wold Architects and Engineers 110 North Brockway, Suite 220, Palatine, Illinois, 60067
D.	Civil Engineer:	Meritcorp Group 50 North Brockway, Suite 3-9 Palatine, Illinois 60067
E.	Structural Engineer:	Johnson Wilbur Adams 175 North Washington Street Wheaton, Illinois 60187
F.	Mechanical Engineer:	Gage Consulting Engineers 1301 West 22nd Street, Suite 220 Oak Brook, Illinois 60523
G.	Electrical Engineer:	Gage Consulting Engineers 1301 West 22nd Street, Suite 220 Oak Brook, Illinois 60523

1.04 SUMMARY OF THE WORK

Briefly and without force and effect upon the Contract Documents, the Work of this single prime Contract can be summarized as follows:

A. Work under this Contract includes:

1. Sitework

   a. Site utilities: Water mains, storm sewers, sanitary sewers.

   b. Rough and finish grading, paving, concrete sidewalks and plazas, ground cover, and swales.

   c. Fencing and miscellaneous site improvements.

   d. Construction details for site improvements and site utilities.

2. Building Structure

   a. Concrete footings, masonry and concrete foundation walls, concrete slabs on grade, pre-engineered wood building system with metal roof and wall panels, and miscellaneous metal items including stairs, railings.

3. Building Enclosure

   a. Face brick, veneer and cast stone sills.

   b. Aluminum windows, storefront entrance systems and glazing.

   c. Overhead garage door.

4. Interior Finishes

   a. Insulated gypsum board stud partitions.

   b. Floor finishes of epoxy painted concrete, ceramic tile, and decorative quartz flooring.

   c. Wall finishes of paint and ceramic tile.

   d. Ceiling finishes of acoustical lay-in tile, and gypsum board.

   e. Plastic laminate casework, HM doors and frames, wood doors, access panels, hardware, glazing, toilet accessories, signage.

5. Plumbing:

   a. New combined incoming fire protection/domestic water service. New water meter and RPZ. 4” blind flange for fire protection.

   b. New gas fired water heater.

   c. New Plumbing fixtures and drains.

   d. New domestic hot water, hot water return, and cold water distribution.

   e. New triple basin oil interceptor.

f. New sanitary and sanitary vent system.

6. Fire Protection:

   a. New incoming service backflow device connected to incoming combined fire protection/domestic water service.

   b. New dry valve with riser mounted compressor and piping system to serve attic, overhangs and apparatus bay.

   c. Wet piping system serving all interior heated spaces.

   d. New fire department connection.

7. Mechanical Systems

   a. Plumbing including, supply and waste piping systems, piping insulation, plumbing fixtures.

   b. Heating including piping, piping insulation, boilers, furnaces.

   c. Ventilation to include, air handlers, unit ventilators, fan coils, ductwork, duct insulation, chilled water piping, DX condensers, chillers, cooling towers.

   d. Temperature control system.

   e. New gas/dx single zone vav unit located on pad outdoors serving all interior rooms.

   f. Low pressure supply, return, and exhaust duct systems.

   g. New diffusers, grilles, and registers.

   h. New general exhaust and apparatus bay exhaust systems.

   i. New electric cabinet unit heaters in vestibule and toilet rooms with exterior walls.

   j. New gas fired unit heaters in apparatus bay.

   k. New intake and exhaust louvers in apparatus bay.

   l. New incoming gas service and piping to gas fired mechanical and plumbing equipment.

   m. New stand-alone controls for all systems.

8. Electrical Systems

   a. Electrical service, distribution panels, conduit and wiring.

   b. Interior and exterior lighting. Parking lot lighting.

   c. Communications including telephone and data wiring.

   d. Fire alarm and rough-in for future security systems.

9. Keep Architect fully informed about progress of the work, performance of the work and potential problems.

10. The Owner will hold a ground breaking at the start of construction. The Contractor is responsible to supply 20 new hard hats and 20 new shovels for the participants.

1.05 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

   1. Contractor is to visit site and be familiar with existing conditions. Contractor will be required to accept existing conditions on site prior to mobilizing.

B. Use of Site: Limit use of premises to work in areas where indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

   1. Allow for Owner occupancy of Project site.

   2. Driveways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

      a. Schedule deliveries to minimize use of driveways and entrances.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

   3. Public Streets: Maintain clear of automobile parking, equipment or material storage unless arrangements have been made with the appropriate jurisdiction.

   4. Lock automotive type vehicles, such as passenger cars and trucks and other mechanized or motorized construction equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place.

C. Do not allow construction waste and debris to accumulate; remove debris as it accumulates and, unless specified otherwise, dispose of legally off-site.

D. Conform to Village's noise control regulations, including limited hours of construction operations.

1.06 LAYING OUT WORK

A. Locate all general reference points. Where dimensions or observed scope of work differ substantially from Drawings, notify Architect for decision.

B. Lay out Work from the reference points furnished and be responsible for all lines, elevations, and measurements inside workspace. Exercise proper precaution to verify figures shown on Drawings before laying out work and will be held responsible for any error resulting from its failure to exercise such precaution.

C. Hire the services of a locator company to locate all privately owned utilities that may be disturbed by construction operations.

D. Coordinate utility connections with Village/utility company in which project is being constructed.

1.07 OWNER'S OCCUPANCY REQUIREMENTS

A. Partial Owner Occupancy: Owner will occupy the site during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.

2. Provide not less than 72 hour's notice to Owner of activities that will affect Owner's operations.

B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a punchlist for each specific portion of the Work to be occupied before Owner move in.

2. Obtain a temporary Certificate of Occupancy if required from authorities having jurisdiction before Owner occupancy to install furnishings and equipment.

1.08 WORK RESTRICTIONS

A. The Contractor shall limit access to grounds as indicated on Civil Drawings.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than seven (7) days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's or Owner's permission.

1.09 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Division and Sections using the 49-division format and CSI/CSC's "Master Format" numbering system.

1. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

END OF SECTION 01 11 00

SECTION 01 25 00

SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1: GENERAL

1.01 DESCRIPTION

A. This Section defines procedures to be followed to gain acceptance of products in the Work which are not listed in the individual specification sections. A two step process is required.

B. Requests for acceptance for bidding purposes of alternative manufacturers is encouraged except where specifically prohibited by this Project Manual.

C. Submit Prior Approval request via email to mail@woldae.com with the following information in the subject line: Prior Approval 173013 XX XX XX (Specification Section).

1.02 PRODUCT OPTIONS NOT REQUIRING PRE-BID SUBMITTAL

A. Where a single manufacture is specified and acceptable manufacturer are also listed, acceptable manufacturers must provide an identical product or accept responsibility for all design implications when providing a product other than the specified product.

B. Where products are specified by reference standards, any product established by a material testing agency to meet these standards is acceptable.

C. Where multiple manufacturers and associated models are specified, select any one named.

D. Where manufacturer(s) alone are specified, select any manufacturer and the product recommended in writing by the manufacturer as most suited to the application shown on the Drawings and Specifications.

E. Where the phrase "or equal" follows the name of a manufacturer, any product which meets the performance and appearance standards established by the specified manufacturer may be selected, subject to the Architect's acceptance.

F. Where a manufacturer is listed in both a technical specification section and the Material Finish/Color Schedule, on Architectural Drawings and a color is provided.

1.03 PRODUCT SUBSTITUTIONS REQUIRING PRE-BID SUBMITTALS

A. Step One - Manufacturers Acceptance

1. Individual specification sections may be amended by the Architect during the bid period to include additional names of manufacturers determined to be capable of providing acceptable materials.

2. The Material Finish/Color Schedule, on Architectural Drawings or Specifications may be amended by the Architect during the bid period to include colors by manufacturers listed in technical sections, but not noted on the Material Finish/Color Schedule, on Architectural Drawings or Specifications.

3. To propose the names of specific manufacturers, submit, or arrange for suppliers to submit, written requests to Architect or appropriate Architect's Consultant. Requests received ten (10) calendar days prior to bid date will be considered.

   a. Provide sufficient review data. Include specified manufacturer's model numbers and proposed manufacturer's product literature, noting product numbers for proposed substitutions, and where appropriate, samples and data relating to construction details. If the product is not identical to specified product, submit letter stating proposed manufacturer will custom make products to meet specified product.

b. Architect's acceptance is based upon their determination that a manufacturer is capable of supplying acceptable materials. Approval is not assured or implied for a specific material, item of equipment, color or finish.

c. Official notification will be by addendum to the Contract Documents. However, in addition, if letters of request are delivered in duplicate with accompanying stamped self addressed envelopes, copies may be returned with Architect's decision in advance.

B. Step Two - Product Acceptance

1. Upon award of a construction contract, accepted manufacturers may submit for review to the Architect through the General Contractor or Construction Manager, specific products, materials or equipment items as substitutes for those specified. Contractor to provide letter stating they will reimburse Architect to review substitutions.

2. Architect will review substitute products for performance, appearance, color, finish, size and suitability for inclusion in the work. If a substitute product is not accepted, submit another product by the same or other accepted manufacturer or provide the specified product.

3. Match specified colors and dimensions exactly, whether or not they are standard with the substitute product, unless a minor variation is accepted by the Architect.

4. If a substitute product is accepted, coordinate any necessary changes in other related work and pay for these changes. Pay cost of architectural or engineering services, if any, required to incorporate substitute products in the Work.

1.04 SUBSTITUTIONS BY CHANGE ORDER

A. A substitution for a specified product may be permitted by "change order" at no additional cost to the Owner if product proposed is determined to be equivalent in performance and suitability, and if at least one of the following conditions apply:

1. Owner is given a credit for the work.

2. Product is of superior quality than product specified.

3. Product color or finish selection is preferable.

4. Products specified and upon which building is designed have been discontinued by manufacturer.

B. Provide Architect, through Owner, reasonable compensation for product evaluation.

END OF SECTION 01 25 00

SECTION 01 26 63

CHANGE ORDERS

1.01 CHANGE ORDER PROCEDURES

A. Changes in the Project scope of work affecting the project cost can be made only through AIA Document G701 - Change Order.

B. The procedures for processing changes in the scope of Work are listed as follows:

1. The Architect prepares one of the following documents to modify the scope of work. Documents and attachments revising the drawings and specifications will be distributed electronically and the Contractor will be responsible for printing.

   a. Supplemental Instructions (SI) which are used for no cost changes.

   b. Proposal Request (PR) to be used for proposed changes that need written approval on cost prior to proceeding.

   c. Construction Change Directive AIA Document G714 (CCD) which is used when the work must proceed immediately and time and material cost submitted as soon as possible for review by the Architect.

2. The Contractor reviews and responds as follows:

   a. Supplemental Instructions (SI): This no cost change is to be carried out in accordance with the following modifications to the contract documents described herein. If this change effects cost, do not proceed with this change. Notify the Architect in writing within 10 calendar days of receipt that an itemized (labor and material) quotation will be submitted within 21 calendar days of initial receipt of this Supplemental Instruction. If a cost is not submitted within 21 calendar days, this Supplemental Instruction will be accepted at no additional cost.

   b. Proposal Request (PR): Submit an itemized (labor and material) quotation for the proposed modifications to the contract documents as described herein within 21 calendar days of receipt. If a cost is not submitted within 21 calendar days, this Proposal Request can be accepted at no additional cost. Written approval is required prior to proceeding with this change.

   c. Construction Change Directive AIA Document G714 (CCD): Proceed immediately to carry out this change in the contract documents as described herein. If this revision effects cost, submit an itemized (labor and material) quotation within 21 calendar days of receipt. If a cost is not submitted within 21 calendar days this Change Directive will be accepted at no additional cost.

3. The Architect will review the Contractor's labor and material itemized quotation and respond in writing whether it is acceptable or needs revision. When all pricing is accepted by the Architect and Owner, a Change Order will be processed. Change Orders will be processed at increments determined by the Architect throughout the construction schedule.

C. See General Conditions and Supplementary Conditions of the Work for methods of determining cost or credit, mark-up and schedule on submitting claims.

END OF SECTION 01 26 63

SECTION 01 31 19

PROJECT MEETINGS

PART 1: GENERAL

1.01 DESCRIPTION

A. Schedule and administer pre-construction meeting, periodic progress meetings, and specially called meetings throughout the progress of the work.

1. Notify Architect in advance.

2. Prepare agenda for meetings.

3. Make physical arrangements for meetings.

4. Preside at meetings.

B. Representatives of contractors, subcontractors and suppliers attending the meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. Architect may attend meetings to ascertain that Work is expedited consistent with Contract Documents and the construction schedules.

1.02 PRE-CONSTRUCTION MEETING

A. Schedule within 15 calendar days after date of Notice to Proceed.

B. Location: A central site, convenient for all parties, designated by Contractor.

C. Attendance:

1. Owner's representative

2. Architect and his professional consultants

3. Contractor's superintendent

4. Major subcontractors

5. Major suppliers

6. Others as appropriate

D. Suggested Agenda:

1. Distribution and discussion of:

a. List of major subcontractors and suppliers

b. Projected construction schedules Refer to Section 01 32 00

- Critical Path Method. Schedule for entire construction period.
- Submittal Schedule
- Schedule pre-scheduling conf.

2. Critical work sequencing.

3. Major equipment deliveries and priorities.

4. Project coordination and scheduling:

   a. Designation of responsible personnel.

   b. Pre-installation conferences as specified:

      - Weather barrier
      - Slab on grade
      - Masonry flashing
      - Windows
      - Tile

   c. Mock-up panels.

5. Procedures and processing of:

   a. Field decisions

   b. Proposal Requests/Supplemental Instructions

   c. Submittals

      1) Mechanical Electrical Coordination drawings

   d. 21 day time limit on claims

   e. Change orders

   f. Applications for payment

6. Adequacy of distribution of Contract Documents.

7. Procedures for maintaining Record Documents.

8. Use of premises:

   a. Office, work and storage areas

   b. Owner's requirements

9. Construction facilities, controls and construction aids.

10. Temporary utilities.

11. Safety and first-aid procedures

12. Security procedures

13. Housekeeping procedures Refer 01 50 00

    - Debris removed weekly
    - Daily clean requirements
    - Failure to maintain clean site will result in Owner cleaning and back charging Contractor.

14. Final Cleaning Refer to Spec 01 74 00

- Schedule in time for Owner to complete furniture installation, required clean (i.e. floors)
- Any cleaning done by Owner due to unacceptable cleaning by Contractor, or to and contractor in completing cleaning on schedule will be back charged to Contractor.

1.03 PROGRESS MEETINGS

A. Schedule regular periodic meetings, as required.

B. Hold called meetings as required by progress of the work.

C. Location of the meetings: The project field office of the Contractor.

D. Attendance:

1. Architect and his professional consultants may attend as needed.

2. Subcontractors as appropriate to the agenda.

3. Suppliers as appropriate to the agenda.

4. Others

E. Suggested Agenda:

1. Review, approval of minutes of previous meeting.

2. Review of work progress since previous meeting.

3. Field observations, problems, conflicts.

4. Problems which impede Construction Schedule.

5. Review of off-site fabrication, delivery schedules.

6. Corrective measures and procedures to regain projected schedule.

7. Revisions to Construction Schedule.

8. Plan progress, schedule, during succeeding work period.

9. Coordination of schedules.

10. Review submittal schedules; expedite as required.

11. Maintenance of quality standards.

12. Review proposed changes for:

    a. Effect on Construction Schedule and on completion date.

    b. Effect on other contracts of the Project.

13. Other business

END OF SECTION 01 31 19

SECTION 01 31 26

ELECTRONIC COMMUNICATION PROTOCOLS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including Division-1 Specification Sections.

1.02 SUMMARY

A. The Architect will provide the Contractor with one (1) electronic copy of the background drawing relevant to their request. Requested files will be provided via email to the Contractor in AutoDesk AutoCAD format.

B. The terms and conditions on the attached form "Agreement Between Architect and Contractor for Transfer of Computer Aided Drafting (CAD) Files on Electronic Media" apply to all Electronic Documents issued by Wold Architects and Engineers or it's consultants for the project.

C. Electronic Document Availability

1. Pre Bid: AutoCAD backgrounds pertaining only to Survey and/or proposed grading will be available prior to bid. Requesting Contractors must complete "Attachment A - Agreement Between Civil Engineer and Contractor for Transfer of Computer Aided Drafting (CAD) Files on Electronic Media" at time of request.
2. After Bid: Backgrounds as requested by the awarded contractors at the discretion of the Architect or Engineer. Electronic Documents are available upon completion of "Attachment A - Agreement Between Architect and Contractor for Transfer of Computer Aided Drafting (CAD) Files on Electronic Media" by the General Contractor on project.

D. See attached form "Attachment A – Agreement Between Architect and Contractor for Transfer of Computer Aided Drafting (CAD) Files on Electronic Media."

PART 2: PRODUCTS – (Not Applicable)

PART 3: EXECUTION – (Not Applicable)

END OF SECTION 01 31 26

ATTACHMENT A – AGREEMENT BETWEEN ARCHITECT AND CONTRACTOR FOR THE TRANSFER OF COMPUTER AIDED DRAFTING (CAD) FILES ON ELECTRONIC MEDIA

The purpose of this agreement is to grant permission from the Transmitting Party (Architect and/or Engineer) to the Receiving Party for the Receiving Party's use of electronic media on the Project, and to set forth the terms. All data transmitted is defined as the electronic media and is considered confidential and containing business proprietary information. Wold Architects & Engineers and its consultants grant Bidders and Contractors a limited license to use Electronic Media issued by Wold Architects & Engineers exclusively for this project. The terms are set forth as follows:

1. The files are transmitted for the Receiving Party's convenience and remain the sole property of Wold Architects and Engineers and/or its consultants. No warranty, expressed or implied, is made respecting this electronic data.
2. The Architect and/or Engineer makes no representation regarding the accuracy, completeness, or permanence of Electronic Media files (ie CAD files). Addenda information or revisions made after the date indicated on the files may not have been incorporated. In the event of a conflict between the Architect and/or Engineers sealed Contract Drawings and Electronic Media files, the sealed Contract Drawings shall govern. It is the Owner, Contractor, or Third Party's responsibility to determine if any conflicts exist.
3. The information contained in the Electronic Media may not included final data or represent exact as-built conditions. The accuracy of the information is not guaranteed and the recipient shall be solely responsible to verify and check all field conditions against the information and to make all adjustments necessary to utilize such information for its work.
4. The Electronic Media files shall not be considered to be Contract Documents as defined by the General Conditions of the Contract for Construction.
5. Wold Architects and Engineers and their consultants shall not be responsible for any decline in accuracy or readability due to the medium on which the Electronic Media are stored, or for any unintentional transmission of computer viruses.
6. Information contained in the Electronic Media shall not be used by Contractor (Receiving Party) for any purpose other than as a convenience in the preparation of Shop Drawings, layout, and other purposes related to the Project. Any other use or reuse by the Receiving Party or others, will be at the Receiving Party's sole risk and without liability or legal exposure to the Architect, Engineers, or their consultants.
7. This Agreement is entered into as of the day and year written below and will terminate upon Substantial Completion of the Project, as defined in the General Conditions of the Contract for Construction, unless otherwise agreed by the parties and set forth below.
8. The Architect reserves the right to determine what content will be distributed to the Receiving Party.

By signing below, the Receiving Party agrees to the terms set for by this Agreement.

AUTHORIZED ACCEPTANCE:

By Receiving Party/Contractor of Record

_____
Signature

_____
Print Name and Title

_____
Print Name of Company

_____
Date

SECTION 01 32 00

CONSTRUCTION SCHEDULING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction (CPM) Schedule.
2. Shop Drawing Submittals Schedule
3. CPM Reports

1.03 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.

2. Predecessor activity is an activity that must be completed before a given activity can be started.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1. Float time is for the exclusive use or benefit of the Contractor to meet schedule milestones and Contract completion date.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.

3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

G. Major Area: A story of construction, a separate building, or a similar significant construction element.

H. Milestone: A key or critical point in time for reference or measurement.

I. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

1.04 SUBMITTALS

A. Submittals Schedule: Submit six copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's final release or approval. (Assume 15 working day turnaround.)
7. Identify submittals that effect critical path.

B. Contractor's Construction (CPM) Schedule: Submit two printed copies of initial schedule large enough to show entire schedule for entire construction period.

C. CPM Reports: Concurrent with CPM schedule, submit three printed copies of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, early start date, early finish date, late start date, late finish date, and total float.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.

1.05 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to review methods and procedures related to the Contractor's Construction (CPM) Schedule, including, but not limited to, the following:

1. Discuss constraints, including phasing, work stages, area separations, interim milestones and partial Owner occupancy.
2. Review delivery dates for Owner-furnished products.
3. Review schedule for work of Owner's separate contracts.
4. Review time required for review of submittals and resubmittals.
5. Review requirements for tests and inspections by independent testing and inspecting agencies.
6. Review time required for completion and startup procedures.
7. Review and finalize list of construction activities to be included in schedule.
8. Review submittal requirements and procedures.
9. Review procedures for updating schedule.

1.06 COORDINATION

A. Coordinate requirements in this Article with "Submittals Schedule" Article in Part 2. If a submittal review sequence policy governs, revise this Article to comply with requirements. See Evaluations for discussion on submittal review sequence policies.

PART 2: PRODUCTS

2.01 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates. Identify items that affect critical path.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using CPM (critical path method) format.

B. Preliminary Network Diagram: Submit diagram within 14 days from the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a CPM network analysis diagram.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted prior to first pay request.

2. Establish procedures for monitoring monthly and updating CPM schedule if work is not on schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.

3. Use "one workday" as the unit of time. Activities should not be shorter than 2 work days or longer than 10 work days for projects with a construction period over 6 months and/or longer than 5 work days for projects with a construction period under 6 months.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

   a. Preparation and processing of submittals.
   b. Purchase of materials.
   c. Delivery.
   d. Fabrication.
   e. Installation.

2. Processing: Process data to produce output data or a computer-drawn, logic network diagram. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.

PART 3: EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating:

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.

2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 33 00

SUBMITTALS

PART 1: GENERAL

1.01 DESCRIPTION

A. This Section defines procedures for the following submittals required by the Contract Documents.

B. Provide submittals as noted in each Section.

C. Allow for two weeks review of submittals to avoid delay of Work.

D. Include with submittal preparation, field verifications of measurements, field construction criteria, verification of catalog numbers and similar data, and coordination of Work requirements and Contract Documents.

E. Submit all color samples within 45 days of contract award for Architect's use in color selections. The Architect will not start the color schedule until all samples are received.

PART 2: REQUIRED SUBMITTALS

2.01 SHOP DRAWINGS AND SAMPLES

A. Submit shop drawings in accordance with Article 3 of the General Conditions and the following.

B. Prepare clearly identified shop drawings or schedules to this specific project, containing only data applicable. Include with the shop drawings or schedules a letter of transmittal listing and dating the submitted drawings in sets.

C. Contractor to review all submittals prior to submittal to Architect, and indicate such review with a stamp and signature. Review submittals for conformance to Drawings, Specifications, coordination with other trades and adjacent construction and verification of field dimensions. Failure of Contractor to adequately review submittals shall be cause for rejection.

D. Prepare and submit electronically (with exception for color charts and samples) to Architect for review, all shop drawings and manufacturers catalog sheets showing illustrated cuts of items to be furnished, scale details, sizes, dimensions, performance characteristics, capacities, wiring diagrams, weights and arrangements. Each submittal to include a transmittal on contractor letterhead. Submittal to be in the form of one combined PDF, professionally assembled so all documents are facing the same way.

1. The Contractor will provide submittals labeled as follows:

   a. 173013, CAFT Bldg, XX-XX-XX-X [SPECIFICATION # AND CONSECUTIVELY NUMBERED SUBMITTAL] _____[SPECIFICATION NAME] _____[SUBMITTAL NAME].

   [Example: 173013, CAFT Bldg, 04 20 00-1, Non-Bearing Masonry – Masonry Accessories]

E. Reproduction or exact replication of contract documents are not an acceptable form of shop drawings. Contractor is to generate shop drawings based on the information identified in the contract documents and notify the architect of discrepancies in the documents.

F. The Architect will take one of the following actions on submittals:

1. “Reviewed”: Contractor shall proceed with ordering and/or fabrication.

2. “Review Comments”: Contractor shall proceed with ordering and/or fabrication after taking into account noted comments.

3. “Rejected”: Contractor shall provide a submittal that meets the intent of the specifications.

4. “Revise and Resubmit”: Contractor shall modify submittal to address comments and resubmit.

G. If equipment other than that used in the design of this project is proposed to be used, the Contractor and/or supplier shall verify electrical differences, dimension variations and weight increases. The Contractor shall be responsible for any extra costs incurred as a result of equipment substitutions.

H. Information submittals and submittals that are not required shall be for Architects’ and Engineers’ use and be available for the design team’s review at the jobsite. Quantity of submittals will be the same for Architect as noted under shop drawings. These submittals will not be reviewed, stamped or returned to the Contractor.

I. Unless otherwise specified, submit to the Architect's office samples of size, and nature representing typical qualities. Where required, submit a sufficient number of samples to demonstrate the complete range of variations of the material or quality. Written acceptance of the Architect is required prior to ordering any item for which samples are required.

J. Submit samples to Architect's office, securely packaged, with the name of the Project clearly indicated on the package exterior. Each physical sample shall have a label or tag, firmly attached to the sample, bearing the following information: (a) Name of Project, (b) Name of Supplier, (c) Name of Contractor, and (d) Product information such as manufacturer's designation, finish, type, class, grade, etc. as is appropriate. The Architect will retain one copy of each sample.

2.02 LIST OF MATERIALS

A. Within 7 days after the award of the Contract (notice to proceed or letter of intent), submit 4 copies of a complete list of all material, products, and equipment proposed to be used in construction to the Architect for acceptance. Do not order materials until the proposed listed materials, products and equipment to be used in construction are accepted by the Architect.

B. Where two or more makes or kinds of items are named in the specifications (or additional names are called for in addenda), the Contractor shall state which particular make or kind of each item he proposes to provide. If the Contractor fails to state a preference, the Owner shall have the right to select any of the makes or kinds named without change in price.

C. This list shall be arranged generally in order of specification sections. The items listed shall fully conform to project requirements and specifications. All materials are subject to the Architect's acceptance. After acceptance, changes or substitutions will not be permitted.

D. Clearly identify or list the material, product or equipment by manufacturer and brand by listing the names for all items, including those where only one material or product is specified. Each and every material, product and equipment shall be specifically named, not listed "as specified".

2.03 LIST OF SUBCONTRACTORS

A. Refer to the General Conditions of the Contract for Construction.

B. Propose use of subcontractors or sub-subcontractors who are established, reputable firms of recognized standing with a record of successful and satisfactory past performance. Include the following information: specification section, item of work, subcontractor or supplier, material/manufacturer (as specified will not be allowed), project manager, phone and facsimile numbers. List major sub-subcontractors for mechanical and electrical work. Use only those subcontractors (and sub-sub-contractors, when appropriate) who are acceptable to the Architect and Owner on the Work.

2.04 SCHEDULE OF VALUES

A. Requirements

1. Submit Schedule of Values to Architect ten (10) days prior to first Application For Payment (AIA Form G702, G702a).

2. Use Schedule of Values only as basis for Contractor's Application For Payment.

B. Form of Submittal

1. Base format on Sections listed in Section 00 01 10 Table of Contents, as well as, the Mechanical and Electrical Table of Contents. Break down labor and material separately.

2. Provide a separate line item on the schedule of values for coordination drawings as defined in Division 23 Specification Section 23 05 00 “Common Work Results for HVAC”.

3. Round off amounts to nearest ten dollars.

2.05 PROGRESS SCHEDULE

A. Refer to the General Conditions of the Contract for Construction and Section 01 32 00 Construction Scheduling for submittal requirements.

END OF SECTION 01 33 00

SECTION 01 45 16

QUALITY CONTROL

PART 1: GENERAL

1.01 SELECTION AND PAYMENT

A. The Contractor shall select, hire and pay for the services of an independent testing laboratory(s) acceptable to the Owner and Architect to perform specified Source Quality Control and other tests and inspections called for in the Specifications.

B. The Owner will select, hire, pay for services of an independent testing laboratory, to perform specified Field Quality Control and other inspections, test of materials and construction called for in the Specifications.

1.02 RESPONSIBILITY OF CONTRACTOR

A. Be responsible for furnishing materials and construction in full conformance with Plans and Specifications.

B. Pay for all tests, conducted by the testing laboratory that fail and also pay for all scheduled tests for which the pours are cancelled and a test field crew is on site before that particular pour is cancelled.

1.03 COOPERATION OF CONTRACTOR

A. Contractor: Cooperate with the Laboratory, and:

1. Make available, without cost, samples of all materials to be tested in accordance with applicable standard specifications.

2. Furnish such nominal labor and working space as is necessary to obtain samples at the Project.

3. Advise Laboratory of the identity of material sources and instruct the suppliers to allow test or inspections by the Laboratory.

4. Notify Laboratory sufficiently in advance of operations to allow completion of initial tests or inspections by the Laboratory.

1.04 REJECTION OF MATERIALS/INSTALLATION

A. Laboratory: Notify the Owner, Architect, Engineer and Contractor or his authorized representative of any materials or installation which are not in full conformance with the specifications.

1.05 FILING OF REPORTS

A. Laboratory: File a copy of the inspection report with the Architect, appropriate Architect's Consultant, Owner and Building Official.

PART 2: PRODUCTS – Not Applicable.

PART 3: EXECUTION

3.01 GENERAL SCOPE OF TESTING, INSPECTION

A. Require laboratory to conduct tests and inspections as directed by the Owner, Architect or Engineer.

B. Refer to individual specification sections for test requirements.

3.02 QUALIFICATION TESTING

A. In addition to tests specified, if a product, material, or method of assembly that is of unknown or questionable quality to Architect, the Architect may require and order suitable tests to establish a basis for acceptance or rejection. Pay for these tests. "Standard" test reports or reports on "similar" material will not be accepted.

3.03 MISCELLANEOUS (REGULATORY) INSPECTIONS

A. Should specifications, Architect's instructions, laws, ordinances or any public authority require any work to be inspected or approved, Contractor shall give timely notice of its readiness for inspection and a reasonable date fixed for such inspection. If any work should be covered up without approval or consent of approving agency, or Architect, it must be uncovered for examination at Contractor's expense.

END OF SECTION 01 45 16

SECTION 01 45 43

TESTING, ADJUSTING, AND BALANCING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

B. Related Sections:

1. Other Division 22 and Division 23 Sections specify balancing devices and their installation, and materials and installations of mechanical systems.

2. Individual Division 23 system sections specify leak testing requirements and procedures.

1.02 SUMMARY

A. The testing, adjusting, and balancing contractor will be hired by the mechanical contractor for the work scope as defined under this specification section.

B. This Section specifies the requirements and procedures for mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, recording and reporting the results.

C. Test, adjust, and balance the following mechanical systems:

1. Supply air systems.
2. Return air systems.
3. Exhaust air systems.
4. Hydronic systems.
5. Domestic hot water recirculation loop.

D. Test systems for proper sound and vibration levels.

E. This Section does not include:

1. Testing boilers and pressure vessels for compliance with safety codes;

2. Specifications for materials for patching mechanical systems;

3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

4. Requirements and procedures for piping and ductwork systems leakage tests.

1.03 DEFINITIONS

A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

1. the balance of air and water distribution;
2. adjustment of total system to provide design quantities;

3. electrical measurement;
4. sound and vibration measurement.

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

F. Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal: The point where the controlled fluid enters or leaves the distribution system. There are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

H. Main: Duct or pipe containing the system's major or entire fluid flow.

I. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.

J. Branch main: Duct or pipe serving two or more terminals.

K. Branch: Duct or pipe serving a single terminal.

L. Construction Tests: Tests specified in other sections. Includes leak testing of piping and duct systems.

1.04 SUBMITTALS

A. Agency Data:

1. Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

B. Engineer and Technicians Data:

1. Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

C. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

D. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in maintenance data specified in Division 1 and Section 23 05 00.

E. Test and Balance Reports:

1. Sample Forms: Submit sample forms, if other than those standard forms prepared by the AABC, NEBB, TABB are proposed.

2. Sample Forms: Submit sample forms, if other than those standard forms prepared by the NEBB are proposed.

3. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and

balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

a. Preliminary Reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports shall be submitted prior to Substantial Completion and include at a minimum documentation of required ventilation airflows and preliminary balancing of all primary supply air equipment including central air handlers, rooftop units, fan coil units and unit ventilators. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.

b. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.

c. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:

1) General Information and Summary
2) Air Systems
3) Hydronic Systems
4) Temperature Control Systems
5) Special Systems
6) Sound and Vibration Systems
7) Domestic Hot Water Recirculation Loop

d. Report Contents: Provide the following minimum information, forms and data:

1) General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the name, address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

2) The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

4. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.05 QUALITY ASSURANCE

A. Test and Balance Engineer's Qualifications: The on-site test and balance technician shall be NEBB or TABB certified, be in the employ of the Test and Balance agency and have at least 3-years of successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for this project.

B. Agency Qualifications: The testing, adjusting and balancing technicians and supervisor staffed to perform work on site shall be certified by the National Environmental Balancing Bureau (NEBB) or TABB in the following disciplines:

1. Testing, adjusting, and balancing.

a. Air
b. Hydronics

C. Codes and Standards:

1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems".
2. ASHRAE: ASHRAE Handbook, 2007 HVAC Applications, Chapter 37. Testing, Adjusting, and Balancing.

D. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect and representatives of installers of the mechanical systems, and the Owner's commissioning agent. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.06 PROJECT CONDITIONS

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate all onsite inspections with the prime contractor.

B. Develop detailed work plan with the prime contractor, HVAC subcontractors, and Building Automation System contractor such that testing work will proceed in areas as systems are started and available.

PART 2: PRODUCTS

Not Used.

PART 3: EXECUTION

3.01 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform these steps:

1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.

2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.

3. Compare design to installed equipment and field installations.

4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.

5. Check filters for cleanliness.

6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.

7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.

8. Determine best locations in main and branch ductwork for most accurate duct traverses.

9. Place outlet dampers in the full open position.

10. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.

11. Lubricate all motors and bearings.

12. Check fan belt tension.

13. Check fan rotation.

3.02 PRELIMINARY PROCEDURES FOR HYDRONIC SYSTEM BALANCING

A. Before operating the system perform these steps:

1. Open valves to full open position. Close coil bypass valves.

2. Remove and clean all strainers.

3. Examine hydronic systems and determine if water has been treated and cleaned.

4. Check pump rotation.

5. Clean and set automatic fill valve for required system pressure.

6. Check expansion tanks to determine that they are not air bound and that the system is completely full of water.

7. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).

8. Set temperature controls so all coils are calling for full flow.

9. Check operation of automatic bypass valves.

10. Check and set operating temperatures of chillers to design requirements.

11. Lubricate all motors and bearings.

3.03 MEASUREMENTS

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Apply instrument as recommended by the manufacturer.

E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

G. Take all readings with the eye at the level of the indicated value to prevent parallax.

H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

I. Take measurements in the system where best suited to the task.

3.04 PERFORMING TESTING, ADJUSTING, AND BALANCING

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts and piping, and test for and repair leaks.

E. Seal insulation to re-establish integrity of the vapor barrier.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

G. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.05 TESTING FOR SOUND AND VIBRATION

A. Testing, adjusting, and balancing work shall include an allowance of 16 hours to perform sound and vibration testing at the direction of the Engineer. The goal of the testing will be to identify corrective work such that all areas perform within the design sound levels. All teaching and office areas are designed for a sound level of NC 35 or less. Sound testing shall be conducted in accordance with the referenced standards.

3.06 RECORD AND REPORT DATA

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

C. Include an allowance of 8 hours per building location to provide re-testing and re-balancing at the direction of the architect/engineer. The goal of this re-testing and re-balancing will be to verify the performance of any corrective work and to help assure that all areas perform within the design range set for air and water flow rates.

3.07 DEMONSTRATION AND TRAINING

A. Training:

1. Train the Owner's maintenance personnel on troubleshooting procedures and testing, adjusting, and balancing procedures (minimum of 8 hours) in accordance with the requirements of specification section 01 79 00, “Demonstration and Training.”

2. Schedule training with Owner through the Architect/Engineer with at least 7 days prior notice.

END OF SECTION 01 45 43

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

B. Support facilities include, but are not limited to, the following:

1. Dewatering facilities and drains.
2. Project identification and temporary signs.
3. Housekeeping and waste disposal facilities.
4. Field offices.
5. Storage and fabrication sheds.
6. Lifts and hoists.
7. Construction aids and miscellaneous services and facilities.
8. Temporary heating, cooling, and ventilation.
9. Temporary power and lighting.

C. Security and protection facilities include, but are not limited to, the following:

1. Environmental protection.
2. Stormwater control.
3. Tree and plant protection.
4. Pest control.
5. Site enclosure fence.
6. Security enclosure and lockup.
7. Barricades, warning signs, and lights.
8. Temporary enclosures.
9. Temporary partitions.
10. Fire protection.

D. Related Sections include the following:

1. Division 1 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.

2. Part 3 of this specification "Execution Requirements" for progress cleaning requirements.

3. Division 1 Section “Construction Dust Control” for partitions and procedures for control of construction dust.

4. Divisions 3 through 49 for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.03 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weather-tight; exterior walls are insulated and weather-tight; and all openings are closed with permanent construction or substantial temporary closures.

1.04 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:

1. Owner's construction forces.
2. Occupants of Project.
3. Architect.
4. Testing agencies.
5. Personnel of authorities having jurisdiction.

B. Water Service: Use water from Owner's existing water system without metering and without payment of use charges.

1. Pay for pumps, pipe, hoses, and backflow preventors as required to distribute water.

B. Electric Power Service: Use electric power from Owner's existing system without metering and without payment of use charges.

PART 2: PRODUCTS

2.01 MATERIALS

A. General: Provide new materials or undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

B. Portable Chain-Link Fencing: Minimum 2-inch 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top and bottom rails. Provide concrete or galvanized steel bases for supporting posts.

C. Lumber and Plywood: Comply with requirements in Division 6 Section "Carpentry."

D. Gypsum Board: Minimum 1/2 inch thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36.

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

F. Paint: Comply with requirements in Division 9 Section "Painting."

G. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.

H. Water: Potable.

I. Wood Walkways: ¾” Plywood, framed with 2x__ joists (size as required to support span), with wood rails to contain occupants.

J. Poly Film Guard: 3 mil. self adhering clear poly film utilizing tack water-based adhesive.

2.02 EQUIPMENT

A. General: Provide equipment suitable for use intended.

B. Field Offices: Prefabricated with lockable entrances, insulated, weather-tight; heated and air conditioned. Provide stairs with handrails as required for accessibility.

C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.

   1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

D. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

E. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.

F. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

   2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.

PART 3: EXECUTION

3.01 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.

   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

   2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.

   3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

1. Provide rubber hoses as necessary to serve Project site.

2. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

3. Provide pumps if required due to low static pressure on-site. Equip pumps with surge and storage tanks and automatic controls to supply water uniformly at reasonable pressures.

4. Provide backflow prevention devices to protect Owner's water system.

B. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.

2. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel as required by government jurisdictions.

C. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.

1. Maintain a minimum temperature of 50 deg F (10 deg C) in permanently enclosed portions of building for normal construction activities, and 65 deg F (18.3 deg C) for finishing activities and areas where finished Work has been installed.

D. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

F. Power is available on-site.

1. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations and to maintain schedule.

2. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and to meet government regulations.

a. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

E. Telephone/Computer Service:

1. Provide a computer with internet service in each field office.

2. Provide a portable cellular telephone for superintendent's use in making and receiving telephone calls.

3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.

2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.

3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.

C. Dewatering Facilities and Drains: Comply with requirements in applicable Division 33 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.

2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.

3. Remove snow and ice as required to minimize accumulations and provide access to and throughout the site as required to complete the work/fire department access.

D. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.

1. Prepare temporary signs to provide directional information to construction personnel and visitors.

2. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood in sizes and thicknesses indicated. Support on posts or framing of preservative-treated wood or steel.

E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section for progress cleaning requirements.

1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.

2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

F. Housekeeping

1. Do not allow debris to accumulate on-site or within the building work areas. The contractor shall implement and provide the following cleaning services:

   a. Debris shall be removed from the construction site and police exterior project site area on a weekly basis at a minimum to clean-up any wind-blown or excess construction materials or debris and dispose of in construction dumpsters to maintain a clean project site.

   b. Debris shall be removed from interior of the buildings on a daily basis and disposed of in construction dumpsters.

   c. Lower waste materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

   d. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

   e. Once floor slabs are in place, walk-off mats shall be provided at all exterior entrances that are utilized by the workers. Mats shall be cleaned on a daily basis and change out mats on a monthly basis.

   f. Areas without final floor finish in place shall be cleaned of debris and swept on a daily basis.

   g. Areas that workers have access to with final floor finish in place shall be vacuumed on a daily basis. Carpeted major circulation paths shall be covered with poly film guard. Replace poly film guard when it develops holes or tears as they occur. Poly film guard to be replaced if left in place over 45 days. Horizontal and vertical surfaces shall be wiped down as construction dust has accumulated.

   h. Where Contractor has periodic access to ancillary spaces occupied by Owner, thoroughly clean after each use, so as to not disrupt Owner's ongoing operations.

   i. Failure to maintain a clean construction area may result in the Owner cleaning the site and back-charging the Contractor.

   j. Remove waste materials, rubbish and debris from the site and legally dispose of at public or private dumping areas off the Owner's property.

G. Common-Use Field Office: Provide an insulated, weather-tight, air-conditioned field office for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings of 12 persons at Project site. Keep office clean and orderly.

1. Furnish and equip offices as follows:

   a. Desk and four chairs, file cabinets in quantities to file shop drawings, supplemental instructions, proposal requests, and change orders, a plan table, a plan rack, and bookcase to store project manuals, detail books, and addenda.

   b. Provide a room of not less than 240 sq. ft. for Project meetings. Furnish room with conference table, 12 folding chairs, and 4-foot square markerboard.

H. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.

I. Lifts and Hoists: Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.

C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

D. Site Enclosure Fence: Before construction operations begin, install chain-link enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.

1. Drive fence posts in existing soil of gravel and earth.

2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.

3. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.

E. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

F. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

1. For safety barriers, sidewalk bridges, and similar uses, provide minimum ¾-inch thick exterior plywood and appropriate 2x___ framing for support.

G. Food Consumption: Limit food and soft drink consumption to within the Contractor's trailer or out of the building.

H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather-tight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

I. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses as required by the local fire marshal.

3.05 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Temporary Facility Changeover: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.

2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 74 00

FINAL CLEANING

PART 1: GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Cleaning required for specified work is specified in sections pertaining to that work.

B. Cleaning during construction and prior to substantial completion – Section 01 50 00 Temporary Facilities and Controls.

PART 2: PRODUCTS

2.01 CLEANING MATERIALS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3: EXECUTION

3.01 FINAL CLEANING

A. Employ experienced workers or professional cleaners for final cleaning.

B. At completion of construction and just prior to acceptance or occupancy, conduct a final inspection of exposed interior and exterior surfaces.

C. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from interior and exterior surfaces.

D. Repair, patch and touch up marred surfaces to match adjacent finishes.

E. Broom clean paved surfaces; rake clean other surfaces of grounds.

F. Maintain cleaning until the Building or portion thereof, is occupied by the Owner.

END OF SECTION 01 74 00

SECTION 01 77 00

PROJECT CLOSEOUT

1.01 GENERAL

A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the Work.

B. Related requirements in other parts of the Project Manual

1. Fiscal provisions, legal submittals and additional administrative requirements: Conditions of the Contract.

C. Related requirements specified in other sections

1. Closeout Submittals Required: The respective sections of specifications.

1.02 SUBSTANTIAL COMPLETION

A. Refer to the General Conditions of the Contract for Construction.

B. When the Project is determined by the Architect to be sufficiently complete to permit utilization for the intended use, the Architect will issue a Certificate of Substantial Completion.

C. To receive the Certificate of Substantial Completion, perform the following:

1. Submit to the Architect a notice declaring that work is believed to be substantially complete.

2. Submit a list of work items that remain to be completed or corrected and the date this work will be accomplished.

3. Obtain Occupancy certificate when required from governing municipality.

4. Submit a signed document from a Registered Land Surveyor certifying that completed contours meet the requirements of the drawings.

D. Architect will visit the project to evaluate the request for issuance of a Certificate of Substantial Completion.

1. If the Architect concurs that the Project is substantially complete, the Architect will deliver a Certificate of Substantial Completion and a list of work items necessary for completion or correction prior to request for inspection for final completion.

2. If the Architect determines that the work is not substantially complete, the Architect will deliver to the Contractor a written statement including reasons.

3. Complete work on the items required by the Architect for achieving substantial completion and make additional written requests for issuance of a Certificate of Substantial Completion until the Architect determines that sufficient Work has been performed.

1.03 FINAL INSPECTION

A. When the Work is considered complete, submit written certification that:

1. Contract Documents have been reviewed.

2. Work has been completed and inspected by the Contractor for compliance with Contract Documents and is ready for final inspection.

3. Building Permit Final has been submitted.

B. Architect will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should Architect consider that the Work is incomplete or defective:

1. Architect will notify the Contractor in writing, listing the incomplete or defective work.

2. Take immediate steps to remedy the stated deficiencies, and send a second written certification to Architect that the Work is complete.

3. Architect will reinspect the Work.

D. When the Architect finds that the Work is acceptable under the Contract Documents, he will request preparation of closeout submittals.

1.04 REINSPECTION FEES

A. Should Architect perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:

1. Owner will compensate Architect for such additional services.

2. Owner will deduct the amount of such compensation from the final payment.

1.05 CLOSEOUT SUBMITTALS TO ARCHITECT

A. When the Architect has determined that the Construction Work is acceptable under the Contract Documents and the Contract fully performed, prepare and submit final Application for Payment to the Architect together with one original and one copy of the following:

1. A letter recommending acceptance of the Project and indicating all punch list items are complete.

2. Contractor's Affidavit of Payment of Debts and Claims, AIA Document G706, with bonds for any exceptions.

3. Consent of Surety to Final Payment on Consent of Surety Company to Final Payment, AIA Document G707.

4. Contractors Affidavit of Release of Liens, AIA Document G706A.

5. Project Record Documents, if required.

6. Warranties and Bonds.

7. Documentation from Building Official that building permit has been closed out.

1.06 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to Architect.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.

2. Additions and deductions resulting from:

a. Previous Change Orders

b. Allowances

c. Unit Prices

d. Deductions for uncorrected Work

e. Penalties and Bonuses

f. Deductions for liquidated damages

g. Deductions for reinspection payments and costs incurred by Architect or Architect's Consultants if project is not closed out within sixty (60) days of Substantial Completion.

h. Other adjustments

3. Total Contract Sum, as adjusted.

4. Previous payments.

5. Sum remaining due.

C. Architect will prepare a final Change Order, reflecting approved adjustments to the Contract Sums which were not previously made by Change Orders.

1.07 FINAL APPLICATION FOR PAYMENT

A. Submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

END OF SECTION 01 77 00

SECTION 01 78 23

OPERATING, MAINTENANCE AND WARRANTY DATA

1.01 GENERAL

A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under the Contract.

B. Prepare operating, maintenance and warranty data as specified in this Section and as referenced in other pertinent section of Project Manual.

C. Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.

D. Related requirements specified in other sections:

1. Shop drawings, product data and samples: Section 01 33 00.
2. Project Closeout: Section 01 77 00.
3. Project Record Documents: Section 01 78 39.

1.02 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel with the following qualifications:

1. Trained and experienced in maintenance and operation of the described products.
2. Completely familiar with requirements of this Section.
3. Skilled as a technical writer to the extent required to communicate essential data.
4. Skilled as a draftsman competent to prepare required drawings.

1.03 FORM OF SUBMITTALS

A. Prepare data in the form of an instructional manual for use by the Owner's personnel.

B. Format shall conform to the following:

1. Size: 8½" x 11".
2. Paper: 20 pound minimum, white, for typed pages.
3. Text: Manufacturer's printed data, or neatly typewritten.
4. Drawings
   a. Provide reinforced punched binder tab, bind in with text.
   b. Fold larger drawings to the size of the text pages.
5. Provide fly-leaf for each separate product, or each piece of operating equipment.
   a. Provide typed description of product, and major component parts of equipment.
   b. Provide indexed tabs.
6. Cover: Identify each volume with typed or printed title "OPERATING, MAINTENANCE AND WARRANTY INSTRUCTIONS". List:
   a. Title of Project
   b. Identity of separate structure as applicable.

c. Identity of general subject matter covered in the manual.

C. Binders

1. Commercial quality three-ring binders with durable and cleanable plastic cover.

2. Maximum ring size: 2 inch.

3. When multiple binders are used, correlate the data into related consistent groupings.

D. Digital Format: Submit one PDF copy of the O&M Manual on a DVD Disk.

1.04 CONTENT OF MANUAL

A. Arrange neatly typewritten table of contents for each volume, in the following systematic order.

1. Contractor, name of responsible principal, address and telephone number.

2. A list of each product required to be included, indexed to the content of volume.

3. List, with each product, the name, address and telephone number of:

a. Contractor or installer.

b. Maintenance contractor, as appropriate.

c. Identify the area of responsibility of each.

d. Local source of supply for parts and replacement.

e. Include warranty information as specified.

4. Identify each product by product name and other identifying symbols such as set in Contract Documents.

B. Product Data

1. Include only those sheets which are pertinent to the specific product.

2. Annotate each sheet to:

a. Clearly identify the specific product or part installed.

C. Content, for moisture-protection and weather-exposed products:

1. Manufacturer's data, giving full information on products.

a. Applicable standards

b. Chemical composition

c. Details of installation

2. Instructions for inspection, maintenance and repair.

D. Additional requirements for maintenance data: The respective section of the Project Manual.

1.05 SUBMITTAL SCHEDULE

A. Submit one copy of completed data in final form within thirty days of substantial completion. Copy will be returned with comments.

B. Submit two copies of approved data in final form ten (10) days after comments are received.

END OF SECTION 01 78 23

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

1.01 GENERAL

A. Fully cooperate with the Architect to accomplish the following.

B. These requirements supplement the requirements set forth in the General Conditions.

C. Maintain at each site one record copy, as applicable, of:

1. Drawings and Details with addenda marked in.
2. Specifications with addenda marked in.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Architect/Engineer Supplemental Instructions, Proposal Requests or written instructions.
6. Approved shop drawings, product data and samples.
7. Field test records.

1.02 MAINTENANCE OF RECORD DOCUMENTS AND SAMPLES

A. Store record documents and samples in Contractor's field office in files and racks. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with the Construction Specifications Institute MASTERFORMAT.

C. Maintain record documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

D. Make record documents and samples available at all times for inspection by Architect or Owner.

1.03 RECORDING

A. Label each document "PROJECT RECORD" in neat large printed letters.

B. Continuously record information and changes.

C. Drawings: Legibly mark to record actual construction.

1. Depths of various elements of foundation in relation to finish first floor datum.
2. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
4. Field changes of dimension and detail.

5. Changes made by Field Order or by Change Order.

6. Details not on original contract drawings.

D. Specifications and Addenda - Legibly mark each Section to record:

1. Manufacturer, trade name, catalog number, and Supplier of each Product and item of equipment actually installed.

2. Changes made by Field Order or by Change Order.

E. Shop Drawings – Label each set by corresponding specification section. At the completion of the project, provide the Owner with one complete set, reviewed and stamped by architect, organized by specification section in the following formats:

1. Paper (various sizes) folded to 8 1/2" x 11" and boxed with project name and completion date clearly labeled on exterior.

2. Scanned PDF copy on a compact disk, ordered by specification section.

1.04 SUBMITTAL

A. Deliver Record Documents to the Owner at contract close-out.

B. Accompany submittal with transmittal letter in duplicate, containing:

1. Date

2. Project title

3. Title and number of each Record Document

END OF SECTION 01 78 39

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Recording of training sessions.

B. Related Sections:

1. Division 1-14 – Individual sections with training requirements.
2. Divisions 21-25 – Mechanical sections with training requirements.
3. Divisions 26-28 – Electrical sections with training requirements.

1.03 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. At completion of training, submit one complete training manual for Owner's use.

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

E. Demonstration and Training DVD: Submit one copy at end of each training module.

1.04 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.05 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 – PRODUCTS

2.01 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project Record Documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.

f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training through Architect with at least seven days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

E. Demonstration and Training Recording: Record each training module separately on digital, window's compatible DVD media.. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.03 REQUIRED DEMONSTRATION AND TRAINING

A. The following is a list of demonstration and training requirements listed in individual specification sections. Inconsistencies or omissions from the list does not relieve the Contractor from providing required demonstration and training delineated in each specification section.

Specification Section	**Item**	**Minimum Time***
01 45 43	Testing, Adjusting and Balancing	8 hours
21 10 00	Water-Based Fire-Suppression Systems	As required
22 11 16	Domestic Water Piping	As required
22 13 29	Sanitary Sewage Pumps	2 hours
22 33 00	Electric Domestic Water Heaters	4 hours
22 34 00	Fuel-Fired Domestic Water Heaters	4 hours
26 05 26	Grounding and Bonding for Electrical Systems	4 hours
26 09 23	Lighting Control Devices	4 hours
26 51 00	Interior Lighting	8 hours
26 56 00	Exterior Lighting	8 hours
28 31 11	Digital, Addressable Fire-Alarm System	4 hours + 2 site visits

3.04 DEMONSTRATION

A. Manufacturer's onsite field technician shall demonstrate the operation of the doors to the Owner. A video outlining the operation of the item or system, scheduled maintenance, basic troubleshooting and care of the item or system shall be provided to the Owner by the door manufacturer. Refer to Section 01 79 00 Demonstration and Training.

END OF SECTION 01 79 00

SECTION 04 05 14 - GROUTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Portland cement grout.
2. Rapid curing epoxy grout.
3. Non-shrink cementitious grout.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete.

1.2 REFERENCES

A. (SSWSC) Standard Specification for Water and Sewer Construction in Illinois

B. U.S. Army Corps of Engineers Concrete Research Division (CRD):
1. CRD C61 – Non-Shrink Grout

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit product data on grout.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the municipality.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver grout in manufacturer's unopened containers with proper labels intact.

C. Store grout in a dry shelter, protect from moisture.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Per Manufacturer Specifications.

PART 2 PRODUCTS

2.1 NON-SHRINK CEMENTITIOUS GROUT

A. Non-shrink Cementitious Grout: Pre-mixed ready for use formulation requiring only addition of water; non-shrink, non-corrosive, non-metallic, non-gas forming, no chlorides.

B. Properties: Certified to maintain initial placement volume or expand after set and meet the following minimum properties when tested in accordance with CRD-C621, for Type D non-shrink grout:

Property	Test	Time	Result
Setting Time	ASTM C191	Initial	2 hours (Approx)
		Final	3 hours (Approx)
Expansion			0.10% - 0.4% Maximum
Compressive Strength	CRD-C621	1 day	4,000 psi (27.6 MPa)
		7 days	7,000 psi (48.3 MPa)
		28 days	10,000 psi to 10,800 psi (69.0 MPa to 74.5 MPa)

2.2 FORMWORK

A. Refer to Section 03 10 00 for formwork requirements.

2.3 CURING

A. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or with use of wet burlap method.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify areas to receive grout.

3.2 PREPARATION

A. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.

B. Rough concrete lightly, but not enough to interfere with placement of grout.

C. Remove foreign materials from metal surfaces in contact with grout.

D. Align, level and maintain final positioning of components to be grouted.

E. Saturate concrete surfaces with clean water; remove excess water, leave none standing.

3.3 INSTALLATION - FORMWORK

A. Construct leakproof forms anchored and shored to withstand grout pressures.

B. Install formwork with clearances to permit proper placement of grout.

3.4 MIXING

A. Mix grout components in proximity to work area and transport mixture quickly and in manner not permitting segregation of materials.

3.5 PLACING GROUT

A. Place grout material quickly and continuously.

B. Do not use pneumatic-pressure or dry-packing methods.

C. Apply grout from one side only to avoid entrapping air.

D. Do not vibrate placed grout mixture, or permit placement when area is being vibrated by nearby equipment.

E. Thoroughly compact final installation and eliminate air pockets.

F. Do not remove leveling shims for at least 48 hours after grout has been placed.

3.6 CURING

A. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. After grout has attained its initial set, keep damp for minimum of 3 days.

3.7 FIELD QUALITY CONTROL

A. Section [01 40 00 - Quality Requirements] [01 70 00 - Execution and Closeout Requirements]: Field inspecting, testing, adjusting, and balancing.

B. Tests of grout components may be performed to ensure conformance with specified requirements.

END OF SECTION

SECTION 04 20 00

NON-BEARING UNIT MASONRY

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Furnish and install brick where shown on the drawings.

2. Furnish and install mortar, cavity insulation, masonry accessories, masonry reinforcing and other items embedded in masonry construction.

3. Composite Sample Panel

   a. Prior to laying of any brick, gain acceptance on preliminary sample panels and construct composite sample panel.

   b. Prior to applying cleaning agent to masonry or stone, apply to sample panel for Architect's review.

4. Prior to installation of finished materials, all flexible flashings shall be observed by the Architect. The Architect shall be given a minimum of 72 hours notice prior to the desired observation time. Any finish materials (i.e., brick, insulation, metal, etc.) installed without observation by the Architect shall be removed and replaced at the Contractor's expense.

B. Related work specified in other sections:

1. Structural Testing and Special Inspection – Section 01 45 33.
2. Insulation – Section 07 21 00.
3. Flashings – Section 07 65 00/13.

1.03 REFERENCES

A. The following specifications and standards are incorporated by reference. Where provisions of these Project Specifications are at variance with those reference specifications, the maximum criteria or requirements shall govern.

1. ACI 530.1/ASCE 6/TMS 602 – "Specifications for Masonry Structures"; American Concrete Institute International 2005.
2. ASTM A82/A 82M, "Steel Wire, Plain, for Concrete Reinforcement"; 2005a.
3. ASTM A153/A 153M, "Zinc Coating (Hot-Dip) on Iron and Steel Hardware"; 2005.
4. ASTM A615/A 615M, "Deformed and Plain Billet-Steel Bars for Concrete Reinforcement"; 2007.
5. ASTM C55 – "Concrete Building Brick"; 2006.
6. ASTM C67 – "Sampling and Testing Brick and Structural Clay Tile"; 2007.
7. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2004.
8. ASTM C150 - Standard Specification for Portland Cement; 2005.
9. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006.
10. ASTM C216 – "Facing Brick (Solid Masonry Units Made From Clay or Shale)"; 2007.
11. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2007.

12. ASTM C387, "Packaged, Dry, Combined Materials for Mortar and Concrete"; 2006.
13. ASTM C780 - Standard Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2006a.
14. ASTM C1072 – "Measurement of Masonry Flexural Bond Strength"; 2006.
15. ASTM C1314 – "Compressive Strength of Masonry Prisms"; 2003b. AN
16. International Building Code (IBC) Edition enforced by local jurisdiction.

1.04 QUALITY ASSURANCE

A. Employ and pay for the services of an independent testing laboratory acceptable to the Owner and Architect to perform the specified Source Quality Control.

1.05 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Mix Design: Submit mix designs for each mortar type at least seven days prior to preparation of job mortar and delivery to the site. Include copies of test reports for aggregate and mortar strength.

2. Mortar Samples: Submit samples of manufacturer's standard colors for preliminary selection. If requested, prepare and submit custom-mixed samples to match materials or colors as directed by the Architect. Prepare custom color samples using specified mix design; make 3/8" wide, tool concave smooth. Up to two different custom mortar colors may be selected for brick, in addition to standard gray mortar and colored pointing mortar.

3. Mortar Mixes: Test mortar for consistency, compressive strength and water retentively in accordance with ASTM C780 recommendations for preconstruction testing.

   a. Preconstruction tests will be used to establish optimum mortar proportion and establish control values for construction testing. They are not required to meet the compressive strength requirements of ASTM C270.

4. Test Reports

   a. Submit reports on manufacturer's normal quality control.

   b. Provide report on modified ASTM C67 test for face brick as follows: Test to determine if the exterior face brick will meet the SW grade requirements of ASTM C216. Testing is recommended to document compressive strength, saturation coefficient, dimensions, distortion and potential for efflorescence. For this testing, a total of 15 bricks will be required. Make the samples representative of the whole lot of brick from which they are selected and include specimens representative of the complete range of colors and sizes of the brick in the shipment. Upon completion of testing, cut several of the brick samples and observe the cross section for the presence of stratification.

5. Submit samples of all specified masonry accessories for Architect's review.

6. Provide exterior elevation drawings showing all proposed brick expansion joints and floor plans with proposed block control joint location.

B. Masonry Samples

1. Manufacturer's samples: Preliminary selection of brick type and color has been based upon manufacturer's samples supplied to the Architect prior to bidding. Brick supplied to the site which, in the judgment of the Architect, varies significantly from these samples in color, color range or finish will be rejected.

2. Sample panels: At the site, erect a 2'-0" square panel of each brick type, incorporating the preliminary mortar selection(s) and the full range of brick color to be expected. After review by the Architect, construct additional sample panels to adjust brick range and mortar color. Do not begin final production and/or delivery of materials until acceptance of preliminary sample panel.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle, transport and store at the job site in a manner that will avoid damage.

B. Protect masonry units from water. Deliver the units to the job cubed on pallets.

C. Deliver and store scored masonry units with cardboard separators to reduce chipping and other damage to block surface and edges.

D. Store materials under cover in dry place; in manner to prevent damage, intrusion of foreign material. During freezing weather protect all masonry units with tarpaulins or other suitable material. Store concrete masonry under covers that will permit circulation of air, prevent excessive moisture absorption; protect against wetting prior to use.

PART 2: PRODUCTS

2.01 MORTAR MATERIALS

A. Portland Cement: ASTM C150, Type I. Use of masonry cement is not permitted.

B. Hydrated Lime: ASTM C207, Type S.

C. Aggregates: ASTM C144.

D. Water: Clean, potable, free of deleterious amounts of acids, alkalies or organic materials.

E. Pre-Mixed Mortar: ASTM C387. Specific property and material requirements of this Section shall govern.

F. Antifreeze Compounds: Not allowed in mortar to lower freezing point.

G. Mortar Colorant: Inert, sunfast, weather resistant, alkali resistant, water insoluble, free of deleterious fillers and extenders. By Solomon Grind-Chem Service, Inc., Euclid, Twin City Concrete Co., Tamms Industries Co. or Prism Pigments.

1. Colors: As selected from Manufacturer's full range of colors.

2.02 MORTAR MEASURING AND MIXING

A. Measure and mix in accordance with ASTM C270 (Proportion Specifications) and the following:

1. Mix mortar as required for immediate use only and discard any mixed for a period exceeding 2-1/2 hours.

2. Accurately maintain and control the specified proportions of the mortar materials during the entire progress of the work.

3. Thoroughly mix cementitious materials and aggregates with the amount of water to produce satisfactory workability. Machine mix all mortar.

4. Proportion colorant for mortar in accordance with printed instructions by pigment manufacturer to avoid reducing mortar properties, at a rate not to exceed 10 pounds per 94 pound bag of portland cement.

5. Mix pointing mortar with specified admixtures strictly according to manufacturer's printed instruction.

2.03 MORTAR SOURCE QUALITY CONTROL

A. Test proposed aggregate for conformance to ASTM C144 and these specifications.

B. Test each mortar mix design for water retentivity and compressive strength in accordance with ASTM C270.

C. Mix mortar in the laboratory from representative samples of materials to be used in the Work, including selected colorants. Average compressive strength at 28 days shall be as follows:

Mortar Type	Compressive Strength Range
M	2,500 psi - 3,000 psi
S	1,800 psi - 2,200 psi
N	750 psi - 1,100 psi

D. Adjust mix design so as to achieve compatibility with brick to be supplied, considering initial rate of absorption of brick and water retentivity of mortar.

E. Do not start masonry work until Architect has reviewed test reports and accepted mix design.

F. Prepare and test new mix designs if mortar does not meet specifications or if, during the course of the Work, significant changes occur in aggregate or other materials.

G. Use field measuring methods to accurately control mortar mix proportions.

2.04 MASONRY ACCESSORIES

A. Horizontal Wall Reinforcement and Masonry Veneer Anchors: ASTM A153 - Class B2 hot dipped, galvanized, (unless noted otherwise) Hohmann & Barnard or equivalent products by other manufacturers are acceptable.

1. Veneer anchors for steel studs: Hohmann & Barnard: Stainless steel HB-213-2X adjustable veneer anchor with 3/16” dia. hook. Back plate thickness to accommodate no insulation or match insulation thickness.

2. Dovetail Brick Tie: HB-315

B. Brick expansion joint filler or material: HS-NS Closed Cell Neoprene Sponges or equal. Size: thickness to match joint thickness x 3” wide. Constructed of closed cell neoprene.

C. Flashing: Conform to the requirements of Section 07 65 00 Flashings. Color: See Material Finish/Color Schedule on Architectural Drawings.

D. Cavity Wall and Perimeter Insulation: Conform to requirements of Section 07 21 00, Insulation.

E. Cavity Weep/Vent: H&B-QV Quado-Vent. Color as selected from manufacturers full range of available colors.

F. Rope Wicks: Conform to requirements of Section 07 65 00, Flashings.

G. Mortar Net: 90% open weave, 200 denier 100% recycled polyester, dovetail/continuous bottom strip design, thickness to match cavity width x 5'-0" length as manufactured by Mortar Net USA, Ltd.

H. Flashing Termination Bar and Fasteners: Conform to requirements of Section 07 65 00, Flashings.

I. Bond Breaker: No. 15 Building Paper, red rosin kraft paper or 6 mil polyethylene.

2.05 FACE BRICK

A. Brick No.1:

1. Manufacturer: Hebron Brick Company
2. Size: Modular
3. Name/Texture: Chocolate/Velour
4. Contact: Illinois Brick Company, Nathan Karaway, 708-912-8544, nkaraway@illinoisbrick.com

2.06 SOURCE QUALITY CONTROL

A. Perform tests of each brick type in accordance with ASTM C67 to determine compliance with ASTM C216, Grade SW. Document compressive strength, saturation coefficient, initial rate of absorption, dimensional tolerance and potential for efflorescence.

B. Perform tests of each brick/mortar combination to determine flexural bond strength in accordance with ASTM C1072.

PART 3: EXECUTION

3.01 LAYOUT

A. Unless noted on Drawings as "clear", all dimensions on Drawings are modular, from center to center of vertical joints and from bottom to bottom of horizontal joints.

B. Lay out exposed masonry to achieve joint pattern shown on Drawings. Where not shown, lay out exposed masonry to minimize cutting of units. Where possible, provide full 8" wide units at outside corners, jambs, and other openings.

3.02 MORTAR

A. Mortar proportioning and mixing as specified.

B. Tempering: The consistency of mortar may be adjusted to the satisfaction of the mason. Use mortar within two and one half (2-1/2) hours after mixing.

C. Type: Lay masonry in mortar of the type specified below, as adjusted for compatibility with masonry units.

Kind of Masonry	Mortar Type
Exterior walls, non-load bearing at or below grade.	M
Exterior walls, non-load bearing, above grade; Brick veneer.	S
Interior non-load bearing partition walls.	N

3.03 PRECAUTIONS

A. Cold Weather Requirements

1. Cold weather conditions exist when temperature is 40 degrees F. or below.

2. Keep masonry units dry. Do not use wet or frozen masonry units.

3. Following general rules may be modified as approved by Architect to suit project conditions.

AIR TEMP.
(Degrees F.) CONSTRUCTION REQUIREMENTS

40 - 32	Heat mixing water or sand to produce mortar temperature between 40 degrees F. and 120 degrees F. Heat grout materials when their temperatures are below 32 degrees F. Do not heat water or aggregates used in mortar or grout above 140 degrees F.
32 - 25	Comply with construction requirements above. Heat grout materials so grout is at a temperature between 70 and 120 degrees F. during mixing and placed at a temperature above 70 degrees F. Maintain temperature of mortar on boards above 40 degrees F. Employ windbreaks when wind is in excess of 15 MPH.
25 - 20	Comply with construction requirements above. Heat masonry units so their temperature when laid is not less than 20 degrees F. Heat masonry to a minimum of 40 degrees F. prior to grouting. Utilize sources of heat on both sides of wall under construction.
20 and below	Comply with construction requirements above. Provide enclosure and auxiliary heat to maintain air temperature above 32 degrees F. for 24 hours. Extend time period to 48 hours for grouted masonry.

MEAN DAILY AIR TEMP. (Degrees F.)	PROTECTION REQUIREMENTS
40 - 32	Protect masonry from rain or snow for 24 hours.
32 - 25	Completely cover masonry for 24 hours.
25 - 20	Completely cover masonry with insulating blankets or approved equal protection for 24 hours. Extend time period to 48 hours for grouted masonry.
20 and below	Maintain masonry temperature above 32 degrees F. for 24 hours by enclosure and approved supplementary heat. Extend time period to 48 hours for grouted masonry.

B. Hot Weather Requirements

AIR TEMP (Degrees F.)	PROTECTION REQUIREMENTS
Greater than 110 or 90 with 8 mph wind velocity	Maintain the temperature of mortar and grout below 120°F; flush mixers, mortar transport containers and mortar boards with cool water before they come into contact with mortar ingredients or mortar; maintain mortar consistency by retempering with cool water; and use mortar within 2 hours of initial mixing.

C. Protect facing material against staining; keep top of walls covered with non-staining waterproof coverings when work is not in progress.

D. Where fresh masonry joins partially or totally set masonry, clean, roughen, lightly wet set masonry before new masonry is joined. Make necessary horizontal stop-offs by racking back masonry; do not tooth.

E. Where units are specified to be wetted, uniformly wet units 3 to 4 hours before using.

3.04 LAYING MASONRY UNITS

A. Lay masonry plumb, true to lines. Unless noted on drawings as "clear", all dimensions on drawings are modular, from center to center of vertical joints and from bottom to bottom of horizontal joints.

B. Lay hollow masonry units 4 inches or less in thickness, all solid masonry units in full beds of mortar with full head joints.

C. Lay hollow masonry units exceeding 4 inches in thickness with divided bed, head joints.

D. Avoid over-plumbing, pounding of corner, jambs after setting masonry in position. Where an adjustment must be made after mortar has started to harden, remove mortar, replace with fresh mortar.

E. Lay masonry within one minute of placing mortar.

3.05 BONDING AND ANCHORAGE

A. Anchor abutting or intersecting non-load bearing walls, partitions at vertical intervals of 2 feet with corrugated ties.

B. Where indicated anchor walls, partitions abutting or facing against steel columns, beams with flexible anchors. Unless indicated otherwise, maximum spacing; 16 inches vertically at columns, 16 inches horizontally at beams.

C. Anchor exterior walls, veneer facing against concrete beams, columns, walls with dovetail anchors spaced 16 inches vertically, 16 inches horizontally.

D. Anchor exterior walls parallel to open web joists with prefabricated anchoring and reinforcing assembly with adjustable rectangular ties welded to structural steel as indicated.

E. Bond non-bearing walls, partitions of more than one wythe with wire ties; use at least one tie for each 3½ sq. ft. of wall surface; spaced maximum of 16 inches vertically, 36 inches horizontally, stagger alternate rows. Embed ties in horizontal joints.

F. Anchor veneer to backup with ties spaced 16" horizontally and vertically.

G. Bond bearing walls of more than one wythe as required for non-bearing walls. Fill all collar joints between all wythes with mortar.

3.06 BUILT-IN WORK

A. Consult other trades in advance, make provision for installation of their work in order to avoid cutting, patching. Build-in work specified under other sections as work progresses.

B. Set steel lintels in beds of mortar. Fill door and borrowed light frames solid with grout around jambs, heads of bucks, frames.

C. Flexible Flashing:

1. Apply where concealed wall flashing is indicated; at heads; sills of exterior masonry openings; at exterior wall damp courses; under all precast concrete copings; as otherwise indicated.

2. Flashing Installation: Properly clean and dry backup prior to applying primer as recommended by flashing manufacturer. Lay one layer of flexible flashing on bed joint of brick. Install continuous metal flashing and adhere another layer of flexible flashing over metal and continue up vertical back-up material a minimum of 8 inches. Lap all flashing joints a minimum of 8 inches. Install flashing termination bar at top of flashing.

3. At heads, sills of masonry openings; carry head flashing 6" beyond ends of steel lintels; at heads, sills turn up ends to form pans, with corners folded, not cut.

4. Fully adhere flexible flashing to steel lintels.

5. Apply a bead or trowel coat of mastic along top of termination bar, seams, cuts and penetrations.

D. Where masonry is built around steel columns, wrap columns with 1½" thick batt insulation or No. 15 asphalt-impregnated building paper and remove mortar droppings from around columns.

3.07 RIGID INSULATION

A. Install cavity wall insulation against face of back-up substrate with boards horizontal, tight butted joints. Fasten with adhesive or mechanical fasteners.

3.08 BRICK

A. Clay Masonry Erection, Workmanship: Conform to latest recommended standard specifications for clay masonry as published by the Brick Institute of America (BIA).

B. Moisten brick with absorption rates in excess of 20g/30 sq. in./min. as determined by ASTM C67, so that rate of absorption when laid does not exceed this amount.

C. Finish face joints exposed on exterior walls with metal tool to form concave joint, close hairline cracks, crevices.

D. Remainder of Joints: Cut off flush.

E. Provide continuous vertical 3/8" expansion joints in brick where shown on drawings. Where not shown, or in addition to those shown, provide joints, at a minimum, within two feet of outside corners, at inside corners, above window and door jambs, between dissimilar materials and no more than 20 feet on center elsewhere. Verify location and alignment with Architect.

F. Provide rope wicks as shown on drawings in exterior masonry in vertical joints immediately above all flashing, at base of cavity, veneer walls at top of all cavity walls; use weep vents where shown on drawings.

G. Keep air space within cavity walls clean, free from obstruction. Provide positive means of catching mortar droppings, or cleanouts to remove mortar from base of cavity.

H. Install mortar net so it is snug between insulation and back face of brick. Install in layers if needed to fill cavity.

3.09 POINTING AND CLEANING

A. Point up exposed masonry, fill holes, joints, remove loose mortar, cut out defective joints, repoint with mortar.

B. Thoroughly clean exposed masonry with stiff brushes and water. Before applying any cleaning agent to entire wall, apply to sample wall area or sample panel of approximately 20 sq. ft. in location approved by Architect. Do not proceed with cleaning work until sample area is approved. Use approved cleaning material, method on remaining wall area, including cover of all items that could be damaged (i.e. aluminum, windows, hardware, metal items) prior to using cleaning agents.

C. If stiff brushes, water do not suffice, clean the surface on which no green efflorescence appears with Sure-Klean Vana-Trol as manufactured by Pro So Co., Inc.

D. Remove "problem" stains as follows with the as specified formulations of Pro So Co., Inc., or equal:

1. Green Efflorescence - "Sure-Klean No. 800 Stain Remover".
2. Tar, Asphalt - "Sure-Klean Asphalt & Tar Remover".
3. Ferrous Stains - "Sure-Klean Ferrous Stain Remover".

E. Do not use acid solutions for cleaning masonry units unless specifically approved by Architect.

F. Clean off loose mortar, remove stains from concrete masonry units.

G. Schedule, complete cleaning work as soon as possible; in any event, before Owner's signage work is commenced.

3.10 APPLICATION OF ACOUSTIC SPRAY SYSTEM

A. Install mineral wool backing at depth required per manufacturer's details.

B. Apply acoustic spray to required thickness and overlap onto adjacent surfaces as recommended by manufacturer to achieve specified sound transmission classification.

3.11 MORTAR FIELD QUALITY CONTROL

A. The Owner will employ a testing agency to perform the following:

1. Field test mortar for consistency, water content, mortar aggregate ratio, air content (only for those mixes with entrained air), and compressive strength in accordance with ASTM C780. Make one test for each 2,500 square feet of wall area.

2. Test brick prisms for flexural bond strength in accordance with ASTM C1072. Make one test for each mortar/brick combination.

3. Provide test results to Architect for comparison with laboratory results.

END OF SECTION 04 20 00

SECTION 05 50 00

METAL FABRICATIONS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes: All labor, material necessary to complete all items of miscellaneous metal as listed on the schedule in Part 2 and shown on the Drawings.

1. The design, fabrication, transportation to the project site, and associated operations required to complete miscellaneous metals, including all the various metal items manufactured to more or less standard details in sizes conforming to specific requirements of the project.

2. Decorative metal fence as shown on the Drawings.

B. Related work specified in other sections:

1. Structural Testing and Special Inspection – Section 01 45 33.

2. Steel support brackets for countertops - Section 12 35 13.

3. Overhead Doors – Section 08 36 00

1.03 REFERENCE STANDARDS

A. The following specifications and standards are incorporated by reference. Materials and operations shall comply with requirements of the specified issue of published reference. Where provisions of these Project Specifications are at variance with those reference specifications, the maximum criteria or requirements shall govern.

1. ASTM A36-03a, "Carbon Structural Steel"

2. ASTM A53-02, "Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless"

3. ASTM A123-02, "Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products"

4. ASTM A307-02, "Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength"

5. ASTM A325-02, "Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength"

6. ASTM A500-03, "Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes"

7. ASTM A563-00, "Carbon and Alloy Steel Nuts"

8. ASTM A666-00, "Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar"

9. ASTM A992-02, "Steel for Structural Shapes for Use in Building Framing"

10. ASTM F1554-99, "Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength"

11. AWS D1.1-2002, "Structural Steel Welding Code"

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Shop drawings required for all items. Show all work to be fabricated with all construction details shown in appropriate scale, methods of attachment to other materials, finished dimensions, shop welds and grinding of welds, field assembly joints, etc. Indicate welded connections, including net weld lengths, using standard AWS welding symbols.

2. Calculations: Accompany shop drawings with a complete structural design and analysis prepared and certified by a Professional Engineer (P.E.) licensed in the State in which the project is located. The design and analysis shall show all design loads, reactions, forces or stresses, and structural characteristics of members and connections for the items listed in section 2.01.B. Include a certified letter stating that shop drawings as submitted conform to the requirements on the design calculations.

3. Coordinate work with other suppliers and subcontractors; obtain their approved shop drawing where necessary, or obtain any necessary additional detail information regarding mounting conditions or other aspects of related work.

1.05 PRODUCT PROTECTION

A. Package, handle, deliver and store at the job site in a manner that will avoid damage or deformation. Damaged material will be rejected.

B. Furnish items to be built into concrete, masonry, carpentry, etc. as the work progresses.

1.06 JOB CONDITIONS

A. Verify dimensions in field, as required, for pre-cut or prefabricated items.

B. Examine job conditions and adjoining construction which may affect the acceptability of the work.

PART 2: PRODUCTS

2.01 DESIGN

A. All materials shall be free from defects impairing strength, durability, appearance, and shall be of the best commercial quality for the purposes indicated. Structural properties shall be such to withstand safely all strains and stresses to which they will be normally subjected.

B. Metal railings, stairs, catwalks, ladders, and other items specified in this section shall be designed to resist self-weight and the more stringent of:

1. Superimposed Dead and Live Loads indicated on the Contract Documents, and

2. Loads set forth by the governing Building Code.

C. The maximum Live Load deflection shall be L/360. Deflection determined based on structural section(s) alone.

2.02 MATERIALS

A. Structural Steel: ASTM A36 or A992.

B. Fastenings: Bolts, welds, rivets or other fastenings as required.

C. Anchor Bolts, Nuts: ASTM F1554, Grade 36.

D. Steel Pipe: ASTM A53, Grade B.

E. Steel Tubing: ASTM A500 Grade B.

F. Shop Paint Primer: Manufacturer's standard rust inhibiting primer.

G. Stainless Steel:

1. In all other areas where stainless steel is noted, provide grade 302 or 304, #4 satin finish conforming to ASTM A167 standards.

2. In chlorine environments (swimming pools) provide grade 316L (low carbon) with #4 satin finish conforming to ASTM A167 Standards.

H. Galvanizing: ASTM A123.

I. Expansion and Adhesive Anchors.

1. Wedge Anchors: Hilti "Kwik Bolt II" or Ramset/Redhead "Trubolt" or equal.

2. Heavy Duty Sleeve Anchors: Hilti "HSL" or equal.

3. Adhesive Anchors: Hilti "HVA" or "HIT", Ramset/Redhead "EPCON" or equal.

2.03 GENERAL REQUIREMENTS FOR FABRICATION

A. Weld permanent connections wherever possible; use continuous welds where exposed and grind smooth, straighten members after welding.

B. Perform welding in accordance with AWS D1.1.

C. Perform shop cutting, drilling, fitting and assembly wherever possible. Take field measurements before fabrication when required.

D. Provide all supporting members, fasteners, framing, hangers, bracing, brackets, straps, bolts, angles, etc. required to set, connect the work rigidly and properly to other construction.

E. Install welded end caps at all handrail terminations.

2.04 SHOP COATS PROTECTIVE TREATMENT

A. Clean free of all mill scale, rust and foreign matter by wire brushing, scraping, sandblasting or flame cleaning. Remove grease, oil with solvent. Dust, dirt: Remove with air blast or brush.

B. Apply one shop coat of specified primer to all ferrous metal products, except galvanized. Provide primer for field touch up. Be responsible for quality and adhesion of shop prime finish.

C. Hot-dip galvanize all ferrous metal items exposed to weather in the finish work and shop prime with primer recommended for use on galvanized metal.

2.05 SCHEDULE OF MISCELLANEOUS METAL ITEMS

A. Items listed in this Section are intended only as a guide, but do not relieve responsibility for verifying quantities and inclusion of all similar items. Thoroughly examine all Drawings for items of miscellaneous metal fabrications.

1. Overhead door corner guards.
2. Overhead door frames.
3. Steel pipe bollards.
4. Trench drains.
5. Steel bollards for handicap signs as shown on Civil Drawings.
6. Other miscellaneous metal items shown on Drawings.

PART 3: EXECUTION

3.01 INSTALLATION GENERAL REQUIREMENTS

A. Anchor to concrete and masonry with expansion or adhesive anchors where built-in anchorage is not provided; do not fasten to wood plugs set in masonry.

B. Vertical members set into concrete or masonry: As shown.

C. Bolts, screws, etc., for field connections: Same material, finish as base material.

3.02 FIELD SPLICES, WELDS

A. Perform field welding in accordance with AWS D1.1.

B. Welders shall be certified by AWS.

C. Continuously weld field splices and grind smooth where exposed to view.

D. Fill exposed splice joints with body filler and sand smooth.

E. Touch-up joints, welds with specified primer.

F. Touch-up damaged hot dipped galvanizing with Galvanizing Repair Compound per manufacturer's requirements.

3.03 FIELD QUALITY CONTROL

A. Structural Testing and Special Inspection

1. Comply with the requirements of Section 05 10 00 – Structural Steel Framing

2. The Owner will employ a Special Inspector for the following:

   a. Visual inspect 100% of all fillet welds, for size, length, and quality, per AWS D1.1. Qualifications: Technical II.

END OF SECTION 05 50 00

SECTION 06 10 53

CARPENTRY

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Miscellaneous blocking, sleepers and nailers, shown on Drawings or required.

2. Blocking/sill sealer for anchorage of windows, storefront and entrances.

3. Blocking within gypsum wallboard partitions for support of markerboards, grab bars, toilet accessories, casework, hardware, other wall mounted specialties.

4. Painted wood chair rail where shown on Drawings.

B. Related work specified in other sections:

1. Concrete Formwork - Section 03 30 00

2. Plastic Laminate Casework - Section 12 32 16.

3. Pre-Engineered Wood Building System - Section 13 34 21.

1.03 QUALITY ASSURANCE

A. Lumber Grades: Western Wood Products Association "Product Use Manual".

B. Preservative Treated Lumber: American Wood Preservers Bureau, "LP-2 Pressure Treated with Water-Borne Preservatives".

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Furnish certificates for preservative treated lumber.

2. Submit roofing material manufacturer's current printed instructions for installation of nailers.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Immediately upon delivery to job site, place materials in area protected from weather.

B. Store materials a minimum of 6 in. above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation.

C. Do not store seasoned material in wet or damp portions of building.

D. While unloading, protect sheet materials from corners breaking and damaging surfaces.

1.06 COORDINATION

A. Coordinate blocking for windows, storefront and entrances with Section 08 40 00.

B. Coordinate blocking for miscellaneous specialties with Division 10 suppliers.

C. Coordinate blocking for door stops in gypsum walls with Section 08 71 00.

D. Obtain product data, sizes and anchorage requirements prior to installation of blocking.

PART 2: PRODUCTS

2.01 ROUGH HARDWARE

A. Nails, spikes, screws, bolts and similar items of size and types to rigidly secure members in place or as otherwise indicated.

B. Non-corrosive type fasteners for redwood and preservative treated and fire retardant lumber such as stainless steel or double dipped galvanized.

C. Sill Sealer: Closed-cell plastic foam, ¼" thick, selected from manufacturers' standard widths to suit width of sill members indicated.

2.02 LUMBER

A. Framing, blocking lumber: No. 2 or better, S4S, Douglas Fir-Larch, Hem-Fir or Southern Pine, moisture content not to exceed 19%.

1. Provide preservative-treated lumber for work exposed to moisture or indirect contact with concrete slabs. Preservative-treated lumber is not required for blocking that is protected by roofing membrane, peel and stick flashing or weather barrier.

2. Provide fire-retardant lumber for all interior framing and blocking. Concealed blocking does not require to be fire-retardant lumber in construction types other than Type I and Type II.

2.03 PLYWOOD

A. Meet APA C-D exterior, thickness as shown on Drawings.

1. Provide preservative-treated lumber for work exposed to moisture or indirect contact with concrete slabs, as shown on drawings. Preservative-treated lumber is not required for blocking that is protected by roofing membrane, peel and stick flashing or weather barrier.

2. Provide fire-retardant lumber for all interior framing and blocking. Concealed blocking does not require to be fire-retardant lumber in construction types other than Type I and Type II.

B. Medium Density Overlay (MDO) Plywood: Phenolic Resin finished surface on plugged "B" grade ply over "C" grade inner plys.

PART 3: EXECUTION

3.01 ROUGH CARPENTRY

A. Provide wood nailers of size, shape where indicated, required.

B. Fasten securely to substrate with appropriate fasteners. Use expansion-type anchors at masonry or concrete, self-tapping screws at steel. Use corrosive resistant fasteners for roofing applications or where otherwise exposed to moisture.

C. Install blocking for windows, storefront and entrances according to approved Shop Drawings. Blocking shall be continuous the width or height of rough openings, unless otherwise shown on Drawings. Install sill sealer under windowsill blocking as detailed

D. Install blocking for finish materials, such as windows and sheet metal fascias, with minimum number of joints, plumb, level, true and straight with no distortions. Discard materials which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned.

END OF SECTION 06 10 53

SECTION 07 21 00

INSULATION

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes product specification of the following:

1. Perimeter insulation used primarily on vertical surfaces below grade at foundation walls.
2. Cavity wall insulation.
3. Batt insulation used with interior stud wall construction.
4. Sound batt insulation used to control sound transfer in stud wall construction.
5. Expanding foam insulation as shown on drawings.
6. Vapor barriers used under slab, and in combination with batt insulation in walls.
7. Batt insulation occurring in exterior envelope.
8. Acoustic spray system.

B. Installation of insulation specified in other sections:

1. Cast-in-Place Concrete – Section 03 30 00
2. Unit Masonry – Section 04 20 00
3. Carpentry – Section 06 10 53
4. Aluminum Entrances, Storefronts and Curtainwalls – Section 08 40 00
5. Aluminum Windows – Section 08 51 13
6. Gypsum Board – Section 09 21 16
7. Acoustical Ceilings – Section 09 51 00

C. Related work specified in other sections:

1. Pre-Engineered Wood Building System – Section 13 34 21

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

1. ASTM E 1745-09 Standard Specification for Plastic Water Vapor Retarders used in Contact with Soil or Granular Fill under Concrete Slabs.
2. ASTM E154-99 (2005) Standard Test Methods for Water Vapor Retarders used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover.
3. ASTM E96-05 Standard Test Methods for Water Vapor Transmission of Materials.
4. ASTM E 1643-09 Selection, Design, Installation, and Inspection of Water Retarders used in Contract with Soil or Granular Fill under Concrete Slabs.
5. ASTM F 1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
6. ASTM D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

B. American Concrete Institute (ACI):

1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials. Vapor Retarder component is not less than 10 mils thick.

1.04 SUBMITTALS

A. Submit in accordance to Section 01 33 00 Submittals.

B. Vapor Barriers

1. Manufacturer's product samples and literature.
2. Manufacturer's installation instructions for placement, seaming and pipe boot installation.
3. Third party laboratory test results showing compliance with specified properties.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver material to the site in unopened packages, with identification labels intact.

B. Store under water-resistant cover and protect from weather and direct sunlight.

C. Remove damaged materials from site.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not install rigid insulation (on vertical surfaces with adhesive) when temperature is below 40° F., during rain or wet weather, or when surfaces are wet.

1.07 SCHEDULING

A. Coordinate installation with other trades whose work may be affected or have effect.

PART 2: PRODUCTS

2.01 MATERIALS

A. Rigid Board Insulation: Rigid closed cell extruded polystyrene thermal board insulation.

1. Thermal Resistance: Aged R-value per inch of 5 at 75° F mean temperature per ASTM C518.

2. Water Vapor Permeance: 1.5 maximum per ASTM E96.

3. Water Absorption: 0.3% by volume, maximum per ASTM C272.

a. Perimeter Insulation:

1) Conforming to ASTM C578-95 type IV.
2) Compressive strength: 25 psi per ASTM D1621.

b. Cavity Wall Insulation:

1) Conforming to ASTM C578-95 type IV.
2) Compressive strength: 25 psi per ASTM D1621.

B. Batt Insulation:

1. Unfaced fiberglass batt (used in interior) as manufactured by Certain Teed, Johns Manville, and Owens Corning.

a. Thermal resistance: Minimum R-value of 3.3 per inch per ASTM C518.
b. Conforming to property requirements of ASTM C665, type 1 and ASTM E136.

2. Exterior envelope: Unfaced insulation as manufactured by Roxul, or ThermaFiber produced by combining thermosetting resins with mineral fibers manufactured from glass, slag, wool or rock wool. Fiberglass batts are not considered an equal.

   a. Thermal resistance: Minimum R-value of 4 per inch per ASTM C518.
   b. Conforming to property requirements of ASTM C665, type 1 and ASTM E136.
   c. Moisture resistance: Absorbs less than 1% by volume per ASTM C1104.

C. Sound Batt Insulation: ASTM C665, type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag, wool or rock wool. Fiberglass batts are not considered an equal.

1. Fire resistance-rated assemblies: Comply with mineral-fiber requirements of assembly.
2. Use 2" thick batts at stud cavities, 3" thick elsewhere.

D. Acoustic Spray System:

1. Hilti CP 572 Smoke and Acoustic Spray or equal.

   a. Chemical basis: Acrylic
   b. Curving time: +/- 3 days
   c. Skin-forming time: +/- 15 minutes
   d. Application temperature range: 40ºF to 104 ºF
   e. STC classification per ASTM E90: 56
   f. Flame spread per ASTEM E84-08: Flame spread: 10 and smoke development: 5
   g. Movement capability: Approximately 12.5%
   h. Mold resistant
   i. Backing material: Mineral wool.

E. Expanding Foam Insulation: Dow Chemical Great Stuff Pro or equal one part polyurethane foam sealant.

1. Conform to ASTM C557-93, D6464, CA25-4 and is UL Class 1 (Flame Spread of 15, Smoke of 20).
2. Application temperature range of 25°F to 120°F.
3. Paintable, stainable and sandable.
4. Acoustical Rating: Sound transmission class rating of 69.
5. Minimum R.Value of 4 per inch.

F. Vapor Barriers:

1. Walls: Glass reinforced or laminated polyethylene sheet, minimum perm rating, 0.1 when tested in accordance with ASTM-E96, Procedure A.

   a. Vapor Barrier Tape: Compatible polyethylene self adhesive tape recommended by vapor barrier manufacturer.
   b. Adhesive: Manufacturers vapor-proofing mastic.

2. Under Floor Slabs: Meet requirements of ASTM E1745 Class A.

   a. Materials: Meets Class A, 15 mil minimum thickness, high density polyethylene constructed of 100% virgin high-grade, polyolefin resins conforming to the following properties.

1)	Water Vapor Permeance	ASTM E 96	0.01 perms (US) per ASTM E 1745 Sec. 7.1
2)	Water Vapor Transmission	ASTM E 96	0.004 perms (g/hr-m2)
3)	Water Vapor Barrier	ASTM E 1745	Exceeds Class A (Plastics)
4)	Tensile Strength	ASTM D 882	60 lbs/in.
5)	Puncture Resistance	ASTM D 1709	2200 grams

6)	Life Expectancy	ASTM E 154	Indefinite
7)	Chemical Resistance	ASTM E 154	Unaffected
8)	Peel Adhesion to Concrete	ASTM D 903	8 lbs/in.

3. Vapor Barrier Accessories:

   a. Seam tape and vapor proofing mastic conforming to the following properties and as recommended by vapor barrier manufacturer:

1)	Water Vapor Permeance	ASTM E 96	0.03 Perms
2)	Tensile Strength (lbs/in)	ASTM D 1970	MD-20.09/TD-26.42
3)	Peel Adhesion (lbs/in)	ASTM D 3330	5.55
4)	Total Thickness		6 mil

   b. Pipe boots constructed from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

   c. Mastic to have a water vapor transmission rate per ASTM E 96, 0.3 perms or lower.

   d. Material for conduit/pipe bank sealing (when pipe boots will not work): Granular Seaming Bentonite with the following properties:

      1) Moisture: 9%
      2) PH of 6 percent suspension: PH 9.5
      3) Plate Water Absorption: 900 w+%
      4) Swell Index (ASTM D 5890): 28 ml
      5) Specific Gravity: 2.7
      6) Calcium Oxide (Ca0): 0.70%
      7) Surface Area (N_2 absorption): 20 m^2/gram
      8) Bulk Density (uncompacted): 61 lb/ft^3
      9) Bulk Density (compacted): 68 lb/ft^3

   e. Termination Bar: TB-100 termination bar with sealant ledge, .100" thick x 1" wide extruded aluminum with ¼" x 3/8" slotted holes at 8" o.c. as manufactured by Tru-Fast Corp (1-800-443-9602) or equal. Vapor Barrier manufacturers standard plastic termination bar is also acceptable. Fasteners to be stainless steel or galvanized for compatibility with aluminum.

PART 3: EXECUTION

3.01 INSTALLATION

A. Refer to specific specification sections for installation.

END OF SECTION 07 21 00

SECTION 07 62 13

SHEET METAL FLASHING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Sheet metal flashing and counterflashing shown on Drawings.

2. Prior to installation of finished materials, all flexible flashings shall be observed by the Architect. The Architect shall be given a minimum of 72 hours notice prior to the desired observation time. Any finish materials (i.e., brick, insulation, metal, etc.) installed without observation by the Architect shall be removed and replaced at the Contractor's expense.

B. Related work specified elsewhere:

1. Flexible flashing – Section 07 65 00.

2. Wood blocking, nailers – Section 06 10 53.

3. "Roofing", "Flashings", and "Coping" – Division 7 Roofing Specifications.

4. Aluminum flashing at windows, storefront and curtainwall - Division 8.

5. Sheet metal for mechanical work – Division 23.

1.03 QUALITY ASSURANCE

A. Referenced Standards: Recommended practices as set forth by the Sheet Metal and Air Conditioning Contractors Association, Inc. (SMACNA) in the "Architectural Sheet Metal Manual" are by reference made a part of this work.

B. Perform Work in a manner that will maintain warranties on associated work specified in other sections.

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Shop Drawings: Indicating joint treatment, fastening methods, thickness and finish of materials.

2. Samples: Actual metal samples of each color indicated.

PART 2: PRODUCTS

2.01 GENERAL

A. Provide all accessories, other items essential to completeness of installation, though not indicated, specified. All such items, unless otherwise indicated, specified: Of same kind of material as item to which applied. Nails, screws, bolts: Of types best suited for purpose intended, of composition that is compatible with metal to which it will contact.

B. Type, locations of various kinds, gauges, thickness, finish of Sheet Metal to be used is specified hereinafter, however, where sheet metal is indicated and kind, type of metal is not definitely specified, noted, provide 24 ga. prefinished galvanized steel.

2.02 MATERIALS

A. Sheet Metal (Exposed)

1. Materials manufactured by Firestone Building Products - UNICLAD are specified. Other manufacturers meeting specified requirements are acceptable, subject to approval of color and warranty.

2. Minimum 24 ga. G-90 galvanized steel prefinished with Kynar 500 or Hylar 5000 fluorocarbon coating.

3. Colors: As selected by Architect from manufacturer's full line of available colors.

4. Provide 20 year warranty covering color fade, chalking and film integrity. (Submit per Section 01 78 23)

5. Provide factory applied protective film. Do not remove until after fabrication and installation is complete.

B. Sheet Metal (Concealed): Minimum 22 ga. G-90 hot dipped galvanized steel.

C. Solder: ASTM B32, 50% tin, 50% lead.

D. Elastomeric Sealant: Generic type recommended by manufacturer of metal and other components being sealed.

E. Flexible Flashings: Conform to the requirements of Section 07 65 00/13 "Flashings."

2.03 FABRICATION

A. Accurately form work with brakes straight, true and sharp. Make plain surfaces free from waves and buckles. Match profiles exactly at connections. Bead or return exposed edges for strength and appearance. Provide ribs, cleats and reinforcement necessary to make the sections rigid and substantial. Allow for expansion and contraction.

B. Overlap seams in the direction of flow. Finished width of lock seams and soldered lap seams: Not less than 1". Finished width of unsoldered lap seams: Not less than 3".

C. Locate joints of sheet metal work exposed to view with respect to column centers, mullions, control joints or other architectural features as indicated on the Drawings or as directed by the Architect. Use concealed cover plates. Where appearance is not a factor, sheet metal work may be fabricated in 8 or 10-foot lengths.

D. Generally, joints shall be single locked and soldered or double locked and sealed. Field joints shall be designed to permit expansion. Shop form corner pieces. Internal corners shall be lapped, riveted and sealed. External corners shall be lapped, riveted and sealed where exposed to view and locked and soldered where appearance is not a factor. Locate field joints not less than 12" nor more than 3 feet from actual corner.

E. Fabricate sheet metal to be installed using concealed clips or other concealed fasteners where possible. Form joints and hem edges to conceal uncoated edges of metal. Handle prefinished sheet metal with care to prevent scratching or damaging surface.

PART 3: EXECUTION

3.01 WORKMANSHIP

A. Examine surfaces to be covered by sheet metal. Report any improper defective surfaces to Contractor, Architect in writing. Beginning of Sheet Metal Work over surfaces: Presumed as acceptance of surfaces as satisfactory by Sheet Metal Sub-contractor.

B. Verify field dimensions prior to fabrication.

C. Junctures where sheet metal abuts into adjacent dissimilar materials: Executed in manner that will prevent electrolysis between the two materials.

D. Insure that all work is precisely done, true to line, and free from over bending, burning, deforming, stretching, distortion, waves and buckles.

E. Seal under and around all fasteners which penetrate elastomeric roofing or flashing.

3.02 REPAIR

A. Repair or replace all damaged or defective work.

3.03 CLEANING

A. Clean exposed sheet metal of roofing materials, mortar, hand marks, other foreign materials.

B. Remove protective covering from sheet metal.

C. Touch up minor scratches in finish with matching paint, compatible with specified finish.

END OF SECTION 07 62 13

SECTION 07 65 00

FLASHING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes product specification of the following:

1. Flexible and metal flashing used in masonry, exterior finish materials and exterior openings.

B. Installation of flashings installed in other sections:

1. Unit Masonry – Section 04 20 00.
2. Sheet Metal Flashing – Section 07 62 13.
3. Aluminum Entrances, Storefronts and Curtainwalls – Section 08 40 00
4. Aluminum Windows – Section 08 51 13
5. Louvers – Section 08 91 00.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Product data indicating proposed material conforms to specification.
2. Submit samples of all specified materials for review.

PART 2: PRODUCTS

2.01 MATERIALS

A. Products by WR Grace are specified unless noted otherwise. Equivalent products by Carlisle Coatings and Waterproofing, Miradri, Polyken, WR Meadows are acceptable.

B. Flexible Flashing: Perm-A-Barrier Wall Flashing manufactured of 32 mils of self-adhesive rubberized asphalt integrally bonded to 8 mil of cross-laminated, high-density polyethylene film to provide a min. 40 mil thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:

1. Water Vapor Transmission: ASTM E96, Method B: 2.9 ng/m2sPa (0.05 perms) max.
2. Water Absorption: ASTM D570: max. 0.1% by weight
3. Puncture Resistance: ASTM E154: 356 N (80 lbs.) min.
4. Tear Resistance

   a. Initiation ASTM D1004: min. 58 N (13.0 lbs.) M.D.
   b. Propagation ASTM D1938: min. 40 N (9.0 lbs.) M.D.

5. Lap Adhesion at -4ºC (25ºF): ASTM D1876: 880 N/m (5.0 lbs./in.) of width
6. Low Temperature Flexibility ASTM D1970: Unaffected to -43ºC (-45ºF)

7. Tensile Strength: ASTM D412, Die C Modified: min. 5.5 MPa (800 psi)
8. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: min. 200%.

9. Wall Flashing Accessories:

   a. Surface Conditioner:

      1) Perm-A-Barrier Surface Conditioner: Water based latex liquid for substrate preparation conforming with the following:

         (1.) Flash Point: No flash to boiling point
         (2.) Solvent Type: Water
         (3.) VOC Content: Not to exceed 125 g/L
         (4.) Application Temperature: -4°C (25°F) and above
         (5.) Freeze/Thaw Stability: 5 cycles min.
         (6.) Freezing point (as packaged): -10°C (14°F)

   b. Termination Mastic:

      1) Bituthene® Mastic: Rubberized asphalt-based mastic with 20 g/L max. VOC Content.

   c. Optional Primers:

      1) Bituthene Primer WP-3000: Water-based latex primer with 110 g/L max. VOC Content.

      2) Bituthene Primer B2: Rubber-based primer in solvent with 440 g/L max. VOC Content.

C. Miscellaneous Accessories

1. Metal Flashing: 24 ga. G-90 hot dipped galvanized steel, prefinished with Kynar 500 or Hylar 5000 fluorocarbon coating.

   a. Color: See various technical sections for colors.

   b. Provide 20 year warranty covering color fade, chalking and film integrity.

   c. Provide factory applied protective film. Do not remove until after fabrication and installation is complete.

2. Rope Wicks: 1/4" cotton sash cord.

3. Flashing Termination Bar and Fasteners.

   a. Termination bar: TB-100 termination bar with sealant ledge, .100” thick x 1” wide extruded aluminum with ¼” x 3/8” slotted holes at 8”o.c. as manufactured by Tru-Fast Corp. (800-443-9602) or equal.

   b. Fasteners to be #14 x 1 ¼”stainless steel Crete Flex SS4, hex head with silver stalgard finish as manufactured by ELCO Fastening Systems or equal.

PART 3: EXECUTION

3.01 INSTALLATION OF ACCESSORIES

A. See various technical sections listed in paragraph 1.02.B for installation of flashings.

END OF SECTION 07 65 00

SECTION 07 65 19

WEATHER BARRIER

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes product specification of the following:

1. Fluid applied vapor permeable weather barrier on exterior sheathing behind other exterior finishes. Provide all auxiliary materials including liquid membrane for detailing wall primer, flexible membrane, joint reinforcing strips, transition membranes, substrate patching membrane, and foam sealant for a complete installation.

B. Installation of flashings installed in other sections:

1. Unit Masonry – Section 04 20 00.
2. Gypsum Sheathing – Section 06 16 43.
3. Sheet Metal Flashing – Section 07 62 13.
4. Aluminum Entrances, Storefronts and Curtainwalls – Section 08 40 00.
5. Louvers – Section 08 91 00.
6. Pre-engineered Wood Building System – Section 13 34 21.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of weather barrier.

2. Shop Drawings: Show locations and extent of weather barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

   a. Include details of interfaces with other materials that form part of weather barrier.
   b. Include details of mockups.

3. Samples: Submit representative samples of the following for approval:

   a. Fluid applied membrane
   b. Transition Membrane
   c. Through Wall Flashing

4. Product Certificates: For weather barriers, certifying compatibility of weather barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

5. Qualification Data: For Applicator.

6. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for weather barriers, submit certified test report showing compliance with requirements specified for ASTM E2178.

1.05 PERFORMANCE REQUIREMENTS

A. General: Weather barrier shall be capable of performing as a continuous vapor-impermeable weather barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Weather barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

1.06 REFERENCES

A. The following standards and publications are applicable to the extent referenced in the text. The most recent version of these standards is implied unless otherwise stated.

B. American Society for Testing and Materials (ASTM)

1. C836 Standard Specification for High Solids, Cold Liquid-Applied Elastomeric.
2. D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
3. E96 Test Methods for Water Vapor Transmission of Materials
4. E2178 Standard Test Method for Air Permeance of Building Materials
5. D95 Water absorption
6. E154 Resistance to degradation
7. D412 Standard Test Methods for Rubber Properties in Tension.

1.07 QUALITY ASSURANCE

A. Manufacturer: Weather barrier systems shall be manufactured and marketed by a firm with a minimum of 5 years experience in the production and sales of flashing and weather barriers.

B. Source Limitations: Obtain primary weather-barrier material and through wall flashing through one source from a single manufacturer.

C. Applicator Qualifications: A firm experienced in applying weather barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

D. Mockups: Before beginning installation of weather barrier, provide weather barrier work for exterior wall assembly mockups, incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of weather barrier membrane.

1. Coordinate construction of mockup to permit inspection by Owner's testing agency of weather barrier before external insulation and cladding is installed.
2. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply weather barrier until mockups are approved.

E. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Preinstallation conference shall include the Contractor, installer, Architect, and system manufacturer's field representative. Agenda for meeting shall include but not be limited to the following:

1. Review of submittals.
2. Review of surface preparation, minimum curing period and installation procedures.
3. Review of special details and flashings.

4. Sequence of construction, responsibilities and schedule for subsequent operations.
5. Review of mock-up requirements.
6. Review of inspection, testing, protection and repair procedures.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

B. Do not double-stack pallets of fluid applied membrane components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.

C. Store fluid-applied membrane components above 40°F.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Apply weather barrier within the range of ambient and substrate temperatures recommended by weather barrier manufacturer. Protect substrates from environmental conditions that affect performance of weather barrier. Do not apply weather barrier to a wet substrate or during snow, rain, fog, or mist.

PART 2: PRODUCTS

2.01 MATERIALS

A. Products by Polyguard Products (www.polyguardproducts.com) are specified.

1. Similar products by the following manufacturers are acceptable:

a. TK Products "Airmax" (www.tkproducts.com)
b. BASF – "Enershield" (www.wallsystems.basf.com)

2.02 WEATHER BARRIER (VAPOR-IMPERMEABLE)

A. Fluid-Applied, Fully-Adhered, Vapor-Impermeable Membrane Air Barrier, Basis of Design: Subject to compliance with requirements, provide the following:

1. Single component, elastomeric, thermoplastic rubber: Polyguard AirLok Flex

B. Physical and Performance Properties: Provide products with the following minimum properties:

Property	Test Method	Typical Value
Cured Film Thickness	ASTM D 3767 Method A	0.010 in. nominal
Solids Content	ASTM D 1644	100%
Air Permeance at 75Pa (0.3 in. water) Differential Pressure	ASTM E 2178	<0.0007 cfm/ft^2
Assembly Air Permeance at 75Pa (0.3 in. water) Differential Pressure	ASTM E 2357	0.0008 cfm/ft^2
Water Vapor Permeance	ASTM E 96, Method BW	Less than 0.1 Perms
Pull Adhesion	ASTM D 4541	>100 psi
Elongation	ASTM D 412	500% minimum
Pliability, 180° Bend over 1 in. Mandrel at -23°F	ASTM D 1970	Unaffected
Low Temperature Flexibility and Crack Bridging 1/8 in. crack cycling at -15°F	ASTM C836	Pass
Extensibility over 1/4 in. crack after heat aging	ASTM C836	Pass

2.03 WEATHER BARRIER (VAPOR-PERMEABLE)

A. Fluid-Applied, Fully-Adhered, Vapor-Permeable Membrane Air Barrier, Basis of Design: Subject to compliance with requirements, provide the following:

1. Single Component, Elastomeric, Rubber: Polyguard AirLok Flex VP

B. Physical and Performance Properties: Provide products with the following minimum properties:

Property	Test Method	Typical Value
Air Permeance	ASTM E 2178-01	≤0.0037 cfm/ft^2 on sheathing @ 70 SF/gal
Membrane Vapor Permeance	ASTM E 96	7.6 Perms
Elongation	ASTM D 412	500% minimum

2.04 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Liquid Membrane for substrate patching, details and terminations.

1. Poly-Wall Hole Filler or Poly-Wall Fiber Flash

   a. Air permeability system: 0.0007 cfm/ft^2 ASTM E2178
   b. Elongation: 275% ASTM D 412
   c. Low Temperature Pliability: -75°F.
   d. UV Rating: 2000 hours no change ASTM G 26.

C. Transition Membrane: Poly-Wall Self-Adhering Flashing. A self-adhesive polymer-modified asphalt laminated to a high-density polyethylene film conforming with the following:

1. Water Vapor Transmission: ASTM E96, Method B: .05 grains/sq.ft./hr./in.
2. Air Permeance: ASTM D 2178-01: .0014 cfm/ft^2
3. Puncture Resistance: ASTM E154: 178 N (40 lbs.) min.
4. Peel and Lap Adhesion ASTM D 1000 8lbs/in width.
5. Tensile Strength: ASTM D412, Die C Modified: min 325 psi
6. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, 600%.

D. Transition Membrane Primer: Poly-Wall Commercial Stretch and Poly-Wall AirLok Flex.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
4. Verify that masonry joints are tooled and completely filled with mortar.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid-applied air barrier system.

B. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws. Pre-treat all open board joints with liquid membrane or transition membrane.

C. Related Materials: Treat construction joints and install flashing as recommended by manufacturer.

D. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

E. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

F. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

G. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.

H. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

3.03 WEATHER BARRIER MEMBRANE INSTALLATION

A. Apply weather barrier membrane to achieve a continuous air barrier according to weather barrier manufacturer's written instructions.

B. Apply weather barrier membrane within manufacturer's recommended application temperature ranges.

C. Application of Fluid Applied Membrane:

1. Spray, brush or roll to apply a continuous uniform film at min. 40 mils (vapor impermeable) and 32 mils (vapor permeable wet film thickness. Average 10 mil (vapor impermeable) and 19 mil (vapor permeable) dry thickness.

2. Carry membrane into any openings a minimum of 2 in.

3. Seal all brick-ties and other penetrations as work progresses.

D. Do not cover weather barrier until it has been tested and inspected by Owner's testing agency.

E. Correct deficiencies in or remove weather barrier that does not comply with requirements; repair substrates and reapply weather barrier components.

3.04 TRANSITION MEMBRANE INSTALLATION

A. Detailing must be completed prior to 24 hours after application of the Fluid Applied Membrane. Apply transition membrane with a minimum overlap of 3 in. onto each surface at all beams, columns, joints and as indicated in detail drawings.

B. Tie into window and door frames, spandrel panels, roof and floor intersections and changes in substrate.

C. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.05 CLEANING AND PROTECTION

A. Protect weather barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

B. Schedule work to ensure that the weather barrier system is covered as soon as possible after installation. Protect weather barrier system from damage during subsequent operations. If the weather barrier system cannot be covered within 180 days (vapor impermeable) and 365 days (vapor permeable) after installation, apply temporary UV protection such as dark plastic sheet or tarpaulins.

C. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

D. Remove masking materials after installation.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspections: Weather barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of weather barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of weather barrier system has been provided.
3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed, if applicable.
7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Strips and transition strips have been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

C. Tests: Testing to be performed will be determined by Owner's testing agency from among the following tests:

1. Qualitative Testing: Weather barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, smoke pencil with pressurization or depressurization.

D. Remove and replace deficient weather barrier components and retest as specified above.

END OF SECTION 07 65 19

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between, fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. Only tested firestop systems shall be used in specific locations as follows:

1. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

2. Safing slot gaps between edge of floor slabs and curtain walls.

3. Openings between structurally separate sections of wall or floors.

4. Gaps between the top of walls and ceilings or roof assemblies.

5. Expansion joints in walls and floors.

6. Openings and penetrations in fire-rated partitions or walls containing fire doors.

7. Openings around structural members which penetrate floors or walls.

1.04 RELATED WORK OF OTHER SECTIONS

A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:

1. Section 03 30 00 - Cast-In-Place Concrete
2. Section 07 92 00 - Joint Sealers
3. Section 04 20 00 - Masonry Work
4. Section 09 24 /09 23 00 - Lath and Plaster
5. Section 09 21 16 - Gypsum Drywall Systems
6. Division 23 - HVAC
7. Division 21 - Fire Protection
8. Division 22 - Plumbing
9. Division 26 – Electrical
10. Division 27 – Communications
11. Division 28 – Electronic Safety and Security

1.05 REFERENCES

A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"

B. Test Requirements: UL 1479, “Fire Tests of Through-Penetration Firestops”

C. Test Requirements: UL 2079, “Tests for Fire Resistance of Building Joint Systems”

D. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:
   a. Firestop Devices (XHJI)
   b. Fire Resistance Ratings (BXRH)
   c. Through-Penetration Firestop Systems (XHEZ)
   d. Fill, Voids, or Cavity Material (XHHW)
   e. Forming Materials (XHKU)
   f. Joint Systems (XHBN)
   g. Perimeter Fire Containment Systems (XHDG)
2. Alternate Systems: “Omega Point Laboratories Directory” (updated annually).

E. Test Requirements: ASTM E 1966, “Standard Test Method for Fire Resistive Joint Systems”

F. Test Requirements: ASTM E 2307, “Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus”

G. Inspection Requirements: ASTM E 2174, “Standard Practice for On-site Inspection of Installed Fire Stops”

H. ASTM E 84, “Standard Test Method for Surface Burning Characteristics of Building Materials”

I. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

J. International Building Code as modified by local jurisdiction.

K. NFPA 101 - Life Safety Code

L. NFPA 70 - National Electric Code

1.06 QUALITY ASSURANCE

A. A manufacturer's direct representative to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation must meet requirements of ASTM E 814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.07 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions.

2. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in the assembly drawing.

3. Material safety data sheets provided with product delivered to job-site.

4. Documentation from manufacturer that all firestopping installations on-site meet their requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.09 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Firestopping Materials are either "cast-in-place" (integral with concrete placement) or "post installed." Provide cast-in-place firestop devices prior to concrete placement.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ), joint systems (XHBN), and perimeter firestop systems (XHDG) listed in Volume 2 of the UL Fire Resistance Directory: Products specified are by Hilti, Inc., Tulsa, Oklahoma, 800-879-8000/www.us.hilti.com

1. Manufacturers with products which conform to requirements specified herein are acceptable.

2.03 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E 814 or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. L-Rated Systems: Where through-penetration firestop systems are indicated in smoke barriers, provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq. ft. at both ambient temperatures and 400 deg F.

C. Cast-in place firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and cable bundles penetrating concrete floors, the following products are acceptable:

1. HILTI
   a. CP 680 Cast-In Place Firestop Device
      1) Add Aerator adaptor when used in conjunction with aerator ("sovent") system.
   b. CP 682 Cast-In Place Firestop Device for use with noncombustible penetrants

D. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:

1. HILTI
   a. FS-ONE Intumescent Firestop Sealant
   b. CP 604 Self-leveling Firestop Sealant
   c. CP 620 Fire Foam
   d. CP 606 Flexible Firestop Sealant
   e. CP 601s Elastomeric Firestop Sealant

E. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. HILTI
   a. CP 601s Elastomeric Firestop Sealant
   b. CP 606 Flexible Firestop Sealant
   c. FS-ONE Intumescent Firestop Sealant

F. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:

1. HILTI
   a. CP CFS-SP WB Joint Spray
   b. CP 601s Elastomeric Firestop Sealant
   c. CP 606 Flexible Firestop Sealant
   d. CP 604 Self-leveling Firestop Sealant

G. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material.

1. HILTI
   a. CP 777 Speed Plugs
   b. CP 767 Speed Strips

H. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:

1. HILTI
   a. FS-ONE Intumescent Firestop Sealant

I. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:

1. HILTI
   a. FS-ONE Intumescent Firestop Sealant
   b. CP 620 Fire Foam
   c. CP 601s Elastomeric Firestop Sealant
   d. CP 606 Flexible Firestop Sealant

J. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:

1. HILTI
   a. CP 618 Firestop Putty Stick
   b. CP 658T Firestop Plug

K. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:

1. HILTI
   a. CP 617 Firestop Putty Pad

L. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

1. HILTI
   a. CP 643N Firestop Collar
   b. CP 644 Firestop Collar
   c. CP 645/648 Wrap Strips

M. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. HILTI
   a. CP 637 Firestop Mortar
   b. FS 657 FIRE BLOCK
   c. CP 620 Fire Foam
   d. CP 675T Firestop Board

N. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. HILTI
   a. FS 657 FIRE BLOCK
   b. CP 675T Firestop Board

O. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:

1. HILTI
   a. CP CFS-SP WB Joint Spray
   b. CP 601s Elastomeric Firestop Sealant
   c. CP 606 Flexible Firestop Sealant
   d. CP 604 Self-Leveling Firestop Sealant

P. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:

1. HILTI
   a. FS 657 FIRE BLOCK
   b. CP 658T Firestop Plug

Q. For data and communication penetrations in fire and smoke rated assemblies. (Similar products by other manufacturers that allows for ease of re-penetration without the use of sealants or caulking are acceptable.)

1. HILTI
   a. CP 653 2" Speed Sleeve
   b. CP 653 4" Speed Sleeve.

R. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

S. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction joint assembly.

T. Identification Labels

1. Pressure-sensitive, self adhesive, preprinted vinyl labels with the following verbiage:
   a. "Warning: Fireblocking Application – Do Not Disturb. Notify Building Management of Any Damage"
   b. Installing Contractor's name, address and phone number.
   c. Date of installation.
   d. Fireblocking/Stopping product manufacturer's name.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.

2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trades to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or Omega Point Laboratories Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

3. Protect materials from damage on surfaces subjected to traffic.

C. Identification: Install identification labels no greater than 6 feet from penetration or 6 feet on center on continuous firestopping applications.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

E. Manufacturer to inspect sealed penetrations for conformance with appropriate product data information for each contractor installing firestopping on site.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION 07 84 00

SECTION 07 92 00

SEALANTS AND CAULKING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Exterior colored sealants:

1. Joints in masonry.
2. Joints around hollow metal.
3. Miscellaneous joints where "sealant" or "caulk/caulking" is indicated on drawings.
4. Joints around mechanical, electrical and architectural penetrations of exterior.
5. Installation of sealant on masonry quality control panel for color match and adhesion verification by means of an adhesion test.

B. Interior colored sealants:

1. Note: Sealant on materials to be painted will be installed after painting is completed and shall match paint color. A "sacrificial" backer rod shall be installed prior to painting to protect joints from paint over spray. This backer rod may be pushed into the joint or removed prior to installation of final backer rod and sealant.
2. Interior joints around hollow metal, including joint between hollow metal and hard surface flooring.
3. Joints in slabs and at edges where painted, exposed or sealed concrete is shown on Drawings.
4. Miscellaneous joints where "sealants" or "caulk/caulking" is indicated on Drawings.

C. Related work specified in other sections:

1. Sealant for firestopping – Section 07 84 00.

2. Sealant for sheet metal joints – Section 07 62 00.

3. Caulking around windows, storefront and curtainwall – Division 8.

4. Glazing – Section 08 80 00.

5. Acoustical sealant – Section 09 21 16.

6. Sealants at tilework – Section 09 30 00.

7. Sealing at plumbing fixtures and mechanical penetrations through rated walls – Division 21-25.

8. Sealing of electrical penetrations through rated walls – Divisions 26-28.

1.03 REFERENCES

A. ASTM C 920 – Specification for Elastomeric Joint Sealants.

B. ASTM C 1193 – Standard Guide for Use of Joint Sealants.

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods including joint design, surface preparation, and application instructions.
4. Submit manufacturer's test reports indicating test results of adhesion and/or compatibility testing of samples of substrates which either come in contact with or are in close proximity to sealants.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors or samples of custom color matches for Architect's acceptance.

D. Samples of Warranty.

E. Manufactures approval of installer.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications

1. Company specializing in performing work of this section with minimum three years documented experience, minimum three successfully completed projects of similar scope and complexity, and approved by manufacturer.
2. Designate one individual as project foreman who shall be on site at all times during installation.

B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Prepare mock-ups for sealants and for each type of surface using same materials, tools, equipment, and procedures intended for actual surface preparation and application under actual use and environmental conditions. Mock-ups must be complete for 14 days prior to review by Architect.
2. Before installing exterior sealants, field test their adhesion to Project joint substrates as follows:
   a. Conduct field tests for each kind of joint substrate indicated.
   b. Notify Architect seven days in advance of dates and times when test joints will be erected.
   c. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
      1) Test per Field Quality Testing in Part 3 of this Specification.
3. Observe for sealant and surface staining or discoloration.
4. Retain acceptable mock-ups to establish intended standards by which sealants will be judged.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in manufacturers unopened original packaging. Inspect for damage.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1. Store materials in a clean, dry area indoors in accordance with manufacturer's instructions.
2. Store sealants within temperature range in accordance with manufacturer's instructions.
3. Keep containers sealed until ready for use.
4. Do not use materials after manufacturer's use-before date.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1. Do not apply sealants to surfaces that are wet, damp, or contain frost.

2. Do not apply sealants when air or surface temperature is below 40 degrees F.
3. Use caution when applying sealants when air or surface temperature is above 120 degrees F.

1.08 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty for Exterior Sealants: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 EXTERIOR SEALANTS

A. Silicone Sealant: Single Component, Nonsag, Neutral-Curing Silicone joint sealant conforming to ASTM C 920, Type S, Grade NS, Class 100/50. Maximum VOC: 98 g/L

1. Manufacturers/product:
   a. Dow Corning, 790.
   b. GE/Momentive Performance Materials, SilPruf LM SCS 2700.
   c. Pecora, 890 or 890 FTS
   d. Temco Spectrem 1 or Spectrem 4

2. Colors: Custom colors to match material or finish sealant occurs in.

2.02 INTERIOR SEALANTS

A. Polyurethane Sealant: Multi-component, high-performance polyurethane sealant conforming to ASTM C 920, Type M, Grade NS, Class 25. Maximum VOC: 25 g/L.

1. Manufacturers/product:

   a. Pecora, Dynatrol II
   b. SIKA, SIKAFLEX 2-C
   c. BASF MaterSeal NP2
   d. Tremco, Dymeric 240/240FC

2. Colors: Custom colors to match material or finish sealant occurs in.

2.03 ACCESSORIES

A. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

B. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

C. Joint Backing: Round foam rod compatible with sealant; oversized 25 to 50 percent larger than joint width; recommended by sealant manufacturer to suit application.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

E. Masking Tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces.

PART 3: EXECUTION

3.01 EXAMINATION

A. Inspect joints for compliance with requirements for joint configuration, installation tolerance, and other conditions affecting joint sealant performance. Correct unsatisfactory conditions before proceeding.

B. Do not install sealants during use of temporary heaters or until vapors from temporary heaters are flushed from building. Do not install sealant when painting operations are in progress.

3.02 PREPARATION

A. Prepare joints in accordance with ASTM C 1193 and manufacturer's instructions.

B. Clean out joints immediately before installing joint sealants (within 1 to 2 hours of sealant application), in accordance with joint sealant manufacturer's recommendations and the following requirements:

1. Remove from joint substrates foreign material which could interfere with adhesion of joint sealant, including paints other than permanent protective coating tested and approved for sealant adhesion and compatibility by sealant manufacturer, oil, grease, waterproofing, water repellants, water dirt, and frost.

2. Clean porous joint substrates using approved methods such as brushing, grinding, blast cleaning, mechanical abrading, and acid washing as appropriate, or a combination of these methods, to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form-release agents from concrete.

4. Clean metal and other nonporous substrates by using chemical cleaners or other means that neither are harmful to substrates nor leave residues capable of interfering with adhesion of joint sealants.

C. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to area of joint sealer bond; do not allow spillage or migration onto adjoining surfaces. Allow primer to dry before applying sealant.

D. Masking Tape: Use masking tape where required to prevent contamination of adjacent surfaces; remove tape immediately after tooling and before sealants begin to cure without disturbing seal.

3.03 SEALANT INSTALLATION

A. Comply with joint sealant manufacturer's printed installation instructions.

B. Installation of Sealant Backings:

1. Install joint filler to provide support of sealant during application and at position required to produce the cross-sectional shape and depth of installed sealant relative to joint width that allows optimum sealant movement capability.

a. Do not leave gaps between ends of joint fillers.

b. Do not stretch, twist, puncture, or tear joint fillers.

c. Remove fillers which have become wet prior to sealant application and replace with dry materials.

2. Install bond breaker tape when joint depth is to shallow to allow backer rod.

C. Installation of Sealant:

1. Install sealants by proven techniques that result in direct contact with and full wetting of joint substrates by joint sealant, completely filling recesses provided and providing uniform cross-sectional shapes and depths relative to joint widths. Sealant depth to be ½ the width of the joint and 1/3 the width at the center, creating an hourglass shape. Maximum depth of caulk at center to be 3/8". Air pockets or voids are not acceptable.

2. Immediately after sealant application and prior to the skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or which are not approved by sealant manufacturer.

3.04 PROTECTION AND CLEANING

A. Protect joint sealers, during and after curing, from contamination or damage. Cut out and remove damaged or deteriorated sealers and replace with new materials.

B. Clean excess sealants or sealant smears adjacent to joints as work progresses.

3.05 FIELD QUALITY CONTROL

A. Perform adhesion tests on exterior sealant in accordance with manufacturer's instructions and ASTM C1193, Method A, Field-Applied Sealant Joint Hand-Pull Tab.

1. Perform 5 tests for first 1,000 linear feet of applied exterior sealant and 1 test for each 1,000 feet of seal thereafter. If there is less than 1,000 feet, perform 1 test per floor per building elevation minimum.
2. For sealant applied between dissimilar materials, test both sides of joint.

B. Sealants failing adhesion test shall be removed, substrates cleaned, sealants re-installed, and re-testing performed.

C. Maintain test log and submit report to Architect indicating tests, locations, dates, results, and remedial actions.

END OF SECTION 07 92 00

SECTION 08 10 00

STEEL DOORS AND FRAMES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. All hollow metal doors, doorframes and borrowed light frames.

2. Rated doors and frames as scheduled and/or noted on Code Plans.

3. Conduits and boxes in frames for powered hardware.

B. Related work specified in other sections:

1. Finish hardware – Section 08 71 00.

2. Glazing – Section 08 80 00.

3. Painting – Section 09 91 00.

1.03 QUALITY ASSURANCE

A. Provide doors and frames complying with the SDI Standard 100-"Recommended Specifications Standard Steel Doors and Frames" and as herein specified.

B. Obtain hardware templates from hardware supplier (Section 08 71 00) and obtain necessary hardware for factory application.

C. Where noted on Door Schedule, provide nationally recognized testing agency label of proper classification. Label requirements take precedence over conflicting details. Advise the Architect of any conflict before fabricating work on that item is started.

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Coordinate with any special conditions of anchorage. Submit door/opening schedule on shop drawings indicating relationship of door, number of room, number and function of door, such as Corridor A-13 to Lavatory A-14.

2. Shop Drawings: Include the following:

a. Elevations of each door design.
b. Details of doors, including vertical and horizontal edge details and metal thicknesses.
c. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
d. Locations of reinforcement and preparations for hardware.

e. Details of each different wall opening condition.
f. Details of anchorages, joints, field splices, and connections.
g. Details of accessories.
h. Details of molding, removable stops, and glazing.
i. Detail of conduit and preparations for power, signal, and control systems.
j. Rating of doors and frames as noted on door/opening schedule and/or Code Plan.

1.05 PRODUCT PROTECTION

A. Deliver doors and frames in suitable crating or packaging to prevent damage in transit and storage.

B. Storage at jobsite:

1. Store frames on plywood and block at least 4" above plywood, under waterproof cover.
2. Store doors under cover in a dry area with doors set upright with ¼ inch spacers between doors. Keep doors at least 4" above ground.
3. Do not store HM material in a manner that traps excess humidity.
4. Materials that are rusted prior to installation may be rejected.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Approved Manufacturer(s): Steelcraft, Pioneer, Ceco, Curries.

B. Accompany any request for acceptance of alternative manufacturers by descriptive details or brochures demonstrating compliance with specifications, and sample frame corner.

2.02 MATERIALS

A. Steel: Commercial quality, level, cold rolled steel conforming to ASTM A366, free of scale and surface defects. Commercial quality hot rolled and pickled steel conforming to ASTM A569 may be used at contractor's option for interior frames. Where noted, form frames of galvanized steel conforming to ASTM A526 or A527, A60 zinc coating. Gauges are as follows unless otherwise noted:

1. Interior Frames: 16 gauge.

2. Exterior Frames: 14 gauge, galvanized.

3. Flush Doors: 16 gauge galvanized (exterior), 18 gauge (interior).

4. Rough Bucks and Stiffeners: 12 gauge.

5. Miscellaneous Trim: 16 gauge.

B. Rust-Inhibitive Primer

1. Manufacturer's standard rust inhibitive baked-on primer. Provide additional primer for touch-up.

2. Pretreat galvanized metal in accordance with paint manufacturer's recommendations.

2.03 FABRICATION

A. Make hardware mortises and reinforcements according to templates. Provide hinge, lock, door holder and closer hardware reinforcements. Mortise, drill tap for hardware; fabricate grooves, rabbets as necessary for weatherstripping, soundstripping.

B. Fabricate doors to a maximum tolerance of 1/16 inch from a straight edge when laid on face of door in any direction, including diagonal.

C. Attach proper testing agency's labels as indicated on the Drawings. Provide equal labeled frames for labeled doors. Frames with glazing in rated walls must conform to NFPA 252 (hose stream test). Provide intumescent fire and smoke material for fire rated openings as required by door and frame manufacturer to comply with UL 10C, UBC Test 7-2.

D. Clearances: Edge clearances shall be provided as follows:

1. Between doors and frame, at head and jambs - 1/8"

2. At door sills:

where no threshold is used	–	5/8" maximum to finish floor surface
where threshold is used	–	1/4" maximum between door and threshold
where required for hardware operation	–	as recommended by hardware manufacturer

3. Between meeting edges of pairs of doors - 1/8"

2.04 METAL FRAMES

A. Provide custom metal frames of the types and styles indicated on the drawings or schedules and complying with SDI 100 for materials and construction requirements.

B. Provide metal frames for doors, sidelights, borrowed lights, and other openings, as shown on the drawings. Provide thermally broken frames at exterior wall.

C. Miter corners on face of all frames, internally weld face and grind smooth exterior. Die coped frames at mullions and stops. Provide with floor anchors.

D. Provide one removable and one fixed stop at perimeter of openings for glazed frames. Removable stop on secure side.

E. Provide closed metal covers over all hardware cutouts to protect against mortar.

F. Provide integral channel frames, subframes and stiffeners to structure where indicated or required for fastening and stiffening frames.

G. Provide steel spreader temporarily attached to feet of both jambs for welded frames.

H. Provide three factory installed silencers on single door frames at strike jamb; four (two at each head) silencers on double door frames.

I. Hinge reinforcements to have 10 gauge straps welded directly above and below each hinge pocket.

J. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26.

2.05 FLUSH HOLLOW METAL DOOR

A. Provide custom metal doors for the types and styles indicated on the Drawings or schedules and complying with SDI 100 for materials and construction requirements. Fully insulate exterior doors.

B. Close top and bottom edges of all doors with a continuous recessed steel channel not less than 16 ga., full width spot welded to both faces. Provide an additional flush closing channel at top edge for exterior doors. Provide openings to bottom closure of exterior door to permit escape of moisture.

C. Edge profiles to be 1/8" bevel in 2".

D. Provide glass light openings as indicated complete with one fixed stop and one removable stop fastened with flat head Phillips screws not over l0 inches o.c.

E. All doors to have minimum 16-gauge lock reinforcement and either continuous 14-gauge hinge rail or minimum 8-gauge plate hinge reinforcement.

F. All faced edge seams to be continuously wire welded, finished smooth.

2.06 HARDWARE LOCATION

A. Prepare for hardware at mounting heights and locations as recommended by the Builder's Hardware Manufacturing Association.

2.07 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal frames.

2.08 SHOP PAINTING

A. Completely clean all frames by degreasing process, followed by one coat rust inhibitive primer equal to a salt spray test (5% solution) of 70 hours. Thoroughly prime all surfaces without runs, smears, or bare spots, and under and inside all removable stops.

B. Completely clean all doors of impurities and pressure sand to a smooth surface and correct all irregularities with metallic putty sanded smooth. Provide one (1) spray coat of primer, baked on. Thoroughly paint unexposed inside surfaces of exterior doors, fire doors, and other doors occurring in excessive moisture area.

C. Provide vinyl wash pre-treatment of galvanized steel as recommended by shop primer manufacturer.

D. Provide primer for field touch up of rusted areas, splices, connections, welds and abrasions.

PART 3: EXECUTION

3.01 INSTALLATION

A. Prime-Coat Touchup: Prior to erection sand smooth rusted, damaged, connection points and welded areas of prime coat and apply touchup primer.

B. Securely fasten Work in place, without twists, warps, bulges or other unsatisfactory defacing of workmanship. Set plumb, level square to proper elevation true to line and eye. Set clips and other anchors with piston driven fasteners equal to Ramset or drilled-in anchors as approved. Fasten units and trim together with neat, uniform and tight joints.

C. Where field installed hardware is required, provide wood or other suitable filler to avoid drilling and tapping into mortar inside frames.

D. For all attachments including removable stops, use flat head self-tapping screws. Drill and tap in the field for surface mounted closers, brackets, rim exit devices, door holders, and other surface hardware. At horizontal exterior surfaces, set screws with neoprene gaskets or set with caulking compound under screw head and wipe clean.

E. All field splices to be welded and filled with body putty and ground smooth, no exposed screw heads will be accepted. Locate splices where shown on final reviewed shop drawings.

3.02 PROTECTION

A. Protect installed hollow metal work against damage from other construction.

B. Repair or replace all damaged work at no extra cost to Owner.

END OF SECTION 08 10 00

SECTION 08 14 00

WOOD DOORS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Solid core flush wood doors.
2. Rated doors as noted on schedule and/or Code Plan.
3. Factory finishing of wood doors.
4. Factory fitting to frames (prefitting).
5. Factory preparation for hardware (premachining).
6. Glazing, glazing stops and preparation of doors to receive glazing.

B. Related sections:

1. Metal doorframes: Section 08 10 00.
2. Finish hardware: Section 08 71 00.
3. Glazing: Section 08 80 00.

1.03 REFERENCES

A. Most current printing of the noted standards apply.

B. Window and Door Manufacturers Association (WDMA) Industry Standard: WDMA I.S.1A.

C. NFPA 80 Standard for Fire Doors and Other Opening Protectives. National Fire Protection Association.

D. American National Standards Institute (ANSI) A115.W Series.

E. NFPA 252: Standard Methods of Fire Tests of Door Assemblies.

F. How to Store, Handle, Finish, Install and Maintain Wood Doors; National Wood Window and Door Association (NWWDA); undated.

G. International Building Code (IBC) Current Edition.

H. WDMA I.S. 1S: Industry Standard for Architectural Wood flush Doors, Window and Door Manufacturers Association.

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Product Data: Submit door manufacturer's product data for each type of wood door, including details of core and edge construction, and trim for openings.

2. Shop Drawings:

a. Location and size of each door.

b. Elevation of each kind of door.

c. Details of construction.

d. Location and extent of hardware blocking.

e. Fire ratings of doors as noted on door/opening schedule and/or Code Plan.

f. Requirements for factory finishing.

3. Samples:

a. Beads for glazed openings: Submit 6-inch-long sections of glazing beads for each material, type, and finish required.

1.05 QUALITY ASSURANCE

A. Quality Standards: Provide flush doors complying with the following standards:

1. Manufacturer must be an approved WDMA Door Manufacturer in accordance with WDMA I.S.1A.

B. Fire-Rated Wood Doors:

1. Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies per NFPA 252.

2. Acceptable testing and inspection agencies include:

a. Underwriters Laboratories, Inc.

b. Warnock Hersey International, Inc.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect wood doors during transit, storage, and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standard and recommendations of NWWDA I.S. 1, Appendix, "How to Store, Handle, Finish, Install, and Maintain Wood Doors," as well as with manufacturer's instructions.

1. Package doors at factory prior to shipping, using manufacturer's standard method.

B. Identify each door with individual opening numbers using temporary, removable, or concealed markings.

1. Correlate door identification with designation system used on shop drawings.

1.07 WARRANTIES

A. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by manufacturer, installer, and contractor, agreeing to repair or replace defective doors which warp (bow, cup, or twist), which show telegraphing of core construction in face veneers, or which do not conform to tolerance limitations of specified quality standards. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the contractor under the contract documents.

1. Include reinstallation which may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.

2. Warranty shall be in effect during the following period of time after date of substantial completion:

   a. Solid core flush interior doors: Life of installation.

3. Submit per Section 01 78 23.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Manufacturer:

1. Provide products complying with requirements of the contract documents and made by one of the following:

   a. Marshfield – Algoma by Masonite Architectural; www.marshfielddoors.com
   b. Eggers Industries; www.eggersindustries.com
   c. VT Industries; www.vtindustries.com

B. Flush Doors: comply with requirements of WDMA I.S.1A.

C. Fire Rated Doors:

1. Construction: Manufacturer's standard core construction in accordance with testing agency requirements for fire rating indicated, and as specified herein.

2. Edges: Provide manufacturer's standard laminated edge (stile) construction for use with mortise hinges and for indicated fire resistance ratings.

3. Labels: Permanently affixed to hinge stile and in compliance with NFPA 80. For doors with continuous hinges or other hardware which may obscure the label install label at top edge of door.

2.02 SOLID CORE WOOD FACED DOORS

A. Solid Core Door (non-rated):

1. PC-5 WDMA Premium

2. Application: Non-rated interior door.

3. Faces:

   a. Wood Veneer:

      1) Natural maple.

2) Cut: Plain sliced.

4. Construction: 5-ply Standard construction is per WDMA Extra Heavy Duty Performance Levels.

5. Core: Extra heavy duty wood based particleboard, PC. Meet WDMA performance criteria without additional blocking.

B. Solid Core Door (rated):

1. FD-5 WDMA Premium

2. Application: Labeled fire door.

3. Faces and Construction: Same as non-rated door.

4. Core: High-density mineral core laminated to both sides of 3/4" fire retardant plywood.

5. Reinforcing for Hardware: Fire retardant treated top rail and lockblocks for secure anchorage of hardware, without thru bolts as noted in NWWDA I.S. I-A.

6. Provide factory primed rated astragals or metal edges as required by listing agency.

7. Provide intumescent fire and smoke material for fire rated openings as required by door and frame manufacturer to comply with testing requirements of ASTM 252/UL 10C.

   a. Positive Pressure Category “A” type doors required.

8. Door assemblies installed in fire-rated corridor walls or smoke barrier walls shall meet IBC requirements for smoke and draft control as tested in accordance with UL 1784. These door assemblies shall be installed in accordance with NFPA 105.

2.03 GLAZING

A. Glazing Stops:

1. Non-Rated and 20 minute

   a. Wood, of the same species/compatible with door species.

2. Fire-Rated 45 minute or above, manufacturers options:

   a. Flush, wood veneer clad PVC, of same species/compatible to door facing.
   b. Veneer wrapped rolled steel, of same species/compatible to door facing.
   c. Manufacturer to verify compatibility of glazing system with positive pressure requirements.

2.04 FABRICATION

A. Openings: Cut, trim, and seal openings in doors at the factory.

B. Prefitting: Fabricate and trim doors to size at factory to conform to hollow metal frames as shown on approved frame shop drawings and floor finishes as indicated in the finish schedule.

C. Premachining: Make all mortises and cutouts required for hardware at the factory to conform to approved hardware schedules, hardware templates, and door frame shop drawings.

2.05 FACTORY FINISHING

A. Doors to be factory finished to meet or exceed WDMA I.S. 1A TR-6.

PART 3: EXECUTION

3.01 INSPECTION

A. Require installer to examine door frames after their installation, and doors prior to their hanging, for the following purposes:

1. To verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.

2. To verify that doors are free of defects.

B. Obtain installer's written report listing conditions detrimental to compliance with requirements of this section.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Condition doors to average prevailing humidity in installation area prior to hanging.

B. Hardware Installation: Section 08 71 00.

C. Install wood doors in accordance with manufacturer's instructions and referenced standards.

1. Installation of the wood doors, and labeled wood doors shall comply with WDMA I.S.1A-04, Installation and NFPA 80.

2. Dimensional tolerances for hardware cutouts, undercuts, meeting edges, heights and width shall comply with WDMA I.S.1A-04

D. Prefit Doors: Fit to frames and machine for hardware to whatever extent not previously worked at factory as required for fit and uniform clearance at each edge.

E. Shop-Finished Doors: Restore finish on edges of shop-finished doors before installation, if fitting or machining is required at the project site. Touch up any scratched doors to satisfaction of Architect prior to substantial completion or replace doors.

3.03 CLEANING AND ADJUSTMENT

A. Replace doors that are warped, twisted, show through or not true in plane and that do not follow the warranty.

B. Operation: Rehang or replace doors which do not swing or operate freely, as directed by the Architect.

C. Refinish or replace doors damaged during installation, as directed by the Architect.

D. Institute protective measures as recommended and accepted by door manufacturer to ensure that wood doors will be without damage or deterioration at time of substantial completion.

END OF SECTION 08 14 00

SECTION 08 31 00

ACCESS PANELS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes: Wall and ceiling access and fire rated panels as noted on Drawings and specified herein.

B. Provide and install one additional access panel for each type over quantities shown on drawings.

C. Related work specified elsewhere:

1. Openings in gypsum board - Section 09 21 16.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner that will avoid damage.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Nystrom Products are specified, comparable products by others who meet the specification are acceptable.

2.02 UNITS

A. Access Panel #1 (Noted as AP #1 on drawings) "Used in Drywall"

1. Size: 24" x 24"
2. Flange: Drywall bead
3. Door: 14 gauge cold rolled galvanized steel
4. Frame: 16 gauge cold rolled galvanized steel
5. Pan depth: ½"
6. Hinge; Concealed spring button. Concealed pin at fire rated.
7. Latching: Screwdriver cam latch.
8. Finish: Gray powdered primer
9. Fire Rating: As required for panels in rated walls or ceilings. See Code Plan on Architectural Drawings for required rating.

PART 3: EXECUTION

3.01 INSPECTION

A. Verify that openings are correctly dimensioned to receive doors.

3.02 INSTALLATION

A. Install in accordance with manufacturer's current printed recommendations, in locations indicated on architectural reflected ceiling plans and architectural floor plans.

B. Coordinate exact locations to access mechanical/electrical equipment.

C. Attach double layer of gypsum board to recessed ceiling panels in gypsum board ceilings and a single layer of gypsum board and a layer of acoustical tile in areas with acoustical tile glued to gypsum board.

3.03 ADJUST AND CLEAN

A. Adjust latching mechanism to operate smoothly.

B. Leave work area clean and free of debris.

END OF SECTION 08 31 00

SECTION 08 36 00

SECTIONAL METAL OVERHEAD DOORS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes: Furnishing and installing insulated sectional metal overhead doors.

B. Related work in other sections:

1. Doorframes - Section 05 50 00.
2. Electrical rough-in - Division 26.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Shop Drawings: Submit fabrication and erection drawings. Show field verified dimensions, components, details and connections to other construction.
2. Wiring Diagrams: Submit wiring diagrams for operators and controls, for coordination with Division 26.
3. Field verify existing or coordinate with proposed electrical feeder voltage/phase and adjust submittal so motors are compatible.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner that will avoid damage or deformation.

1.05 WARRANTY

A. The overhead door manufacturer shall warrant the overhead doors and operators to be free of defective materials and workmanship for a minimum period of one year from the date of Substantial Completion.

B. In addition, the installed doors shall be warranted against rust penetration of the undamaged paint finish for a minimum period of two years from the date of Substantial Completion.

C. Submit per Section 01 78 23.

PART 2: PRODUCTS

2.01 MANUFACTURER

A. Overhead Doors: Provide products by one of the following: Wayne-Dalton, Crawford, Raynor, or Overhead Door are acceptable.

B. All components for each door to be the product of one manufacturer or items purchased by and approved by the manufacturer, except as noted.

2.02 FABRICATION

A. Construction, Insulated Overhead Doors

1. Door sections: Nominal 2" thick constructed of not less than 27 gauge embossed steel faces permanently laminated to both sides of a high density polyurethane foam core. Section edges: Formed to provide a non-conductive thermal break between the inside and outside steel faces and provide an interlocking profile to insure a weathertight seal with the adjacent panel.

   a. Minimum R-value: 17.5.

2. Galvanized steel end caps: Sufficiently wide to accommodate double-end roller flanges. Seal panel ends with a waterproof mastic before applying. Provide steel reinforcing plates for all intermediate hinge and hardware attachment.

3. Design and installed door and hardware to withstand a minimum wind loading of 20 psf. Provide U-channel or truss-type struts as necessary to eliminate bowing or sagging.

C. Hardware

1. Overhead doors to have 25,000 cycle, oil tempered, helical wound torsion type springs on a solid steel shaft complete with bearing assemblies. Provide blocking inside spring to keep from sagging if necessary.

2. Furnish inclined wedge type track assembly for standard lift operation. Power operated doors shall have 3" track with heavy-duty double-end roller hinges. 3" rollers shall have continuous steel rims with hardened ball bearings in case hardened inner and outer races with long stems.

3. Overhead doors shall have a chain hoist for auxiliary manual operation.

D. Weatherstripping: Furnish weatherstripping to meet or exceed code required air infiltration requirements. Weatherstripping shall, at a minimum, consist of a heavy-duty flap type jamb seal and head seal and U-shaped bottom astragal. Joints between door sections shall have a compressible bulb type gasket. Weatherstripping materials shall be PVC, EPDM or coated Neoprene designed for heavy duty, low temperature, high abrasion applications.

E. Power Operators

1. Operators for overhead doors: Manufacturer's standard industrial duty drawbar type operator with belt or gear reducers and safety clutch. Motor to be ½ HP, 120 volt, single phase of a recognized manufacturer. furnish with starter, limit switch and magnetic braking mechanism to prevent door from coasting.

2. Provide remove disconnects for emergency operation, extended to within 6 feet of floor using 5/32" diameter cable through a minimum of 2 eyelets with a 6" loop at the bottom end.

3. Furnish one replacement set of belts for each operator.

F. Controls: Overhead doors: Controlled by a surface mounted 3-button push control station with momentary contact open, stop and constant contact close.

G. Safety Sensors:

1. Provide reverse edge and photo beam at all overhead doors.

H. Exhaust Port: Provide a carbon monoxide exhaust port in each of the doors.

I. Wiring of controller to motor by this section.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install doors in accordance with reviewed shop drawings and in accordance with manufacturer's current printed instructions.

B. Touch-up mars and abraded spots after installation with factory furnished primer.

C. Adjust doors for proper operation after installation and prior to acceptance of building.

3.02 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain sectional overhead doors. Refer to Section 01 79 00 Demonstration and Training.

END OF SECTION 08 36 00

SECTION 08 40 00

ALUMINUM ENTRANCES, STOREFRONTS AND CURTAINWALLS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section Includes:

1. Aluminum glazed swinging doors.

2. Exterior storefront noted "SF-#" on drawings.

3. Glass

4. Joint sealants in contact with aluminum components.

5. Sealing of the cavity wall at openings in exterior wall.

6. Prior to installation of finished materials, all flexible flashings shall be observed by the Architect. The Architect shall be given a minimum of 72 hours notice prior to the desired observation time. Any finish materials (i.e., brick, insulation, metal, etc.) installed without observation by the Architect shall be removed and replaced at the Contractor's expense.

B. Products installed but not furnished under this Section:

1. Finish hardware - Section 08 71 00.

C. Related Sections:

1. Insulation - Section 07 21 00.
2. Flashings - Section 07 65 00/13.
3. Finish hardware - Section 08 71 00.
4. Joint Sealants - Section 07 92 00.
5. Aluminum Windows - Section 08 51 13.
6. Glazing Section - 08 80 00.

1.03 REFERENCES

A. NAAMM - Metal Finishes Manual, 3rd ed., Jan. 1976.

B. AAMA 501 - Methods of Test for Metal Curtain Walls.

C. AAMA 2605 – Methods of Testing Windows.

D. AAMA 2605 - Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

E. NFRC 500 - Voluntary Test Method for Condensation Resistance of Windows, Doors and Glazed Wall Sections.

F. NFRC 500 - Voluntary Test Method for Thermal Transmittance of Windows, Doors and Glazed Wall Sections.

G. AAMA 606.1 - Voluntary Guide Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.

H. AAMA 607.1 - Voluntary Guide Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.

I. AAMA 608.1 - Voluntary Guide Specifications and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

J. ASTM E 283 - Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors; 1984.

K. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference; 1984.

L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference; 1986.

M. ASTM C 509 - Specification for Cellular Elastomeric Preformed Gasket and Sealing Material.

N. ASTM D 3656 - Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Fiber Yarn.

O. ASTM E 783 - Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

P. ASTM E 1105 - Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform Cyclic Static Pressure Difference.

1.04 PERFORMANCE REQUIREMENTS

A. Exterior Assemblies: Design and fabricate to comply with the performance characteristics listed below.

B. Thermal Movement: Allow for expansion and contraction resulting from ambient temperature range of 120 degrees F (49 degrees C).

C. Condensation Resistance: Where framing systems are "thermal-break" construction, provide units tested for thermal performance in accordance with AAMA 1503-09 showing condensation resistance (CRF) of not less than: 77 for 5500 Series Curtain Wall framing based on an overall depth of 6”.

D. Thermal Transmittance: Provide framing systems which have an overall U-valve (Btu/hr. x sq.ft. x deg. F) at 15 mph exterior wind velocity of not more than values shown in the table below when tested in accordance with NFRC 100 with specified glazing.

	Climate Zone			
	4	**5**	**6**	**7**
Curtainwall/Storefront	0.38	0.38	0.36	0.29
Entrance Door	0.77	0.77	0.77	0.77

E. Air Infiltration Rate

1. Fixed windows/storefront/entrance curtain wall not be more than 0.06 cfm per sq. ft. of window area for an inward test pressure of 6.24 lbf per sq. ft., when tested in accordance with ASTM E 283.

F. Water Penetration: There will be not water penetration, as defined in ASTM E 331, when tested in accordance with ASTM E 331 at an inward test pressure of 15.00 lb per sq. ft.

1.05 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Manufacturer Produced Shop Drawings: Submitted for approval by Architect, prior to fabrication. Indicate installation details, materials used, quantity and size required. Shop drawings to include sizing, type, and locations of all anchors as determined by manufacturer's structural review to assure installation meets specified wind load.
   NOTE: Shop Drawings produced by installer will not be accepted.

2. Samples: (Only required if manufacturer is accepted through prior approval process)

   a. Color: One (1) 12-inch extrusions with specified finish, properly labeled.

   b. Glass: One (1) 12 inch square samples of each glass type indicated, properly labeled.

3. Letter from manufacturer approving contractor to install curtainwall/storefront.

4. Test reports showing compliance with performance requirements.

B. Warranty: Submit per Section 01 78 23.

1.06 PROJECT CONDITIONS

A. Check actual unit opening by accurate field measurement before fabrication. Coordinate fabrication schedule with construction progress to avoid delay of work.

1.07 QUALITY ASSURANCE

A. Manufacturer to be fully responsible for shop drawings, engineering, fabrication and overseeing installation to insure a weather tight installation.

B. Installer Qualifications: Authorized representative of the manufacturer, with not less than five (5) years experience in the fabrication and installation of products similar to those specified under this Section.

C. Warranty:

1. Fabricated products: Manufacturer to provide written warranty agreeing to repair or replace product that fail in materials or factory workmanship within ten (10) years from the date of Substantial Completion.

2. Glass: Provide written warranty of thermal and physical integrity of insulating glass units for ten (10) years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. The following manufacturers/products are approved as noted below with the understanding they will meet the actual products specified: EFCO, Oldcastle BuildingEnvelope, Manko Window Systems, Wausau, Special-Lite.

2.02 MATERIALS - GENERAL

A. Aluminum Members: Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish; ASTM B 221 for extrusions, ASTM B 209 for sheet/plate.

B. Fasteners: Aluminum, nonmagnetic stainless steel, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum components.

1. Do not use exposed fasteners except where unavoidable for application of hardware.
2. Exposed fasteners: Match finish of members and hardware being fastened.

C. Concealed Flashing: Dead-soft stainless steel, 26 gage minimum; or extruded aluminum, 0.062 inch minimum; or an alloy and type selected by manufacturer for compatibility with other components.

D. Exposed Flashing, Sills: .125 inch minimum shop formed aluminum sheet, finish to match window framing.

E. Column covers and panels: .090 inch minimum shop formed aluminum sheet, backed with wall insulation (see Section Insulation 07 21 00 for conformance requirements) laminated with waterproof adhesive, finish to match window framing and be applied after shapes are formed.

F. Brackets and Reinforcements: High-strength aluminum where feasible; otherwise, nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A 123.

G. Concrete/Masonry Inserts: Cast iron, malleable iron, or hot-dip galvanized steel complying with ASTM A 123.

H. Dissimilar Metal Coating: Cold-applied asphalt mastic, zinc chromate paint, or other nonconductive, nonabsorbent material.

I. Glazing Gaskets: Comply with ASTM C 864; style as recommended by manufacturer.

J. Glass and Glazing Accessories: Provide products specified Section 08 80 00.

K. Flexible flashing: Conform to requirements of Section 07 65 00/13.

L. Joint sealants: conform to requirements of Section 07 92 00.
Color: See Material Finish/Color Schedule, on Architectural Drawings.

M. Door Weatherstrip: Silicon treated plastic pile.

2.03 FINISH

A. As selected by Architect from manufacturer's full line of standard colors/finishes.

2.04 ENTRANCE DOORS AND FRAMING

A. Door Model: EFCO Series D518 Durastile – Wide Stile Entrance Door; Oldcastle BuildingEnvelope, Rugged Door; Special-Lite Monumental Door.

1. Stile: Width to accept panic hardware without overhanging stile. (Typically 5" minimum, without including glass stops)
2. Door Material Thickness: 3/16"/.188"
3. Door Thickness: 2"
4. Door (hinge stile): Continuous full height 1¼ x ¼" galv. steel bar stock.
5. Bottom Door Rail: 12"
6. Factory fabricated doors and factory glazed.

B. Isobar Storefront Frame Model (Noted as SF #___ on drawings)

1. Exterior: EFCO 403I thermal storefront; Manko 5450i.

   a. Minimum wall thickness: 0.080” minimum.
   b. Frame profile: 4 ½ minimum depth x 2 1/4” minimum face with 12” sidelite base as detailed.
   c. Frame reinforcing (hinge and latch): Continuous full height 1” x 1 ¼” x 3/16” galvanized steel angle.
   d. Thermal Barrier: Glass reinforced polyamide nylon struts.
   e. Provide adjustable sidelite base as detailed. Horizontals with brake material will not be permitted.

2.05 GLASS

A. Provide products and conform to requirements specified in Section 08 80 00.

2.06 ALUMINUM PANELS

A. Materials

1. Exterior Panels: Flush, minimum 0.125-inch thick laminated to rigid wall insulation (conform to Section 07 21 00, Insulation). Fabricate so panel is glazed into glazing stop and face is flush with outside face of mullion cap.

2. Interior panel, flush, minimum 0.125-inch thick aluminum install with concealed clips so panel is flush with face of adjacent mullion.

2.07 FABRICATION

A. Any dimensions which may vary are indicated on drawings, with maximum and minimum dimensions required to achieve design requirements and coordination with other work. Field verify all opening dimensions.

B. Fabrication: To greatest extent possible, complete fabrication assembly, and finishing at manufacturers plant before shipment to project site. Disassemble components only as necessary for shipment and installation.

1. Maintain accurate relation of planes and angles, with hairline fit of contacting members.

2. Select members for fabrication so that adjacent anodized extruded aluminum members do not have color or texture variation greater than half the range indicated in the submitted samples.

3. Factory-install all hardware except surface-mounted items.

4. Perform fabrication operations, including cutting, fitting, forming, drilling, and grinding of metal work, in manner which prevents damage to exposed finish surfaces.

   a. For hardware, perform these operations prior to application of finishes.

D. Welding: Comply with AWS recommendations to avoid discoloration; grind exposed welds smooth and restore mechanical finish.

E. Reinforcing: Install reinforcing as required for hardware and as necessary for performance requirements, sag resistance, and rigidity; separate dissimilar metals as specified under "Installation."

PART 3: EXECUTION

3.01 PREPARATION

A. Verify and coordinate installation tolerances.

B. Verify that openings are properly prepared, with blocking installed and cavities sealed.

3.02 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation of components. Storefront/curtainwall manufacturer's or designated representative shall be present at both installation of first unit to insure proper installation technique.

B. Install window flexible flashing under all sills and sill flashing. Turn up at ends to form end dams. Lap flashing 4" minimum and seal.

C. Set units plumb, level, and true to line, without warp or rack. Provide proper support and anchor securely in place.

1. Anchorage to allow for normal thermal movement specified building movement and specified wind loads.

D. Separate aluminum exposed to weather from dissimilar metals; coat dissimilar metals that are in drainage cavities using one of the materials specified. Aluminum, stainless steel, zinc, cadmium, and small areas of white bronze are not considered dissimilar from each other.

E. Coat all metals that come into contact with masonry, concrete, and treated wood, using one of the materials specified.

F. Install surface-mounted hardware items, complying with hardware manufacturer's instructions and template requirements.

G. Install joint sealers between framing and adjacent surfaces as indicated, to provide weathertight construction. Comply with requirements of Section 07 92 00 for installation of joint sealers.

H. Install glass as specified in Section 08 80 00 and according to the framing manufacturer's printed instructions.

I. Install aluminum panels and flashing as shown on Drawings.

3.03 ADJUST AND CLEAN

A. Adjust operating hardware to function properly without binding, and to close doors tightly. Ensure that weatherstrip makes contact with door surfaces.

B. Clean completed systems inside and out, promptly after erection and after installation of glass and sealants, taking care to avoid damage to finishes. Remove excess sealants, dirt, and other substances from aluminum surfaces.

C. Clean glass surfaces as specified elsewhere.

END OF SECTION 08 40 00

SECTION 08 71 00

FINISH HARDWARE

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. This Section includes the furnishing and installing of all finish hardware material specified herein, listed in the hardware schedule, or required by the Drawings.

B. Items of hardware include:

1. Finish hardware
2. Aluminum door hardware, except weatherstripping.
3. Thresholds and weatherstrip
4. Cylinders for access panels.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 08 10 00 - Hollow Metal Doors and Frames.

B. Section 08 14 00 - Wood Doors.

C. Section 08 51 00 - Aluminum Entrances.

1.04 REFERENCES

A. Builders' Hardware Manufacturers Assoc., Inc. (BHMA), 60 E. 42nd St., New York, NY 10017.

1. Recommended locations for builders' hardware.

B. American National Standards Institute, Inc. (ANSI), 1430 Broadway, New York, NY 10018.

1. A115.2 - Specifications for standard steel door and frame preparations for bored cylindrical locks for 1-3/8" and 1-3/4" doors.

C. National Fire Protection Association, Inc. (NFPA), Battery March Park, Quincy, MA 02269.

1. NFPA 80 - Standard for fire doors and windows.
2. NFPA 101 - Code for safety to life from fire in buildings and structures.

D. Underwriters Laboratories, Inc. (UL), 333 Pfingsten Road, Northbrook, IL 60062.

1. Building Materials Directory.

E. Builders' Hardware Manufacturers Assoc., Inc. (BHMA), 60 E. 42nd Street, New York, NY 10017.

1. Recommended locations for builders' hardware.

F. Building Codes: International Building Code, Adopted Edition.

1. Include State amendments modifying model codes in jurisdiction where project is constructed.

1.05 QUALITY ASSURANCE

A. Except where specified in the hardware schedule, furnish products of only one manufacturer for each type of hardware.

B. Supplier: Company specializing in the builders' hardware industry.

C. Provide hardware for fire-rated openings conforming to UBC Standard 7-2.

D. Provide hardware for fire-rated openings conforming in compliance with NFPA 80 1995 Edition.

1.06 REGULATORY REQUIREMENTS

A. Furnish hardware listed by UL testing agency for all rated openings in conformance with requirements for the class of opening scheduled.

B. Rating requirements have precedence over this specification where conflict exists.

C. Furnish and install hardware that is in compliance with American with Disabilities Act of 1990 (ADA) technical standards, and current State Building Code.

1.07 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Schedules

a. Immediately after award of the hardware contract, submit a detailed, vertical type hardware schedule and cut sheets for each type of hardware for approval. On existing buildings field verify existing swings and functions prior to submitting schedule.

b. Itemize hardware in the sequence and format established by this specification.

1. List and describe each opening separately; include door number, room designations, degree of swing, and hand.

2. List related details; include dimensions, door and frame material, and other conditions affecting hardware.

3. List all hardware items; include manufacturer's name, quantity, product name, catalog number, size, finish, attachments, and related details where applicable.

c. Submit manufactures cut sheets on each type of hardware proposed.

d. Resubmit the corrected schedule when required.

e. Determine keying requirements by meeting with the Owner coordinated through the Architect, and submit a detailed keying schedule for review; resubmit the corrected schedule when required.

3. Samples: Submit samples of hardware items as may be required by the Architect; identify each sample and indicate the location of subsequent installation in the project.

4. Templates: Furnish a copy of the approved hardware schedule and all pertinent templates or template information to each fabricator of material factory-prepared for the installation of hardware.

5. Include documentation for UL 10C or other approved testing agency stating hardware has passed UBC Standard 7-2.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver hardware to the job site in the manufacturer's original containers that have been marked to correspond with the approved hardware schedule for installation location.

B. Store hardware in dry surroundings and protect against loss and damage.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS/MATERIALS

A. Hinges

1. Butt hinge manufacturers and respective catalog numbers:

	IVES	Hager	Stanley	McKinney	Bommer
a.	5PB1	1279	F179	T2714	5000
b.	5BB1	BB1279	FBB179	TB2714	BB5000
c.	5BB1 630	BB1191	FBB191	TB2314	BB5002
d.	5BB1HW	BB1168	FBB168	T4B3786	BB5004
e.	5BB1HW630	BB1199	FBB199	T4B3386	BB5006

2. Continuous hinges manufacturers and respective catalog numbers:

Markar	Stanley	Ives	McKinney
300 Series	600 Series	700 Series	MCK-300 Series

a. Continuous hinges shall be full height pin and barrel type hinge providing full height door support up to 600 pounds. Edge mount (unless noted otherwise).

b. Hinges shall be constructed of heavy-duty 14-gauge material. The stainless internal pin shall have a diameter of .25 and the exterior barrel diameter of .438.

c. Hinge shall be non-handed with symmetrical templated hole pattern and factory drilled. Hinge must accept a minimum of 21 fasteners on the door and 21 fasteners on the frame.

d. Each knuckle to be 2”, including split nylon bearing at each separation for quiet, smooth, self-lubricating operation.

e. Hinge to be able to carry Warnock Hersey Int. or UL for fire rated doors and frames up to three hours. Note: Fire label for doors and frames should be placed on the header and top rail of rated doors and frames.

f. Provide adjusting screws equal to Markar’s “AdjustaScrew” for continuous hinges specified as HG-305. Adjustment to be able to correct frame fit problems up to 3/8”.

3. When hinges are specified on the hardware schedule, furnish:

   a. Interior openings through 36 inches wide and 60 inches high without a door closer: Two (2) standard-weight, plain bearing hinges #1279 per leaf.

   b. Interior openings through 36 inches wide and 90 inches high without a door closer: Three (3) standard-weight, plain bearing hinges #1279 per leaf.

   c. Interior openings through 36 inches wide and 60 inches high with a door closer: Two (2) standard-weight, ball bearing hinges #BB1279 per leaf.

   d. Interior openings through 36 inches wide and 90 inches high with a door closer: Three (3) standard-weight, ball bearing hinges #BB1279 per leaf.

   e. Interior openings over 36 inches in width and/or 90 inches in height: One (1) continuous hinge per leaf.

   f. Exterior hollow metal or stainless steel openings: One (1) continuous hinge per leaf.

   g. Exterior aluminum openings through 36 inch wide and 90 inches high: Four (4) heavyweight ball bearing hinges #BB1199xNRP per leaf.

   h. Exterior aluminum openings over 36 inches wide in width and/or 90 inches in height: One (1) continuous hinge per leaf.

B. Flush Bolts and Dustproof Strikes

1. Manufacturers and respective catalog numbers:

	Ives	Door Controls	Hager	Rockwood
a.	DP2	80	280X	570
b.	FB31P	842	292D	1842
c.	FB41P	942	291D	1942
d.	FB458	780	282D	550

2. Non-labeled openings: Furnish two flush bolts FB458 for the inactive leaf of pairs of locked or latched doors. Locate centerline of the top bolt not more than 78" from the finished floor. Furnish dustproof strike DP2 for the bottom bolt.

3. Labeled openings: Furnish automatic flush bolt set FB31P or FB41P, as applicable, for the inactive leaf of pairs of doors; furnish dustproof strike DP2 for the bottom bolt.

C. Exit Devices

1. Manufacturers and respective catalog numbers:

Von Duprin	Precision Hardware	Falcon	Sargent	Corbin	Yale
99	APEX 2000 Series	25 Series	80 Series	ED5000 Series	7000 Series

2. Furnish exit device series and functions specified in the hardware schedule.

3. Furnish sex bolt attachments for devices specified for mineral core door application.

4. Furnish reinforced cross bars for door over 40" wide.

5. Furnish rod and latch guards on all surface mounted vertical rod exit device, on bottom rods.

6. Vandal Resistant Lever Design: Von Duprin 996L; Precision Hardware V4900. All exit devices shall be provided with optional trim designs to match other lever and pull designs used on the project.

7. Provide cylinder dogging on all non-rated devices. Provide cylinder to match building system.

8. Provide and install wiring from electric exit device to power supply.

9. Provide all aluminum door leafs with Mullion Stabilizers: Von Duprin #154 or equal by other specified manufacturer.

D. Locks

1. Manufacturers and respective catalog numbers:

Schlage	Sargent	Best	Falcon	Corbin-Russwin	Yale
L9000 03A	8200 LNJ	45H 3H	M Series SG	ML2000 LWA	8700L CRR

2. Furnish lock types and functions specified in the hardware schedule, with the following provisions:

   a. Strikes:

      1) Wrought box type for the inactive leaf of pairs of wood doors, or wood frames.
      2) Lip length sufficient to protect trim, frame or inactive leaf.

3. Furnish knurled lock knobs or lever handles on doors to stairs other than exit stairs, loading platforms, stages, boiler rooms, and other hazardous locations.

4. Lever handles must be cast brass, bronze or stainless steel construction and conform to ASNI A117.1.

5. Provide and install wiring from electric lockset to power supply.

E. Cylinders: Provide cylinders and cores to match Owner's existing keying system.

F. Pulls, Push Plates/Bars, Flush cup pulls

1. Manufacturers and respective catalog numbers:

	Item	Hager	Hiawatha	Burns	Rockwood
a.	Pull	10Q 18"	518B-18"	26C-18"	118
b.	Push Plate (flush doors	30s 8x16	200K	57	70F
c.	Push Plate (6" stile doors)	30s 4x16	200F	54	70C
d.	Pushbar	130s	1081LBP	422	47
e.	Flush Cup Pulls	27p	-	-	BF97

G. Closers

1. Manufacturers and respective catalog numbers:

LCN	Sargent	Norton	Yale	Stanley
4011/4111 EDA	281/281P10	7500 Series	4400 Series	D-4550 Series

2. Where closers are listed in the hardware schedule, furnish series listed above unless other functions/series are specified in the hardware groups.

3. Furnish complete with all mounting brackets, drop plates and special shoes as may be required by the door and frame conditions.

4. Furnish through bolt attachments for closers specified for wood doors.

5. Determine closer size in accordance with manufacturer's recommendations for application on the room side of corridor doors, stair side of stair doors, and interior side of exterior doors.

6. Provide SRI rust inhibitor primer for all closers in pools and corrosive areas.

H. Kick Plates: Where kick plates are specified in the hardware schedule, furnish 16 gauge, .050" plates, with the following dimensions:

1. Width: 2" less than door width.

2. Height: 8" (unless noted different on door schedule.)

3. All kick plates shall be beveled 4 sides and counter sunk.

I. Overhead Stops

1. Manufacturers and respective catalog numbers:

	Glynn-Johnson	Rixson-Firemark
a.	GJ450	10
b.	GJ90	9
c.	GJ100	1

2. Furnish a GJ90 series overhead stop for all doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall and for all doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate.

3. Furnish a GJ90 or GJ100 series overhead holder where listed in the Hardware Schedule.

4. Furnish sex bolt attachments for mineral core door applications, unless solid wood blocking is provided in the door for attachment.

J. Floor and Wall Stops and Holders

1. Manufacturers and respective catalog numbers:

		Ives	Hager	Burns	Rockwood
a.	Wall bumper	WS407CVX	232W	570	407
b.	Wall stop	WS11X	255W	530	475
c.	Floor stop	FS435/FS436	241F/246B	510/525	441U
d.	Wall holder	WS40	326W	533	490
e.	Exterior Floor Stop	FS9			

2. Furnish a WS407CVX series wall stop, as applicable, for each door leaf except where wall bumber WS11X, floor stops FS435/FS436, holders WS20X, wall holder WS40 or overhead stops/holders are specified in the hardware schedule.

3. Where wall stops are not applicable, furnish overhead stops as previously specified within this section of the specification.

K. Thresholds, Weatherstrips and Jamb Gaskets

1. Manufacturers and respective catalog numbers:

		Reese	Pemko	National Guard	Zero
a.	Saddle threshold	S205A	171A	425E	8655
b.	Half saddle threshold	S245A	229A	325 Alum	1675
c.	Bumper seal threshold	S483AV	2005AV	896 Alum (Vinyl)	65A
d.	Weatherstrip	755A	2891APK	700NA	429
e.	Astragral weatherstrip	804	Pair 309	185	8193
f.	Sweep	964C	18061CP	B606A	8192
g.	Head and Jamb Gasket	797	S88	5050	188
h.	Drip	R201	346	16	142
i.	Jamb sound seal	F499	350CSR	1038	770
j.	Auto door bottom	F521	430CPKL	420	361

2. Where specified in the hardware groups, furnish the above products unless otherwise details in groups.

3. Furnish 5050 head/jamb gaskets and NGP 9605 edge stile astragals for pairs, at all fire labeled doors whether listed in group or not. *Reese and Pemko equivalents approved based on passing UL 10C, UBC test Standard 7-2.

4. Coordinate with door manufacturer the intumescent fire and smoke material for fire rated openings as required by door and frame manufacturer to comply with UL 10C, UBC test 7-2.

5. When "threshold" appears within a hardware group provide the following:

   a. At aluminum entrances on new buildings provide a half saddle threshold.
   b. At aluminum entrances on existing buildings provide a saddle threshold.
   c. At interior door ways provide a saddle threshold.
   d. At exterior doorways from occupied rooms and HM or FRP exit only doors provide a bumper seal threshold.
   e. At exterior HM or FRP doors to receiving areas, loading docks and boiler rooms provide a saddle threshold.

2.02 ACCESSORIES AND ATTACHMENTS

A. Furnish all necessary hardware accessories such as wood or machine screws, bolts, nuts, anchors, toggle bolts, and other fasteners, each of the type, size, material and finish for its intended purpose and each according to the material to which the hardware is being applied.

2.03 FINISH AND BASE METALS

A. Finish and Base Metal:

Butt Hinges- Exterior	US32D on stainless steel
Butt Hinges-Interior	US26D on steel
Flush Bolts	US26D on brass or bronze
Exit Devices	US26D on brass or bronze
Locks	US26D on brass or bronze
Pulls And Push Plates/Bars	US32S on stainless steel
Coordinators	USP on steel
Closers	Sprayed AL on cast iron or aluminum
Protective Plates	US32D on stainless Steel
Overhead Stops	US32D on stainless steel
Wall Stops	US26D on brass, bronze, or steel
Thresholds	Mill aluminum
Weatherships and Sweep Strips	Clear anodized aluminum
Miscellaneous	US26D on brass or bronze

2.05 KEYING

A. Change key and masterkey all lock cylinders as directed by the Architect.

B. Furnish two change keys for each lock, six masterkeys for each masterkey set, and two removable core control keys.

C. Stamp keys with file key number and "Do Not Copy."

D. Ship masterkeys and control keys to the Owner via registered mail.

E. Permanent cylinder cores shall be installed by the contractor under the supervision of an owner's representative.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install hardware in accordance with manufacturer's recommendations / instructions, and the adopted Building Code.

B. Install hardware on UL labeled openings in accordance with manufacturer's requirements, so as to maintain the label.

C. Install hardware mountable weatherstipping continuous throughout opening prior to installation of other hardware.

D. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work.

E. Remove, cover or protect hardware after fitting until paint or other finish is applied; permanently install hardware after finishing operations are complete.

F. Install closers on the room side of corridor doors, stair side of stairways, and interior side of exterior doors.

G. Mounting heights:

1. Install hardware at mounting heights conforming to the recommended mounting locations of the Builders' Hardware Manufacturing Association, and the adopted Building Code.

2. Install wall stops WS11X, wall holders WS20X, and magnetic holders to strike near top of doors, but not more than 78" from the finished floor line; install wall stops WS407CVX to engage knobs, levers or pulls.

H. Install pulls at 40" to top of pull and push bars at 36" above finished floor. Off set pull on exterior door rails to allow access to cylinders.

I. Deliver to the Owner one complete set of installation and adjustment instructions, and tools as furnished with the hardware.

J. Before hardware installation, general contractor/construction manager shall coordinate a hardware installation seminar to be conducted on the rough-in of electrical boxes for hardware and the installation of hardware, specifically of locksets, closers/accessibility closers, exit devices, hardware, mountable weatherstrip and overhead stops. Manufacturer's representative of the above products to present seminar. Seminar to be held at the job site and attended by installers of hardware (including low voltage hardware) for aluminum, hollow metal and wood doors. Training to include use of installation manuals, hardware schedule, templates and physical product samples. The architect needs to be informed of the meeting and contractor is to distribute meeting minutes on issues raised at seminar.

K. Install per door and/or frame manufacturer's supplemental "S" label instructions on fire rated openings.

3.02 ADJUSTING AND CLEANING

A. At final completion, adjust and test all hardware for function, performance, building code compliance and leave in good operating condition. Panic Hardware device manufacturer's representative to inspect panic hardware installation and provide a report to contractor and architect on items that need correction.

B. Clean all hardware to restore the original finish.

3.03 PROTECTION

A. Protect the finished installation until acceptance of the project.

B. Provide final adjustment or cleaning where necessary.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative(s) to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. At a minimum, provide the following training:

1.	Miscellaneous hardware	1 hour
2.	Exit devices	2 hours
3.	Locks	1 hour
4.	Closers	1 hour
5.	Electromagnetic locks	2 hours
6.	Accessibility closers	2 hours

Refer to Section 01 79 00 Demonstration and Training.

END OF SECTION 08 71 00

SECTION 08 80 00

GLAZING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Interior Glazing
   a. Safety glass in locations indentified in Part 3.
   b. Clear glass in HM doors and frames.
2. Exterior Insulated Glazing
   a. Safety glass in locations identified in Part 3.
   b. Clear glass in aluminum doors.
   c. Clear glass in storefront.

B. Related work specified in other sections:

1. Steel doors and frames - Section 08 10 00.
2. Wood doors - Section 08 14 00.
3. Aluminum Entrances, Storefronts and Curtainwalls - Section 08 40 00.

1.03 QUALITY ASSURANCE

A. Reference Specification: Glazing Manual by Flat Glass Marketing Association.

B. Materials: Conform in all respects to the "Safety Standard for Architectural Glazing Materials" (16CFR 1201) issued by the Consumer Product Safety Commission and Chapter 24 of the International Building Code.

C. Insulating glass units to be CBA rated with the Insulating Glass Certification Council (IGCC) in accordance with ASTM Specifications E-773 and E-774.

1.04 SUBMITTALS

A. Submit per Section 01 33 00.

1. Manufacturer's recommended installation instructions.

2. Samples for each type glass specified.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner that will avoid damage. Reject scratched glass.

1.06 WARRANTY

A. Manufacturer’s Special Warranty for Coated-Glass Products: Manufacturer’s standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of

coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Submit per Section 01 78 23.

PART 2: PRODUCTS

2.01 MANUFACTURERS/FABRICATORS

A. Glass Manufacturers and/or Coating Manufacturers: Vitro Architectural Glass, www.vitroglazings.com; Guardian Industries, www.sunguardglass.com; Old Castle Building Products, www.oldcastlebe.com; Pilkington North America, Inc., www.pilkington.com; Viracon, www.viracon.com;

B. Safety Glass Manufacturers: SAFTI First, www.safti.com. Comparable products as manufactured by Technical Glass Products, www.fireglass.com; Vetrotech Saint-Gobain, www.vetrotechusa.com are acceptable. School Guard Glass (SGG), www.schoolguardglass.com; Global Security Glazing Secur-tem 3, www.security-glazing.com.

C. Interlayer Manufacturers: Solutia/Saflex, www.saflex.com or equal.

D. Glass Product Fabricators: As certified by glass manufacturers and/or coating manufacturers.

2.02 INTERIOR GLAZING

A. Clear:

1. Clear Float Glass, ¼" thick.

B. Safety:

1. Clear heat-tempered float glass, ¼" thick.

2.03 EXTERIOR GLAZING

A. Low-E glass to be solar control (MSVD coating process).

B. For locations requiring safety glazing, provide heat-tempered glass for inboard and outboard lites, unless laminated glazing is called out on drawings or specified.

C. Clear Insulated Glass: (Type EC1)

1. 1" overall thickness insulated glass.

a. Exterior glass ply/coating: ¼" clear, Vitro Solarban 60 or Guardian SN68; Low-E on Surface #2.
b. Spacer: Warm edge.

c. Airspace: ½” argon filled.
d. Silicone: Black
e. Interior glass ply: ¼” clear.

2. Performance Requirements:

a. Transmittance
   1) Visible Light 70%
   2) Solar Energy 34%
   3) Ultra-Violet 18%

b. Reflectance
   1) Visible Light Exterior 11%
   2) Visible Light Interior 12%
   3) Solar Energy 28%

c. ASHRAE U-Value
   1) Summer Daytime 0.22 Btu
   2) Winter Nighttime 0.24 Btu

d. Shading Coefficient 0.44

e. Relative Heat Gain 91.7 Btu/hr x Sq.Ft.

f. Solar Factor (SHGC) 0.39

g. LSG 1.79

3. For units requiring “Safety Glazing” per Part 3 of Specification, provide “safety” glass plys. Specified under interior glazing.

2.04 ACCESSORIES

A. Glazing Sealant: Two-part silicone similar to Dow Corning 982 Insulating Glass Sealant. Glazer is responsible to verify compatibility to primary seal material.

B. Setting Blocks: 70-90 Shore "A" durometer, sized to accommodate size of glass used, compatible with glazing sealant.

C. Spacers: Warm edge spacer, compatible with sealant used. Maximum “U” value at glass edge: 0.272.

D. Primer - Sealers, Cleaners: As recommended by glass manufacturer.

PART 3: EXECUTION

3.01 INSPECTION

A. Check that glazing channels are free of burrs, irregularities, and debris.

B. Check that glass is free of edge damage or face imperfections.

C. Do not proceed with installation until conditions are satisfactory.

3.02 PREPARATION

A. Field Measurements:

1. Measure size of frame to receive glass.
2. Compute actual glass size, allowing for edge clearances.

B. Preparation of Surfaces:

1. Remove protective coatings from surfaces to be glazed.
2. Clean glass and glazing surfaces, to remove dust, oil and contaminants. Wipe dry.

3.03 SAFETY GLAZING

A. Install safety glazing at the following locations and/or as required by local building codes.

1. Doors and adjacent glazing.
   a. In doors when glass is wider than 2 15/16".
   b. Glass within 24" of vertical door edges and to a point 60" above the floor.

2. Individual fixed or operable panels when any of the following conditions are met:
   a. Individual panes 9 square feet and greater.
   b. Glass within 18" of the floor.
   c. When exposed individual pane is greater than 36" above the floor, except when a horizontal mullion is detailed between 34" and 38" above the floor.
   d. Walking surfaces within 36 inches horizontally of the pane of glazing.

3. Stairs, landings and ramps.

   a. In guards or railings adjacent to stairs, landings and ramps.
   b. Glazing adjacent to stairways, landings and ramps within 36" horizontally of walking surface and less than 60" above pane of adjacent walking surface.
   c. Glazing adjacent to bottom tread of stairways within 60" horizontally and less than 60" above the nose of the tread, unless the glass is protected by a guardrail and the glass is greater than 18" of the guardrail.

3.04 INSTALLATION

A. Install glass in accordance with glass manufacturer's current printed instructions.

3.05 CLEANING

A. Remove excess glazing compound from installed glass.

B. Remove labels from glass surface as soon as installed.

C. Wash and polish both faces of glass.

D. Remove debris from work site.

3.06 PROTECTION OF COMPLETED WORK

A. Attach crossed streamers away from glass face.

B. Do not apply markers to glass surface.

C. Replace damaged glass.

END OF SECTION 08 80 00

SECTION 08 91 00

LOUVERS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Pre-finished aluminum exterior wall louvers.

2. Prior to installation of finished materials, all flexible flashings shall be observed by the Architect. The Architect shall be given a minimum of 72 hours notice prior to the desired observation time. Any finish materials (i.e., brick, insulation, metal, etc.) installed without observation by the Architect shall be removed and replaced at the Contractor's expense.

B. Related work specified in other sections:

1. Metal coping – Section 07 62 00.

2. Flashings – Section 07 65 00/13.

3. Caulking and sealants – Section 07 92 00.

4. Mechanical connections to louvers – Division 23.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Product Data: Submit product data sheet for specified products.

   a. Performance Certificates: Submit performance certification, if not include in product data.

2. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, flexible flashings, accessories, finish colors, patterns and textures.

   a. Include information necessary for fabrication and installation of louvers. Indicate materials, sizes, thickness, fastening and profiles.

3. Quality Assurance Submittals: Submit the following:

   a. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

      1) Submit certified test results from an approved testing laboratory showing that the louvers proposed meet the criteria specified herein.

   b. Certificates: Product certificate signed by manufacturer certifying materials comply with specified performance characteristics and criteria, and physical requirements.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner which will avoid damage or deformation. Damaged louvers including nicks, scratches and blemishes will be rejected.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings.

PART 2: PRODUCTS

2.01 LOUVERS

A. Manufacturer: Products by Industrial Louvers, Inc., www.industriallouvers.com, 763-972-2981 are specified. Other manufacturers noted subject to conformance with specification are acceptable: Airline Products The Airolite Co., Co., All-Lite Architectural Products, American Warming and Ventilating, Arrow United Industries, Cesco Products, Commercial Air Products, Construction Specialties, Inc., Ruskin Manufacturing Co., Safe-air/Dowco.

2.02 WALL LOUVERS

A. Model: 458XP

1. Frame:

    a. Frame Depth: 4 inches.
    b. Material: Extruded aluminum, 6063-T6
    c. Wall Thickness: 0.081 inch, nominal

2. Blades:

    a. Style: Drainable
    b. Material: Extruded aluminum, 6063-T6
    c. Wall Thickness: 0.081 inch, nominal
    d. Angle: 35/45 degrees
    e. Centers: 3.875 inches, nominal

3. Performance Data:

    a. Performance Ratings: Product must be licensed to bear the AMCA Certified Ratings Seal for Water and Air Performance.
        1) Based on testing 48 inches by 48 inches size unit in accordance with AMCA 500-L.
    b. Free Area: 53.4% (8.54 sq.ft)
    c. Water Penetration: Maximum of .01 ounces at an air flow of 1062.8 FPM
    d. Static Pressure Loss: Not more than .15 inch of water gauge at an air flow of 854 FPM free area velocity.

4. Louver Accessories:

    a. Exterior Aluminum Sill: Provide sill flashing of same material and finish as louvers where indicated on the drawings.

    b. Louver Screens: Provide framed removable, re-wire-able screens for exterior louvers.

        1) Bird Screen:

            a) Aluminum, 1/2 inch by 0.063 inch expanded, flattened.

2.03 MATERIALS

A. Aluminum Sheet: ASTM B209 Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer to provide required finish.

B. Aluminum Extrusions: ASTM B221, Alloy 6063.

C. Fastenings: Provide stainless steel screws and fasteners for aluminum louvers and zinc-coated or stainless steel screws and fasteners for steel louvers. Provide other accessories as required for complete and proper installation.

2.04 FABRICATION

A. Fabrication Requirements:

1. Performance: Fabricate as required for optimum performance with respect to water penetration, strength, durability and uniform appearance.

2. Size:
   a. Fabricate louvers in masonry walls to outside dimensions indicated, with allowance of 3/8" on each side for sealant joints.
   b. Verify sizes with final HVAC shop drawings, including detail dimensions of ductwork, dampers or other fittings abutting louvers.

3. Field Measurements: Verify size, location and placement of louver units prior to fabrication.

4. Shop Assembly:
   a. Fabricate to minimize field adjustments, splicing, mechanical joints and field assembly of units.
   b. Preassemble units in shop to greatest possible and disassemble as necessary for shipping and handling.
   c. Clearly mark units for reassembly and coordinated installation.

5. Accessories: Include supports, anchorages and accessories required for complete assembly.

6. Vertical Mullions: Provide vertical mullions of type and spacing indicated but not further apart than recommended by the manufacturer.

7. Horizontal Mullions: Provide horizontal mullions at horizontal joints between louver units except where continuous vertical assemblies are indicated.

8. Connections: Join frame and blade members to one another by welding, except where field bolted connections between frame members are made necessary by size of louvers.

9. Spacing: Maintain equal blade spacing to produce uniform appearance.

2.05 FACTORY FINISHES

A. Finish/Colors: As selected by Architect from manufacturer's full line of available colors.

PART 3: EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Louver Installation:

1. Louvers shall be installed in accordance with manufacturers approved shop drawings and as shown. Provide all necessary fastenings and anchors required to complete installation.

2. Form tight joints within work of this Section. Fit exposed connections accurately.

3. Protect metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces, which shall be in contact with concrete, masonry or dissimilar metals.

3.04 PROTECTION AND CLEANING

A. Protect louvers and finish from damage by other trades.

B. Repair damaged louvers or replace.

END OF SECTION 08 91 00

SECTION 09 21 16

GYPSUM BOARD

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Non load bearing interior metal stud framing for drywall.
2. Gypsum wallboard and joint system.
3. Installation of acoustic spray system at top of walls and penetrations (sealing of mech/elec penetrations is specified in Div 21-28) as noted on drawing.
4. Mold and moisture resistant gypsum board at inside face of exterior walls.
5. Sound batt insulation and acoustic sealant at gypsum board.
6. Gypsum tile backer board as a substrate for ceramic wall tile.

B. Related work specified in other sections:

1. Insulation - Section 07 21 00.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. UL listings for gypsum board partitions for proposed products.
2. UL listings for shaft wall assemblies proposed.
3. Samples of mold and moisture resistant gypsum board.
4. Samples of gypsum tile backer board.
5. Samples of abuse-resistant gypsum board.
6. Samples of high impact-resistant gypsum board.
7. Tackwall: Samples of trim reveal and board. Product data on adhesives.

1.04 QUALITY ASSURANCE

A. Referenced Specifications: Current Gypsum Associates publications (www.gypsum.org).

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling

1. Deliver materials to the project site with manufacturer's labels intact and legible.

2. Handle materials with care to prevent damage.

3. Deliver fire-rated materials bearing testing agency label and required fire classification numbers.

4. The plastic packaging used to wrap gypsum panel products for shipment is intended to provide temporary protection from moisture exposure during transit only and is not intended to provide protection during storage after delivery. Such plastic packaging shall be removed immediately upon receipt of the shipment.

   a. Failure to remove protective plastic shipping covers can result in condensation which can lead to damage, including mold.

B. Storage

1. Store materials inside under cover, stack flat, properly supported on a level surface, all in same direction, off of floor. Gypsum panel products to be fully protected from weather, direct sunlight exposure and condensation.

2. Avoid overloading floor system

3. Store adhesives in dry area; provide protection against freezing at all times.

4. Steel framing and related accessories shall be stored and handled in accordance with AISI's "Code of Standard Practice".

1.06 JOB CONDITIONS

A. Environmental Conditions

1. Do not install gypsum board products at temperatures below 40°F for mechanical installation and 50°F for adhesive installation, unless approved by manufacturer.

2. Measure temperature and humidity on a daily basis during taping operations. Re-application of taping compound shall not occur sooner than shown on the table in Gypsum Association Brochure GA-236.

3. Temperature: During cold weather, in areas receiving wallboard installation, maintain temperature range between 55°0 F to 90° F for 48 hours before, and during gypsum board and joint treatment application. Maintain specified temperature range until joint treatment is completely dry.

4. Ventilation

   a. Provide ventilation during and following adhesives and joint treatment applications.

   b. Use temporary air circulators in enclosed areas lacking natural ventilation.

   c. Under slow drying conditions, allow additional drying time between coats of joint treatment.

   d. Protect installed materials from drafts during hot, dry weather.

B. Protect adjacent surfaces against damage and stains.

1.07 JOB COORDINATION

A. Coordinate Work with installation of metal framing and electrical work.

B. Coordinate framing and blocking for wall mounted accessories with Section 06 10 53.

PART 2: PRODUCTS

2.01 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. General: Complying with ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

2.02 GYPSUM BOARD

A. Standard

1. Panel Physical Characteristics.

   a. Core: Regular
   b. Surface Paper: 100% recycled content paper on front, back and long edges.
   c. Long Edges: Tapered; square edge acceptable at areas with Level 1 finish.
   d. Thickness: As noted on drawings.
   e. Panel shall comply with requirements of ASTM C 1396 Standard Specification for Gypsum Board.

B. Fire-Resistance Rated.

1. Type X, Panel Physical Characteristics

   a. Core: Fire-resistant rated gypsum core.
   b. Surface Paper: 100% recycled content paper on front, back and long edges.
   c. Long Edges: Tapered; square edge acceptable at areas with Level 1 finish.
   d. Thickness: 5/8”
   e. Panel shall comply with Type X requirements of ASTM C 1396 Standard Specification for Gypsum Board.

2. Type C, Panel Physical Characteristics

   a. Core: Fire-resistant rated gypsum core.
   b. Surface Paper: 100% recycled content paper on front, back and long edges.
   c. Long Edges: Tapered; square edge acceptable at areas with Level 1 finish.
   d. Thickness: 1/2”
   e. Panel shall comply with Type C requirements of ASTM C 1396 Standard Specification for Gypsum Board.

C. Mold and Moisture Resistant

1. Panel Physical Characteristics

   a. Core: Moisture resistant (moisture and fire-resistant rated at Type X).
   b. Surface Paper: Coated fiberglass mat on face, back and long edges.
   c. Long Edges: Tapered; square edge acceptable at areas with Level 1 finish.

d. Thickness: As noted on drawings. (5/8” at fire-resistant applications)
e. Humidified Deflection: Not more than ¼” when tested in accordance with ASTM C473 and C1658.
f. Water Absorption: Less than 5% of weight when tested in accordance with C1396M and C1658.
g. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273

D. Gypsum Tile Backer Board:

1. Panel Physical Characteristics

a. Core: Moisture resistant (moisture and fire-resistant rated at Type X).
b. Surface Paper: Coated fiberglass mat on face, back and long edges.
c. Long Edges: Tapered; square edge acceptable at areas with Level 1 finish.
d. Thickness: As noted on drawings. (5/8” at fire-resistant applications)
e. Humidified Deflection: Not more than ¼” when tested in accordance with ASTM C473 and C1178.
f. Water Absorption: Less than 5% of weight when tested in accordance with C1396M and C1178.
g. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273
h. Permeance: Not more than 1.0 perms when tested in accordance with ASTM E96.

E. Metal Framing:

1. Protective Coating: ASTM C 645/C, 645M G40 (Z120) or equivalent corrosion resistance.

a. Metal studs and runners.
1) Metal Thickness
a) 20 gauge or ProSTUD 20 gauge equivalent.
b) 25 gauge or ProSTUD 25 gauge equivalent.
2) Size: 1 5/8”, 2 ½”, 3 5/8”, 4” or 6” deep as noted on drawings.

b. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

c. Fire Stop Track: Top runner designed to allow partition head to move while maintaining integrity of assembly fire-resistance rating. Thickness not less than indicated for studs, and of width to accommodate depth of studs.

d. Hat-Shaped, Rigid Furring Channels
1) Base Metal Thickness: 0.0179 inch.
2) Depth: 7/8” or 1 ½” as noted on drawings.

e. Resilient Furring Channels: ½” deep, steel members designed to reduce sound transmission.

f. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1 ¼”, wall attachment flange of 7/8”, minimum bare metal thickness of 0.0179 inch and depth required to fit insulation thickness.

g. Radius Framing: Steel sheet runner for non-structural curves, bends, variable radii and arches. Design to provide higher strength capacity than conventional lighter gauge material by using a work-hardened steel base strip.
1) Base Metal Thickness and Size: Match studs.

h. Flat Strap and Backing Plate Sheet: For blocking or bracing.
1) Base Metal Thickness: 20 gauge.
2) Width: 6 inch.

i. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power and other properties required to fasten steel framing and furring member securely to substrates involved; comply with recommendations of gypsum board manufacturers for application indicated.

j. Ceiling Suspension Systems. Use one of the following systems:
   1) Metal studs with depth required to handle span.
   2) 1 ½" cold rolled steel channels, 8 gauge annealed hanger wire and furring channels.
   3) Direct-hung system composed of 8 gauge hanger wire, main beams and interlocking cross furring members as manufactured by:
      a) Armstrong World Industries, "Furring Systems/Drywall".
      b) Chicago Metallic Corp. "Drywall Furring 640/Drywall Furring 660".
      c) USG Interiors, Inc. "Drywall Suspension Systems".

F. Accessories:

1. Trim: ASTM C 1047.

   a. Material: Galvanized or aluminum-coated steel sheet, rolled zinc.
   b. Shapes:
      1) Cornerbead.
      2) L-C Bead: J-shaped; exposed long flange receives joint compound.
      3) L-Bead: L-shaped: exposed long flange receives joint compound.
      4) Off-angle or splayed cornerbead.
      5) V-shaped Control Joint protected with plastic tape.

2. Acoustical sealant conforming to ASTM C 919.

3. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

   a. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
   b. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

4. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

   a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR, 59, Subpart D (EPA Method 24).

5. Sound Batt Insulation and Rigid Wall Insulation: Conform to requirements of Section 07 21 00.

6. Joint Treatment Materials:

   a. General: Comply with ASTM C 475/C 475M.
   b. Joint Tape:
      1) Interior Gypsum Wallboard: 2 1/16" wide paper reinforcing tape.
      2) Glass-Mat Gypsum Wallboard: 2" wide self adhering fiberglass tape.
      3) Tile Backing Panels: As recommended by panel manufacturer.
   c. Joint Compound for Interior Gypsum Wallboard: Drying type pre-mixed vinyl base compound and/or drying type pre-mixed vinyl base topping compound.
   d. Joint compound for glass-mat gypsum wallboard: As recommended by wallboard manufacturer.

7. Acoustic spray system: Conform to the requirements of Section 07 21 00 Insulation.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates to which gypsum board construction attaches or abuts, installed hollow metal frames, cast-in anchors and structural framing with installer present for compliance with requirements for installation tolerances and other conditions affecting performance of gypsum board assemblies specified in this section.

   1. Do not proceed with installation until satisfactory conditions have been corrected.

3.02 INSTALLATION OF STEEL FRAMING, GENERAL

A. Steel framing installation standard: Comply with ASTM C 754.

B. Metal Stud Schedule

   1. Use 25 gauge metal studs or equivalent on partitions up to 12’-0” high and soffits.
   2. Use 20 gauge or equivalent metal studs on:
      a. Metal stud partitions over 12’-0” high.
      b. Metal stud ceilings.
      c. Double studs at each door and borrowed light jamb and head.

C. Install supplementary framing, blocking and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, door bumpers, furnishings and similar construction to comply with details indicated and with recommendations of gypsum board manufacturer.

D. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement, at location indicated below to comply with details shown on drawings.

   1. Where suspended ceiling assemblies abut building structure horizontally at ceiling perimeters or penetrations of ceiling.

   2. Where partitions and wall framing abut overhead structure.
      a. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.

E. Do not bridge building expansion and control joints with steel framing or furring members, independently frame both sides of joints with framing or furring members or as indicated.

3.03 INSTALLATION OF STEEL FRAMING FOR CEILINGS AND SOFFITS

A. Suspend ceiling hangers from building structural members and as follows:

   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum not part of supporting structural or ceiling suspension system.

      a. Splay hangers only where required to miss obstruction s and offset resulting horizontal forces by bracing, counter splaying or other equally effective means.

   2. Where widths of ducts and other construction within ceiling plenum produce hanger spacing that interfere with the location of hangers at spacing required to support standard suspension system members, install supplemental suspension system members and hangers in form of trapezes or equivalent devices.

      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

3. Secure wire hangers to structure, by looping or wire tying, directly to supporting structure, including intermediate framing members. Attach to inserts, eye screws, or other devices appropriate for structure to which hangers are attached as well as for type of hanger involved in manner that will not cause deterioration or failure, due to age, corrosion or elevated temperatures.

4. Do not attach hangers to metal roof deck or metal deck tabs.

5. Do not connect or suspend steel framing from ducts, pipes or conduits.

B. Keep hangers and braces 2 inches clear of ducts, pipes and conduits.

C. Wire-tie or clip furring members to main runners and to other structural supports.

D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension system abuts vertical surfaces. Mechanically join main beam and cross furring members to each other and butt cut to fit wall track.

3.04 INSTALLATION OF STEEL FRAMING FOR WALLS AND PARTITIONS

A. Install runners (tracks) at floors, ceilings and structural walls and columns where gypsum board stud system abuts other construction.

1. Use proprietary tracks for non-rated and fire rated walls and partitions.
2. Install studs full height for all partitions unless noted otherwise.
3. Where studs are installed directly against masonry or concrete walls, set studs in acoustical sealant.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surface does not vary more than 1/8” from plane of faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at or just above suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

1. Cut studs ½ inch short of full height to provide perimeter relief.
2. For STC-rated or fire-resistance rated partitions that extend full height, install framing around structural members, as required to support gypsum board closures needed to make partitions continuous from floor to underside of structure above.
3. Install bridging/spacing bar.

D. Brace partition framing, not extending full height to structure above, with studs same size and thickness as partition framing. Provide bracing at:

1. 6’-0” o.c. intervals along length of partitions.
2. Not less than 6’-0” from partition ends and corners.
3. Door and window openings.

E. Terminate partition framing at suspended ceiling where indicated.

F. Install metal studs and furring in sizes and at spacings indicated.

1. Single and Multi Layer Construction: Space studs 16 inches o.c., unless otherwise indicated.

G. Install metal studs with flanges in same direction and leading edge or end of gypsum board panel can be attached to open (unsupported) edges of stud flanges first.

H. Frame door openings to comply with details indicated, with GA-219 and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

I. Frame openings other than door openings to comply with details indicated, or if none indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

1. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

3.05 APPLICATION OF GYPSUM BOARD

A. Install the following gypsum board types as follows:

1. Regular type: All non-rated areas unless noted differently below.
2. Type X or C: As required to meet fire-resistant rated assemblies.
3. Mold and Moisture Resistant: All gypsum board on the interior face of an insulated stud exterior wall. (Note: Gypsum Board on furred masonry walls can be regular type.)

B. Gypsum Board Application and Finishing Standards: Comply with ASTM C 480 and GA-216.

C. Install sound attenuation insulation blankets where indicated, prior to gypsum board, unless readily installed after board has been installed on one side.

D. Single-Layer Application: Install gypsum wallboard as follows:

1. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.

2. On partitions/walls apply gypsum board vertically (parallel to framing), unless otherwise indicated or required by fire resistance rated assembly, and provide sheet lengths which will minimize end joints.
   a. On partitions/walls 8’-1” or less in height, apply gypsum board horizontally (perpendicular to framing); use maximum length sheets possible to minimize end joints.
   b. At stairwells and other high walls, install gypsum board horizontal, unless otherwise indicated or required for fire resistance rating.
   c. On Z-furring, apply gypsum panels vertically (parallel to framing). Locate edge joints over furring member.

E. Double-Layer Application: Install gypsum backing board for base layer and exposed gypsum board for face layer.

1. On ceilings apply base layer prior to application of base layer on walls/partitions; apply face layer in same sequence. Offset joints between layers minimum one stud space. Apply base layers at right angles to supports, unless otherwise indicated.

2. On partitions/walls apply base layer and face layer vertically (parallel to framing) with joints of base layer over supports and face layer joints offset minimum one stud space with base layer joints.

F. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for light at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.

G. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints.

1. Position boards so like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends.
2. Do not place tapered edges against cut edges or ends.
3. Gypsum panel product joints shall be located so that no joint will align with the edge of an opening unless control joints are to be installed at these locations.
4. Joints on opposite sides of a partition shall not occur on the same stud.

5. In single layer gypsum panel products systems, end joints parallel to and on the same side of framing members shall be staggered between alternate courses of gypsum panel products and from joints on the opposite side of the framing members.
6. In multi-layer gypsum panel product systems, end joints parallel to and on the same side of framing members shall be staggered between alternate courses of gypsum panel products.
7. Base layer end joints parallel to and on one side of framing shall be staggered from base layer end joints on the opposite side of the framing members.
8. Install ceiling boards across framing in manner to minimize end-butt joints, and avoid end joints in central area of each ceiling. Stagger end joints at least 24 inches.

H. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors and doors over 32 inches wide except where full grout is shown. Apply spot grout at each jamb anchor clip just before inserting board into frame.

I. Form control joints and expansion joints at locations indicated or as recommended, with space between edges of boards, prepared to receive trim accessories.

1. Where a control joints occurs in an acoustical or fire-rated system, blocking shall be provide behind the control joint by using a backing material such as 5/8" type X gypsum panel product, or other tested equivalent.

J. Cover both faces of metal stud partition framing with gypsum board in concealed spaces (above ceiling, etc.), except in chase walls which are braced internally.

1. Except where concealed application is indicated or required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq.ft. area, and may be limited to not less than 75 percent of full coverage.
2. Fit gypsum board around ducts, pipes and conduits.

K. Isolate perimeters of non-load-bearing drywall partitions at structural abutments. Provide ¼ to ½ inch space to accept trim edge.

L. Where STC-rated gypsum board assemblies are indicated or drawings indicate acoustical sealant, seal construction at perimeters, behind control and expansion joints, openings, and other penetrations with a continuous bead of acoustical sealant. Include a bead of sealant at both faces of partitions.

1. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim and closing off sound flanking paths around or through gypsum board assemblies, including partitions extending above ceilings.
2. Where resilient furring channels are used over steel framing, the screws used to attach the gypsum panel product to the furring channels shall not contact the framing.

M. Gypsum panel products applied to walls shall be applied with the bottom edge spaced a minimum of 1/8 inch and maximum of ¼ inch above the floor.

N. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

O. Wall Tile Substrates: For substrates scheduled to receive ceramic or porcelain tile, comply with the following:

1. Install gypsum tile backer board panels to comply with manufacturer's installation instructions at locations scheduled to receive wall tile. Install with ¼" open space where panels abut other construction.

3.06 METHODS OF GYPSUM BOARD FASTENING

A. Fastener lengths shall be at least 1 1/8" long for ½" gypsum panels and 1 ¼" long for 5/8" gypsum panels used for metal framing.

B. Screws shall be spaced not more than 12 in. o.c. for ceilings and 16 in. o.c. for walls where the framing members are 16 in. o.c. Screws shall be spaced not more than 12 in. o.c. for both ceilings and walls where framing members are 24 in. o.c.

C. Fasteners at gypsum panel product edges or ends shall be located not less than 3/8" from the edge or end. Fasteners at edges or ends in a perpendicular application shall be located not more than 1 in. from the edge or end. Perimeter attachment into partition top and bottom plates is neither required nor recommended except where fire ratings, structural performance requirements, or other special conditions require such attachment.

D. While diving fasteners, gypsum panel products shall be held in firm contact with framing members or underlaying support. Application of fasteners shall proceed from the center or field of the gypsum panel product toward the ends and edges, or shall begin along one edge and proceed toward the other edge.

E. To provide a more flat surface at joints, attach gypsum board to steel studs so leading edge or end of each board is attached to open (unsupported) edge of stud flanges first.

F. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.

G. Screws shall be driven so that screw heads are slightly below the gypsum panel product surface without breaking the face paper, fracturing the core, or stripping the framing member around the screw shank.

H. Double-Layer Fastening Methods: Apply base layer of gypsum board and face layer to base layer as follows:

1. Fasten base layer with screws and face layer with adhesive and supplementary fasteners, except where otherwise required for fire-resistance rated assemblies.

3.07 INSTALLATION OF DRYWALL TRIM ACCESSORIES

A. General: Where feasible, use same fasteners to anchor trim accessory flanges as required to fasten gypsum board to supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.

B. Install corner beads at external corners.

C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound except where "U" bead (semi-finishing type) is indicated.

1. Install "J" bead where drywall construction is tightly butted to other construction and back flange can be attached to framing or supporting substrate.
2. Install "L" bead where edge trim can only be installed after gypsum board is installed.

D. Install control joints at locations as follows:

1. At ceilings, 50'-0" o.c. each way maximum and/or where shown on drawings. At corners and at tee intersections of soffits that change directions.
2. At walls, 30'-0" o.c. maximum, and/or where shown on drawings.
3. Full height door frames shall be considered equivalent to a control joint.

3.08 FINISHING OF GYPSUM WALL BOARD

A. General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim and control joints; penetrations; fastener heads, surface defects and elsewhere as required to prepare work for decoration.

B. Prefill open joints using setting-type joint compound.

C. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.

D. Glass-Mat Water Resistant Backer Board: Comply with glass mat backer board manufacturer's recommendations.

E. Water or additive shall not be added to joint compound unless recommended by manufacturer. See quality assurance for application temperature and drying times.

F. Levels of Gypsum Board Finishing per Gypsum Association GA-214 and as note herein:

1. Level 1/Fire Taping: All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Tape and fasteners need not be covered.

    a. For use in plenum areas above ceilings, gypsum board not scheduled for paint or wallcovering, gypsum board concealed from view in the finished work, except as noted in level 2.

2. Level 2: All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.

    a. For use on areas that are a substrate for tile or wood paneling.

3. Level 3: All joints and interior angles shall have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free to tool marks and ridges.

    a. For use on surfaces of mechanical and electrical spaces scheduled to receive paint.

4. Level 4: All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. When necessary, sand between coats and following final coat to provide smooth surface ready for decoration.

    a. For use on all walls scheduled for paint or wallcovering except those areas noted under Level 3 and 5.

5. Level 5: All joints and interior angles shall have tape embedded in joint compound and two separate coats for joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges. When necessary, sand between coats and following final coat to provide smooth surface ready for decoration.

    a. For use on all ceilings; walls and/or soffits under skylights and clerestories, and as noted on drawings. Note: when Level 5 finish is used, it shall extend to nearest inside or outside corner.

3.09 FINISHING ADJUSTMENT

A. Screw Pop

1. Repair nail pop by driving new screw approximately 1-1/2 inches away and reseat screw.

2. When face paper is punctured drive new screw approximately 1-1/2 inches from defective fastening and remove defective fastening.

3. Fill damaged surface with compound in coats specified by required finish level.

B. Ridging

1. Sand ridges to reinforcing tape without cutting through tape.

2. Fill concave areas on both sides of ridge with topping compound.

3. After fill is dry, blend in topping compound over repaired area.

C. Fill cracks with compound and finish smooth and flush.

D. Application of acoustic spray system

1. Install mineral wood backing at depth required per manufacturer's details.

2. Apply acoustic spray to required thickness and overlap onto adjacent surfaces as recommended by manufacturer to achieve specified sound transmission classification.

3.10 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Protect installed products from damage from weather, condensation, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 21 16

SECTION 09 30 00

TILE

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Mortar bed installations in toilets, showers, kitchens and other areas shown on drawings with floor drains over depressed substrates.

2. Ceramic tile on walls and floors.

3. Caulking of joints in tile on inside corners of tiled rooms and sealing of joints in tile.

B. Related work specified in other sections:

1. Drywall substrates - Section 09 21 16.

1.03 SUBMITTALS

A. Submit in accordance to Section 01 33 00:

1. Submit samples for colors on 12" x 12" panels in duplicate for each tile specified for Architect's selection and approval.

2. Submit two (2) samples each for each different trim piece required for this project.

3. Furnish Master Grade Certificates to Architect for all tile, indicating compliance with TCA 137.1-76.

4. Submit product information on grout and samples indicating color range anticipated, texture.

5. Submit samples of sealant that match grout color.

6. Submit installation system manufacturer qualifications, installer qualifications, and laboratory confirmation of installation materials as outlined in Quality Assurance.

1.04 REFERENCE SPECIFICATIONS

A. The latest edition of following specifications and standards are incorporated by reference.

1. Tile Council of North America, Inc., Handbook for Ceramic Tile Installation (TCNA).

2. American National Standard Specifications for the installation of ceramic tile (ANSI).

B. Maintain a copy of publications in the Contractor's office, available for reference.

1.05 QUALITY ASSURANCE

A. Installation System Manufacturer (single source responsibility): Company specializing in adhesives, mortars, grouts and other installation materials with ten (10) years minimum experience and ISO 9001 certification. Obtain installation materials from single source manufacturer to insure consistent quality and full compatibility.

B. Submit laboratory confirmation of adhesives, mortars, grouts and other installation materials:

1. Identify proper usage of specified materials using positive analytical method.
2. Identify compatibility of specified materials using positive analytical method.
3. Identify proper color matching of specified materials using a positive analytical method.

C. Installer qualifications: company specializing in installation of ceramic tile, mosaics, pavers, trim units and thresholds with five (5) years documented experience with installations of similar scope, materials and design.

1.06 MOCK-UPS

A. Provide mock-up of each type/style/finish/size/color of ceramic tile, mosaics, pavers, trim unit and threshold, along with respective installation adhesives, mortars, grouts and other installation materials. Mock may be part of final installation if accepted.

1.07 PRE-INSTALLATION CONFERENCE

A. Pre-installation conference: at least three weeks prior to commencing the work attend a meeting at the jobsite to discuss conformance with requirements of specification and job site conditions. Representatives of Owner, Architect, General Contractor or Construction Manager, Tile Subcontractor, Tile Manufacturer, Installation System Manufacturer and any other parties who are involved in the scope of this installation must attend the meeting.

1.08 WARRANTY

A. The manufacturer of adhesives, mortars, grouts, and other installation materials shall provide a written twenty-five (25) year warranty, which covers materials and labor; reference Manufacturer Warranty Data Sheet for complete details and requirements.

B. For exterior facades over steel or wood framing, the manufacturer of adhesives, mortars, grouts and other installation materials shall provide a written ten (10) year warranty, which covers replacement of Manufacturer products only – reference Warranty Data Sheet for complete details and requirements.

1.09 PRODUCT HANDLING, DELIVERY AND STORAGE

A. Package, handle, deliver and store at the job site in original unbroken containers in a manner that will avoid damage or contamination. All containers shall bear grade seals, manufacturer's name, size, color and quantity.

B. Reject any tiles that are cracked or broken.

1.10 JOB CONDITIONS

A. Set and grout tile when ambient temperature is at least 50° F. and rising.

PART 2: PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Manufacturers listed in this specification are approved under the following conditions:

1. A manufacturer listed in both the specification and the Material Finish/Color Schedule, on Architectural Drawings is not required to submit a pre-bid approval.

2. Manufacturers listed in this specification, but not in the Material Finish/Color Schedule, on Architectural Drawings shall submit color samples for pre-bid approval by addendum. Refer to Section 01 25 00.
3. When no colors are listed in the Material Finish/Color Schedule, on Architectural Drawings, any manufacturer listed in this specification are not required to submit a pre-bid approval.

2.02 CERAMIC FLOOR TILE

A. Manufacturers: Products by Dal-Tile are specified. Products by Crossville, U.S. Ceramic, American Olean and Florida Tile are acceptable.

B. Ceramic Floor Tile 2" x 2".

1. Colors: See Material Finish/Color Schedule, on Architectural Drawings.

2. Patterns: Provide as shown on drawings.

C. Base: Dal-Tile MB5A 2” x 2” base without bullnose and MB5B 2” x 2” base with bullnose top.

2.03 CERAMIC WALL TILE

A. Manufacturer: Products by Dal-Tile, American Olean, US Ceramics, and Florida Tile are acceptable, subject to color match approval by the Architect prior to bidding.

B. 4-1/4" x 4-1/4" glossy and trim pieces.

1. Colors: See Material Finish/Color Schedule, on Architectural Drawings.

2. Patterns: Provide as shown on drawings.

2.04 SETTING MATERIALS

A. Manufacturers: Products and systems by Bostik Construction Products are specified. Equivalent products and systems by Ardex, Mapei, Bonsal, H.B. Fuller, Laticrete, Custom Building Products, and American Olean are acceptable subject to approval of submittals.

B. Tile Setting Systems:

1. Setting bed for tile on concrete slabs-on-grade, mortar bed, or masonry walls: Acrylic latex modified thin set meeting ANSI A118.4 and ANSI A118.11, Bostik “ReFlex” (TCNA F111 or F113).

2. Setting bed for tile on floors of showers, toilet rooms and locker rooms on above grade locations: Waterproofing membrane and setting adhesive, Bostik “UltraSet Advanced” or “Gold Plus” single step application. (TCNA F121 or F122).

3. Setting bed for tile on existing gypsum board based substrates: Bostik “Ultra Set Advanced”. Use “Stonewall” for any tile over 24” in either direction (TCNA W242).

4. Setting bed for tile on fiberglass faced or tile backer board: Bostik “ReFlex” at dry areas or “ReFlex” with “Gold Plus” at wet areas such as showers, toilet rooms, locker rooms (TCNA W242).

5. Setting tile over existing glazed tile/painted concrete block: Bostik “Tile Mate Premium” mixed with Flex Elastic (TCNA TR713)

   a. Dry Areas: Organic adhesive OR non-sag mortar (ANSI 118.4) “Stonewall”.
   b. Wet Areas: Only non-sag (ANSI 118.4) “Stonewall”.

6. Setting bed for tile on concrete slab-on-grade in large format tile (>24" in any direction): "Stone Wall".

C. Mortar Bed: Mixture of portland cement and sand, roughly in proportions of 1:5 with latex polymer as the liquid portion of the mixture.

1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.

2. Reinforcing: Galvanized, welded wire fabric, 2 by 2 inches by 0.062 inch diameter; comply with ASTM A 185 and ASTM A82 except for minimum wire size.

D. Grout

1. For glazed ceramic and mosaic tile: Acrylic latex modified grout meeting ANSI A118.7, "Bostik" Ceramic Tile Grout" mixed with Bostik "Multi-Purpose Acrylic Latex Grout Additive".
   a. Color: As selected by Architect from manufacturer's full line of available colors.

2.05 MISCELLANEOUS MATERIALS

A. Sealant: One component silicone, color to match tile grout.

B. Silicone sealer for tile joints: "Grout Sealer" at manufactured by Aqua Mix, Inc.

C. Cleaners: As manufactured by Hillyard Chemical Company or American Olean.

D. Provide leveling system for tiles over 24" in any dimension as recommended by tile manufacturer.

E. Thresholds: Solid polymer made from homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without precoated finish. Sizes as detailed on drawings. Colors as selected by Architect to match field color of tile.

F. Metal Trim for Tile: As manufactured by Schluter Systems, LP or equal. Material: Brushed Aluminum.

1. CT Corner Trim: (For use at outside corners of tile to tile and terminations of ceramic/porcelain tile to other materials). RONDEC profile RO x tile height x AE.
   a. Provide, splice connectors, end caps, inside and outside corners as warranted by application.

2. CT Transition Strip:
   a. Carpet to Ceramic/Porcelain Tile Transition: RENO-ETK x Tile Height.
   a. Resilient Tile to Ceramic/Porcelain Tile Transition: RENO-EBU x Tile Height.

2.06 EXTRA STOCK

A. Furnish 1% of each type/shape//color of tile used on this project to Owner as maintenance stock.

PART 3: EXECUTION

3.01 EXAMINATION OF SURFACES

A. Inspect surfaces to which tile is to be applied. Commencement of work implies acceptance of surface and assumption of responsibility for satisfactory results.

3.02 MORTAR BEDS

A. Mix and install mortar, cleavage membrane and reinforcing per ANSI A108.B, sloping top of mortar bed with a constant slope from walls to floor drains.

B. Allow mortar bed to fully cure prior to commencing with tile work.

3.03 SETTING BEDS

A. Use systems identified in “Setting Materials” in Part 2 of this specification.

3.04 TILE INSTALLATION

A. General

1. Installation and workmanship shall be in accordance with ANSI Specifications and as specified herein. The printed instructions of the tile manufacturer and the manufacturer of proprietary mortars and grouts shall be followed where applicable.

2. Before commencing work, establish field pattern and border line locations and center the work symmetrically so that no tile need be cut to less than half size. Cut tile at base so top of base is level around entire room. Joints in wall tile shall be aligned vertically and horizontally; staggered joints will not be accepted. Rub exposed edges smooth.

3. Do not install any cracked or chipped tiles.

B. Movement Joints

1. Install joints to control the effects of substrate movement on tile finishes.
2. Construct joints in tile work according to movement joint details” EJ171” as published in TCNA “Handbook for Ceramic Tile Installation.”
3. Locate movement joints at the following locations:

   a. Interior: 20’ to 25’ maximum in each direction.
   b. Exterior and Interior tile work exposed to direct sunlight or moisture: 8’ to 12’ maximum in each direction.
   c. Where tile work abuts restraining surfaces including but not limited to perimeter walls, dissimilar floors, curbs, columns, pipes, ceilings, inside corners of abutting walls, and where changes occur in backing materials.
   d. All expansion, control, construction, cold and seismic joints in the structure. Expansion joints in tile work must match width of joint in building structure.

C. Crack isolation membrane: Install over minor cracks and non-structural slab joints to prevent transmission of cracking to tile. Strictly follow membrane and mortar manufacturers' printed instructions.

D. Waterproofing membrane: Install per manufacturers printed instructions, including two wet on wet applications at 20-30 mils thick. Full bonding to metal and PVC.

1. Perform 24-hour flood testing. Repeat application as required until flood test passes.

E. Install thresholds at transition from ceramic tile floors to other flooring materials and as shown on drawings.

F. Remove concrete curing compound with shot blasting or other appropriate mechanical means and vacuum floor on installations without mortar bed.

3.05 CLEANING, PATCHING, PROTECTION, SEALING

A. After completion, clean all work, point open joints and replace defective work.

B. Cleaning and Sealing

1. Ceramic Porcelain Tile Walls, Floors and Base: Clean with water, rinse and allow to dry. Apply one coat of silicone sealer. Wipe excess sealer from face of tile.

C. Protection

1. Floors: Close off workspaces to traffic during installation and at least 48 hours after completion of work.

2. Finished tile floors: Covered with clean building paper before foot traffic is permitted on them. Place board walkways on floors that are to be continuously used as passageways by workmen. Protect tiled vertical outside corners with board corner strips in areas used as passageways by workmen.

3. Remove protection just prior to substantial completion and re-clean tile as necessary.

END OF SECTION 09 30 00

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Lay-in acoustic ceilings.

B. Related work specified in other sections:

1. Mechanical penetration of ceilings - Divisions 21-25.

2. Electrical penetration of ceilings - Divisions 26-28.

1.03 SUBMITTALS

A. Submit Shop Drawings indicating installation layouts in accordance with Section 01 33 00.

B. Submit samples of all acoustical and suspension materials to Architect for approval.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unopened, protective packaging, with manufacturer's labels indicating brand name, pattern, size, thickness and fire rating as applicable, legible and intact.

B. Store materials in original protective packaging to prevent soiling, physical damage or wetting.

C. Store cartons open at each end to stabilize moisture content and temperature.

D. Do not begin installation until sufficient materials to complete a room are received.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Complete installation of dampening materials before beginning work.

B. Maintain humidity of 65% - 75% in area where acoustical materials are to be installed, 25 hours before, during, and after installation.

C. Maintain a uniform temperature in the range of 55 F. to 70 F. prior to, during, and after installation of materials.

PART 2: PRODUCTS

2.01 ACOUSTICAL MATERIALS

A. Products specified are as follows:

1. Armstrong, www.armstrong.com
2. USG, www.usg.com

B. ACT 2: Square edge, 5/8” thick, sag and abuse resistant, anti-microbial, low VOC, lay-in tile. Provide 24” x 24” tile.

1. Minimum NRC: 0.50
2. Minimum CAC: 30
3. Minimum LR: 0.86
4. Minimum Recycled Content: 33%
5. Armstrong “Tundra Humigard” #301
6. USG “Touchstone ClimaPlus” #5893

C. Furnish extra materials equal to 1% of each type of acoustical material supplied. Provide materials in new, unopened cartons labeled as to contents.

2.02 SUSPENSION SYSTEMS

A. Systems specified are by Chicago Metallic. Equivalent systems by USG or Armstrong are acceptable.

B. Suspension System for Non-Rated Lay-In Panels (except locations listed below): 200 Intermediate Duty Snap-Grid System, standard white finish.

C. Systems for use in kitchens, kitchen serving areas, toilets and locker rooms to be 1830 intermediate duty hot dipped galvanized capped with white aluminum capping.

D. Perimeter treatment components for all systems to be 0.020 inch thick hot dipped galvanized steel, 15/16” wide x ¾” high. Edges to be hemmed. Finished identical to main runners and cross tees.

PART 3: EXECUTION

3.01 CONDITION OF SURFACES

A. Examine surfaces scheduled to receive suspended or directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of work.

B. Mark access provisions as to size and location before beginning installation.

3.02 REQUIREMENTS FOR ALL MECHANICAL SUSPENSION SYSTEMS

A. Grid layout in each space, area located symmetrically in room, space. Coordinate work with other trades so that lighting fixtures, grilles, other ceiling fixtures work to grid layout.

B. Do not use universal splices or other types whose use would obstruct passage of recessed lighting fixtures through grid openings, or make untenable their reposition upon flanges of beams.

C. Support suspension system from structure above, not from ductwork, equipment or piping.

D. Space hangers not more than 6" from ends, not more than 4'-0" o.c. Between ends of main runners, provide extra hangers as required to support other work resting in or on ceiling.

E. Provide additional tee supports, hangers and cut tiles to support and fit to all sides of light fixtures, linear diffusers and other ceiling penetrations. Coordinate with mechanical and electrical drawings.

3.03 ACOUSTICAL MATERIALS

A. Install ceiling panels and tiles using clean gloves, to avoid soiling materials.

B. Install lay-in panels snugly against support system without damaging panels.

C. Field rabbit edges of panels where field-cut to match shadow-line profile.

D. Adjust any sags or twists which develop in the ceiling systems and replace any part which is damaged or faulty.

E. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings and suspension members; comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

F. Replace any damaged tile just prior to substantial completion.

END OF SECTION 09 51 00

SECTION 09 65 00

RESILIENT FLOORING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Vinyl base.

B. Related work specified in other sections:

1. Concrete Substrates – Section 03 30 00

1.03 SUBMITTALS

A. Submit per Section 01 78 23.

1. Submit full line of color samples for materials to be furnished for Architect's review and selection.

2. Provide manufacturer's recommended maintenance data and instructions prior to completion of work.

B. Specified warranties from manufacturer. Submit per Section 01 78 23.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened containers with labels indicating brand names, colors and patterns, and quality designations legible and intact.

B. Do not open containers or remove markings until materials are inspected and accepted.

C. Store and protect accepted materials in accordance with manufacturer's directions and recommendations.

D. Unless otherwise directed, store materials in original containers at not less than 70° F. for not less than 24 hours immediately before installation.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature in space to receive tile between 70° F. and 90° F. for not less than 48 hours before and 48 hours after installation.

B. Maintain minimum temperature of 65° F. thereafter.

PART 2: PRODUCTS

2.01 VINYL BASE

A. Manufacturer: Products by Johnsonite are specified. VPI, Armstrong, Burke, Roppe, Tarkett are acceptable.

B. Base: 1/8" thick x 4" high, solid vinyl. Straight base at carpet, coved base at other surfaces.

C. Color: See Material Finish/Color Schedule, on Architectural Drawings.

2.02 EXTRA STOCK

A. Furnish 1% of each type/color of flooring, trim used in this project to Owner as maintenance stock.

PART 3: EXECUTION

3.01 PREPARATION

A. Correct adverse conditions of any type before starting any installation.

3.02 ACCESSORIES

A. Apply coved base at all locations.

B. Install non-slip strips on ramps, vestibules 6” o.c.

END OF SECTION 09 65 00

SECTION 09 67 10

DECORATIVE QUARTZ FLOORING

PART 1: GENERAL

1.01 APPLICABLE DOCUMENTS

A. Bidding Requirements, Conditions of the Contract and pertinent portions of Sections in Division One of these Specifications apply to the Work of this Section.

1.02 SUMMARY

A. Section includes:

1. Coating systems for concrete apparatus bay floors; including coved base.

1.03 REFERNENCES

A. ASTM D 16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.

B. ASTM D 4259 – Standard Practice for Abrading Concrete.

C. ASTM D 4263 - Indicating Moisture in Concrete by the Plastic Sheet Method.

D. ASTM F 1869 - Measuring Moisture Vapor Emission Rate of Concrete Sub floor Using Anhydrous Calcium Chloride.

E. International Concrete Repair Institute (ICRI) Guideline No. 03732 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

F. SSPC-SP 13/NACE 6 - Surface Preparation of Concrete.

1.04 DEFINITIONS

A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.

B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.05 SUBMITTALS

A. Comply with Section 01 33 00 – Submittals.

B. Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.

C. Color Samples: Submit manufacturer’s color samples showing full range of standard colors.

D. Manufacturer’s Quality Assurance: Submit manufacturer’s certification that coatings comply with specified requirements and are suitable for intended application.

E. Applicator's Quality Assurance: Submit list of a minimum of 5 completed projects of similar size and complexity to this Work. Include for each project:

1. Project name and location.
2. Name of owner.
3. Name of contractor.
4. Name of architect.
5. Name of coating manufacturer.
6. Approximate area of coatings applied.
7. Date of completion.

F. Warranty: Submit manufacturer's standard 2 year floor coating warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Specialize in manufacture of coatings with a minimum of 5 years successful experience.
2. Able to demonstrate successful performance on comparable projects.
3. Single Source Responsibility: Coatings and coating application accessories shall be products of a single manufacturer.

B. Applicator's Qualifications:

1. Experienced in application of specified coatings for a minimum of 5 years on projects of similar size and complexity to this Work.
2. Applicator's Personnel: Employ persons trained for application of specified coatings.

C. Mock-Ups: Prepare 10 foot x 10 foot mock-up for each coating system specified using same materials, tools, equipment, and procedures intended for actual surface preparation and application. Obtain Architect's approval of mock-ups. Retain mock-ups to establish intended standards by which coating systems will be reviewed.

D. Pre-Installation Conference: Convene a pre-installation meeting 2 weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Contractor, Architect, applicator, and manufacturer's representative. Review the following:

1. Environmental requirements.
2. Protection of surfaces not scheduled to be coated.
3. Surface preparation.
4. Application.
5. Repair.
6. Field quality control.
7. Cleaning.
8. Protection of coating systems.
9. One-year inspection.
10. Coordination with other work.

1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

1. Coating or material name.
2. Manufacturer.
3. Color name and number.

4. Batch or lot number.
5. Date of manufacture.
6. Mixing and thinning instructions.

B. Storage:

1. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
2. Keep containers sealed until ready for use.
3. Do not use materials beyond manufacturer's shelf life limits.

C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Weather:

1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.

B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.

C. Dust and Contaminants:

1. Schedule coating work to avoid excessive dust and airborne contaminants.
2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2: PRODUCTS

2.01 PRODUCT DESCRIPTION

A. Manufacturer: Products specified are by Tnemec Company, Inc.. Equivalent products by Sonneborn and General Polymers are acceptable. Other equivalent products subject to approval by Architect prior to bidding.

B. Product: Laminate quartz flooring system for concrete floors – aggressive environment.

1. Heavy Abuse, Decorative Quartz, Frequently Wet, Heavy Vehicular Traffic: (Apparatus Bays, Turn-Out Gear Room, Storage Room, etc. as indicated on drawings).

a. System Type: Epoxy/Polyurethane.
b. Surface Preparation: Shot Blast or Mech. Abrade (CSP 4-6).
c. Primer: Series 201 Epoxoprime at 200 to 250 square feet per gallon.
d. Intermediate Coat: Series 222 Deco-Tread, (double broadcast or slurry broadcast) DFT 1/8 inch.
e. Epoxy Grout Coat: Series 284 Deco-Clear at 80 to 100 square feet per gallon.
f. Chemical Resistant Urethane Finish Coat: Series 295 Clear CRU at 325 to 350 square feet per gallon.
g. Total System Thickness: 1/8-inch system.
h. Finish Color: As selected by Architect from manufacturer's entire standard color selection.

C. Color/Texture: See Material Finish/Color Schedule, Sections 1-4 of Details of Construction.

D. Physical Properties:

1.	Hardness @ 24 hours Shore D ASTM D 2240	72.3
2.	Compressive Strength ASTM C 579	15,567 psi
3.	Tensile Strength ASTM C 307	2,100 psi
4.	Abrasion Resistance ASTM D 4060, CS-17 Wheel	65.2 mgs lost
5.	Flexural Strength ASTM C 580 ASTM D 790	 4,550 psi 127,876 psi
6.	Adhesion	400 psi
7.	ACI 503R	100% concrete failure
8.	Flammability ASTM D 635	Self-Extinguishing over concrete

2.02 ACCESSORIES

A. Coating Application Accessories:

1. Accessories required for application of specified coatings in accordance with manufacturer's instructions, including thinners.
2. Products of coating manufacturer.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which coating systems are to be applied. Notify Architect of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.02 PROTECTION OF SURFACES NOT TO BE COATED

A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.

B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.03 SURFACE PREPARATION OF CONCRETE FLOORS

A. Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

C. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.

D. Allow concrete to cure for a minimum of 28 days before coating.

E. Level protrusions and mortar spatter.

3.04 APPLICATION

A. Apply coatings in accordance with manufacturer's instructions.

B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.

C. Keep containers closed when not in use to avoid contamination.

D. Do not use mixed coatings beyond pot life limits.

E. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.

F. Uniformly apply coatings at spreading rate required to achieve specified DFT.

G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

H. Install a 4" Rolled radius cove base where directed in accordance with the CSM's written instructions and as indicated on Drawing No. TFS-15.

I. Fill all cracks and recessed joints, including control and construction joints per the methods outlined below for each specific area. When filled, joint should be flush with the floor surface.

3.05 REPAIR

A. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces affected by installation not scheduled to be coated.

B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.

C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.06 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.07 CLEANING

A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.08 PROTECTION OF COATING SYSTEMS

A. Protect surfaces of coating systems from damage during construction.

3.09 ONE-YEAR INSPECTION

A. Owner will set date for one-year inspection of coating systems.

B. Inspection shall be attended by Owner, Contractor, Architect, and manufacturer's representative.

C. Repair deficiencies in coating systems as determined by Architect in accordance with manufacturer's instructions.

END OF SECTION 09 67 10

SECTION 09 91 00

PAINTING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Field finish all materials scheduled and/or specified for paint, trim, stain or seal. Including but not limited to:

   a. Concrete floors
   b. Steel
   c. Galvanized metal
   d. Wood
   e. Gypsum Board
   f. Rated partition identification.

B. Related work specified in other sections:

1. Finishing of wood doors - Section 08 14 00.

2. Shop finishing - Applicable Sections.

3. Colored sealants – Section 07 92 00

1.03 SUBMITTALS

A. Provide three (3) copies of a schedule detailing each substrate in the same order as the schedules used in Part 2 of this section. Include the following:

1. The specific products to be used for each coat.

2. Documentation that the manufacturer has reviewed and approved each painting system.

3. Data pages for all products listed, highlight the following:

   a. Type of resin.
   b. Dry Film Thickness.
   c. Volume Solids.
   d. Units of Sheen.
   e. VOC content and chemical components.
   f. Other performance or descriptive data required by Part 2 of this section.
   g. If this information is not on the data page provide the information in a letter of certification from the manufacturer. Attach the letter to the appropriate data page.

B. Submit three (3) drawdowns of each product and color combination. Drawdowns shall be applied using a 4 mil WFT drawdown bar on Leneta form WD plain white coated cards size 3-7/8” x 6”.

1. Label each card with the following:

   a. Job name.
   b. Date.

c. Product name.
d. Product number.
e. Color number as stated in the material finish/color schedule.
f. Name, address, and phone number of the supplying facility.
g. Surface material product is to be applied onto.

C. Do not deliver material to site until having received written approval of submitted information and samples.

D. Complete sample area on project as selected by Architect on each type surface and with each type of paint system specified. Do not proceed further with application until receiving acceptance of each sample area by Architect. Accepted areas will serve as standard of quality for entire project.

1.04 EXAMINATION OF DOCUMENTS

A. Examine the specifications for the work of other trade contractors and to become familiar with their work. All surfaces that are left unfinished by the requirements of other specifications to be finished by this section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store materials not is use, in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg. F.

1. Maintain containers in clean condition, free for foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.06 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

C. Do not apply coatings during cold, rainy or frosty weather.

D. Do not apply to surfaces, which are exposed to hot sun.

1.07 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in “MPI Approved Products List.”

2. Preparation and Workmanship: Comply with requirements in “MPI Architectural Painting Specification Manual” for products and paint systems indicated.

PART 2: PRODUCTS

2.01 PAINTING SYSTEMS

A. Painting systems for normal applications are specified using the products of Sherwin-Williams Co. (S-W), PPG Paints [Glidden Professional: (GP); DEVOE COATINGS: (DC); (Sika)] (PPG) and Benjamin Moore & Co.: (BM) to establish standards of quality, except as noted.

1. Other manufacturers can submit for approval through the pre-bid process defined in Section 01 25 00 Substitutions and Product options.

a. For approval, submit data sheets for each paint type with volume solids and VOC’s highlighted to indicate they meet or exceed products specified in Part 2.

C. Use the materials of the same manufacturer for each system.

D. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Flat Paints, Coatings, and Primers VOC content of not more than 50 g/L.
2. Non-flat Paints, Coatings and Primers: VOC content of not more than 150 g/L.
3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Floor Coatings: VOC not more than 100 g/L.
5. Shellacs, Clear: VOC not more than 730 g/L.
6. Shellacs, Pigmented: VOC not more than 550 g/L.

E. For color selection see Material Finish/Color Schedule, on Architectural Drawings.

2.02 PRIMERS (INTERIOR AND EXTERIOR)

A. 100% Acrylic Exterior Wood Primer:

1. Minimum Volume Solids: 34%.
2. Maximum VOC: 150 g/L
   a. S-W Exterior Latex Wood Primer B80W41.
   b. GP Hydrosealer Exterior Primer/Sealer 6001-1200.
   c. PPG Speedhide Exterior Acrylic Wood Primer, 6-609.
   d. BM Fresh Start High hiding All Purpose Primer N046.

B. 100% Acrylic Interior Primer:

1. Shall be certifiable for use on gypsum drywall or wood, and paint.
2. Minimum Volume Solids: 35%.
3. Maximum VOC: 150 g/L
   a. S-W Multi Purpose Latex Primer / Seal B51W8020
   b. GP Gripper Interior/Exterior Primer Sealer 3210-1200.
   c. PPG Seal Grip Int/Ext. Acrylic Universal Primer/Sealer, 17-921.
   d. BM Fresh Start High Hiding All Purpose Primer N046.

C. Rust-inhibitive Waterborne Acrylic Primer:

1. Minimum Volume Solids: 37%.
2. Maximum VOC: 250 g/L
   a. S-W DTM Acrylic Primer/Finish B66W1.
   b. DC Devflex 4020PF Direct to Metal Primer and Flat Finish.
   c. PPG Pitt-Tech Int/Ext Primer DTM, 90-712.
   d. BM Corotech Waterborne DTM Metal Primer/Finish V110.

2.03 EXTERIOR FINISH PAINTS

A. 100% Acrylic Exterior Satin Coating:
1. Minimum Volume Solids: 29%.
2. Maximum VOC: 150 g/L
3. Sheen: 10-20 units at 60 degrees.
   a. S-W A-100 Exterior Latex Satin A82 series.
   b. GP Ultra-Hide 150 Exterior Satin Paint 2412V series.
   c. PPG Speedhide Exterior Satin 6-2045XI.
   d. BM Ultra Spec Exterior Satin N448.

B. Non-blocking, 100% Acrylic Exterior Gloss Coating:

1. Minimum Volume Solids: 34%.
2. Maximum VOC: 150 g/L
3. Sheen: 70-90 units at 60 degrees.
   a. S-W Super Paint Exterior High Gloss Latex Enamel A85 Series.
   b. GP Ultra-Hide Interior/Exterior Gloss Paint 3028N.
   c. PPG Manor Hall Interior/Exterior Gloss Acrylic Latex, 52-110.
   d. BM Ultra Spec Exterior Gloss N449.

2.04 INTERIOR FINISH PAINTS

A. Vinyl Acrylic Interior Eggshell Finish:

1. Minimum Volume Soilds: 35%.
2. Maximum VOC: 0 g/L
   a. S-W ProMar 200 0 VOC Interior Latex Eg-Shel, B20-2600 Series.
   b. GP No VOC Interior Eggshell, 1411.
   c. PPG Speedhide Interior Eggshell 6-4310XI.
   d. BM Ultra Spec 500 Interior Eggshell 538.

B. Vinyl Acrylic Interior Flat Finish:

1. Minimum Volume Solids: 32%.
2. Maximum VOC: 0 g/L
3. Sheen: 0-8 units at 85 degrees.
   a. S-W ProMar 200 0 VOC Interior Latex, B30-2600 Series.
   e. GP No VOC Interior Flat 150, 1209
   b. PPG Speedhide Interior Flat 6-4110XI.
   c. BM Ultra Spec 500 Interior Flat 536.

C. 100%, Modified Acrylic, Interior Semi-Gloss Coating:

1. Minimum Volume Solids: 33%.
2. Maximum VOC: 150 g/L
   a. S-W Pro Industrial Pre-Catalyzed Epoxy.
   b. DC Devflex 4216HP Water-Borne Acrylic or
      GP Lifemaster Oil Interior/Exterior Semi-Gloss Paint 1506.
   c. PPG PITT-GLAZE WB1 Interior Semi-Gloss Pre-Catalyzed Water-Borne Acrylic Epoxy.
   d. BM Corotech WB Pre-Cat Epoxy Coating Semi-Gloss V341.

D. 100% Acrylic, Waterborne Eg-Shel Dryfall:

1. Minimum Volume Solids: 30%.
2. Maximum VOC: 150 g/L
3. Sheen: 0-8 units at 85 degrees.
   a. S-W Waterborne Acrylic Dryfall B42W2.
   b. GP Waterbased Interior Eggshell Dry Fall 1482-1200.
   c. PPG Speedhide Super Tech Flat-Eggshell 0-5 @60&85 Dry Fall, 6-725XI.
   d. BM Super Spec Sweep Up Flat Sheen 6@85, 153.

E. Two-component Polyamide Epoxy:

1. Minimum Volume Solids: 50%.
2. Maximum VOC: 450 g/L

3. Sheen: 75-90 units at 60 degrees.
   a. S-W Tile-Clad High Solids Epoxy B62 Series.
   b. DC Tru-Glaze 4508 HIPAC Epoxy Gloss Coating.
   c. PPG Aquapon 35 Polyamide Epoxy Gloss, 95-1.
   d. BM Corotech Polyamide Epoxy Coating Gloss V400-62.

F. Paint for Concrete Floors:

1. Floor Crack Filler
   a. Minimum Volume Solids: 100%, mixed.
   b. Maximum VOC: 10 g/L, mixed
      1) S-W Armorseal Crack Filler B58AQ2/B60VQ2
      2) Sika Sikadur Injection Gel Standard Set.
      3) PPG Megaseal CF Epoxy Crack Filler, 99-114.

2. Water Based Epoxy Floor Primer:
   a. Minimum Volume Solids: 39%, mixed.
   b. Maximum VOC: 50 g/L, mixed.
      1) S-W Armorseal 8100 Water Based Epoxy Floor Coating B70 Series.
      2) Sika Sikafloor 207 General Service Epoxy Binder Coating
      3) PPG Megaseal WBPC Waterborne epoxy primer/sealer, 99-128.

2. Slip Resistant:
   a. S-W H&C Shark Grip-Slip Resistant Additive.
   b. Aluminum Oxide Non Slip Abrasive Additive.
   c. PPG Megaseal AS Anti-Slip Non-Sparking Natural Pumice Additive.

3. Water Based Epoxy Floor Coating:
   a. Minimum Volume Solids: 39%, mixed.
   b. Maximum VOC: 50 g/L, mixed.
      1) S-W Armorseal 8100 Water Based Epoxy Floor Coating B70 Series.
      2) Sika Sikafloor 215 Clear Epoxy Topcoat (with Epoxy Color Additive).
      3) PPG Megaseal SL Self-leveling Epoxy Floor Coating, 99-126.
      4) Color(s): Gray.

2.05 EXTRA STOCK

A. Provide left over paint with Owner for touch-up purposes. At completion of project, provide one complete set of drawdowns in each maintenance manual with a schedule noting the locations each paint color was used. Refer to Section 01 78 39.

PART 3: EXECUTION

3.01 PREPARATION OF SURFACES

A. General

1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

2. Do not start work until preparation specified in surface Section is completed.

3. Ensure surfaces are dry and adequately protected from dampness.

4. Thoroughly clean surfaces free of loose, rough and foreign substances which will affect adhesion or appearance of applied coats.

5. Remove mildew and neutralize surface.

6. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting.

   a. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
   b. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

7. Complete repainting or refinishing will be required if coats are applied over improperly prepared surfaces.

B. Wood

1. Hand sandpaper to smooth surface. Sand direction of grain, taking care not to mar character of details and sharp edges. Remove sanding dust.

2. After first coat is dry, thoroughly coat, with shellac (suitably reduced with alcohol for flowing consistency) or known sealer, knots, pitch pockets and resinous sapwood areas.

3. After first coat is dry, fill nail holes, cracks and defects with colored putty tinted to match stain or paint.

C. Gypsum Board:

1. Fill minor irregularities with patching material and sand to smooth level surfaces taking care not to raise nap of paper.

D. Plaster

1. Fill cracks, holes or imperfections with patching plaster and smooth off to match adjoining surfaces. Do not sandpaper.

2. In case of high alkali or lime conditions, neutralize with solution recommended by paint manufacturer.

3. Do not paint until moisture content of surface is 12% or below, except as may be required by paint manufacturer.

E. Formed and Precast Concrete

1. Remove all traces of form oil, dirt, laitance, loose cement and leftover residue from precast manufacturing process per paint manufacturer's recommendations.

2. Do not paint until moisture content of surface is 15% or below except as may be required by paint manufacturer.

3. Previously painted surfaces must be free of grease, oil, wax or any other contaminants and loose or flaking paint. Clean concrete of oil and grease with detergent, hot water and vigorous scrubbing. All loose and peeling paint must be scraped or sand blasted back to sound adhesion.

F. Masonry

1. Do not paint until moisture content of surface is 15% or below except as may be required by paint manufacturer.

2. After prime coat is dry, fill remaining small holes, cracks and other defects with Swedish putty made by mixing dry spackle with prime paint.

G. Ferrous or Galvanized Metal

1. Remove dirt and grease with mineral spirits or solvent recommended by paint manufacturer and clean cloths.

2. If prime coat is not smooth, sand to bare metal, reprime. Touch up scratched or abraided primer.

H. Aluminum:

1. Remove dirt and grease with mineral spirits or solvent recommended by paint manufacturer and clean cloths.

I. Concrete Floors:

1. To receive paint or non-slip paint: Shotblast floor to resemble 100 grit sandpaper. Torch fiber reinforcing exposed after shot blasting. Fill cracks, voids, bug holes, gouges or divots with Crack Filler.

3.02 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent
2. Masonry: 12 percent
3. Wood: 15 percent
4. Gypsum Board: 12 percent
5. Plaster: 12 percent

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

E. Conditions

1. Do no work when surface, coating product, air temperature, humidity or dewpoint does not meet requirements of PROJECT CONDITIONS in Part 1 of this specification.

2. Do no interior work until building is properly enclosed.

3. Do work under adequate illumination and dust-free conditions.

3.03 APPLICATION

A. Methods: Paint may be applied by brush, roller or spray methods except where particular method will produce unsatisfactory results. Where spray method is used on concrete block, follow with roller to work paint into voids.

B. Materials: Do not open containers until required for use. Stir materials thoroughly and keep at uniform consistency during application.

C. Coats

1. Number specified is minimum. Provide sufficient number of coats to provide even, consistent, opaque coverage of substrate.

2. Touch up suction spots between coats.

3. Refinish surfaces affected by refitting work.

4. Tint prime and under coats of paint approximately 1/2 to 3/4 depth of final color.

5. Touch up suction and "hot" spots in plaster and concrete after application or first coat and before second coat.

6. Do not apply next coat until previous is thoroughly dry.

7. Provide final coat which is solid and even in color; free from runs, laps, sags, brush marks, air bubbles and excessive roller stipple and worked into crevices, joint and similar areas.

8. Do not paint sealant / sealant joints.

3.04 SCHEDULE OF EXTERIOR WORK

A. General: Do not paint brick, stucco, precast concrete, prefinished aluminum, sealant (unless scheduled to receive paint).

1. New Work: Paint or finish all other new, unfinished, primed and factory painted surfaces, including all rooftop mechanical equipment, screen louvers, wall louvers (not factory-finished), miscellaneous metals, steel lintels and prefinished metal copings (color to match brick) occurring in brick as detailed.

B. Concrete, Stucco, Concrete Masonry Units, Fluted Block and Restored Masonry (except soffits):

1. 1st Coat (New Surfaces): 100% Acrylic Exterior Masonry Primer.
   a. Minimum DFT: 8 mils.
2. 2nd and 3rd Coat: 100% Acrylic Exterior Satin Coating.
   a. Minimum DFT: 1.1 mils per coat.

C. Zinc-coated Metal – Flashing, Decking, and Exposed Mechanical Including Rooftop Mechanical:

1. Touch-up: Rust-inhibitive Waterborne Acrylic Primer.
   a. DFT: 2.5-5.0 mils.
2. 2nd and 3rd Coat: 100% Acrylic Exterior Satin Coating.
   a. Minimum DFT: 1.3 mils per coat.

D. Zinc-coated Metal – Doors, Frames and Handrails:

1. Touch-up: Rust-inhibitive Waterborne Acrylic Primer.
   a. DFT: 2.5-5.0 mils.
2. 2nd and 3rd Coat: Non-blocking, 100% Acrylic Exterior Gloss Coating.
   a. Minimum DFT: 1.3 mils per coat.

E. Aluminum – Mill Finish (scheduled to be painted):

1. 1st Coat (New Surfaces): Rust-inhibitive Waterborne Acrylic Primer.
   a. DFT: 2.5-5.0 mils.
2. 2nd and 3rd Coat: Non-blocking, 100% Acrylic Exterior Gloss Coating.
   a. Minimum DFT: 1.3 mils per coat.

F. Wood – Painted, Wood, Plywood.
   1. 1st Coat (New Surfaces): 100% Acrylic Exterior Wood Primer
      c. Minimum DFT: 1.4 mils
   1. 1st Coat (Existing Surfaces): Existing Painted Surface Primer.
      a. Minimum DFT: 0.9 mils.
   2. 2nd and 3rd Coat: 100% Acrylic Exterior Satin Coating
      a. Minimum DFT: 1.3 mils per coat

3.05 SCHEDULE OF INTERIOR WORK

A. General

1. Paint complete all surfaces noted with a "PT" on Room Finish Schedule.

   a. New Work: In rooms with surfaces not scheduled for paint on Room Finish Schedule, paint hollow metal doors and frames, metal stairs and railings as occur.

2. Provide specified finish on exposed surfaces including, but not limited to the following:

   a. Prime coated mechanical units, piping, pipe covering, sprinkler piping, interior duct surfaces visible behind grilles, tanks without factory finish, radiation covers, cabinet unit heaters, exposed ductwork, louvers and grilles.

   b. Electrical panel box covers and surface raceways (over factory finish), conduits and boxes and all factory primed electrical equipment. (Except in maintenance, service and electrical rooms).

   c. Hollow metal doors and frames, steel stairs, ladders and railings, catwalks and safety mesh grilles, access panels, prime painted hardware, painted astragals and vision lite kits on doors, coiling grilles and doors (unless factory finished), metal supports for counters and exposed miscellaneous metals.

3. Do not paint sealant.

4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

5. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

6. Partition Identification

   a. Place identification on all partitions indicated on Code Drawings as having a required fire or smoke rating.

   b. Identification shall be as follows:

      1) Rating (i.e. 2 HR Fire Wall; Smoketight; 2 HR Fire Barrier): Same as indicated on Code Drawing Legend.
      2) Location: With-in 15 feet at the end of each wall and a maximum of 30 feet on center, both sides of partitions, above ceiling line and below access floors.
         a) Place above access panels in hard ceilings.
      3) Style of Lettering: 3 inches high, Arial Bold style, painted with aid of stencils.
      4) Color: Red.

B. Gypsum Drywall – Wall (not scheduled for epoxy):

   1. 1st Coat (New Surfaces): 100% Acrylic Interior Primer.
      a. Minimum DFT: 1.5 mils.
   2. 2nd and 3rd Coat: Vinyl Acrylic Interior Eggshell Finish.
      a. Minimum DFT: 1.5 per coat.

C. Gypsum Drywall – Soffits/Ceilings (not scheduled for epoxy):

1. 1st Coat (New Surfaces): 100% Acrylic Interior Primer.
   a. Minimum DFT: 1.5 mils.
2. 2nd and 3rd Coat: Vinyl Acrylic Interior Flat Finish.
   a. Minimum DFT: 1.4 per coat.

D. Exposed Overhead Work:

1. Touch-up: Rust-inhibitive Waterborne Acrylic Primer.
   a. DFT: 2.0-5.0 mils.
2. 2nd Coat: 100% Acrylic, Waterborne Eg-Shel Dryfall.
   a. DFT: 2.1-4.5 mils.

E. Concrete Floors (scheduled to receive paint)

1. Apply Floor Crack Filler as needed.
2. First Coat: Water Based Epoxy Floor Primer.
   a. Minimum DFT: 2.0-3.0 mils.
3. Second Coat: Water Based Epoxy Floor Coating with color additive.
   a. Minimum DFT: 6.5-7.5 mils.
4. Third Coat: Water Based Epoxy Floor Coating.
   a. Minimum DFT: 6.5-7.5 mils.
   b. Slip Resistant: 3.2 oz per gallon. (Verify with Owner before proceeding).

3.06 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.07 FIELD QUALITY CONTROL

A. Testing and Painting Application: Owner reserves the right to test DFT of painted surfaces.

1. If testing discovers that DFT of installed paint does not meet specification, the Contractor will pay for initial and final testing and recoat surfaces until testing agency confirms specification is met.

END OF SECTION 09 91 00

SECTION 10 28 13

TOILET ACCESSORIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Toilet accessories where shown on the Drawings and specified herein.

B. Related work specified in other sections:

1. Blocking - Section 06 10 53.

1.03 SUBMITTALS

A. Brochure: Submit brochure and schedule of materials in accordance with Section 01 33 00.

B. Submit a sample of each item dispensed by each type dispensing accessory machine or accessory to Construction Manager.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver items in manufacturer's original unopened protective packaging.

B. Store materials in original protective packaging to prevent soiling, physical damage, or wetting.

C. Handle so as to prevent damage to finished surfaces.

D. Protection:

1. Maintain protective covers on all units until installation is complete.

2. Remove protective covers at final clean-up of installation.

PART 2: PRODUCTS

2.01 MANUFACTURER

A. The products of Bobrick are specified, comparable products of Bradley are acceptable. All units and trim stainless steel, #4 finish.

2.02 ACCESSORIES

A. Grab Bars (Field verify sizes)

1. G.B. No. 1: B-6806 x 42" horizontal and B-6806 x 18" vertical.

2. G.B. No. 2: B-6806 x 36".

3. G.B. No. 3: B-6806 x 18".

4. G.B. No. 4: B-6806 x 24”.

5. G.B. No. 5: B-6861 ‘L’ shaped 16” x 31”.

6. G.B. No. 6: B-68616 ‘L’ shaped 24” x 36”.

B. Toilet Paper Holders “TPH”: B-274.

C. Mirrors

1. M No. 1: B-290 2436.

D. Paper Towel Dispenser “PTD” (Surface mounted): Supplied by Owner, installed by Contractor.

E. Shelf and Mop Holder, Janitor Closet: B-239 x 34, with 4 hooks and 3 mop holders.

F. Coat Hook: B-677

G. Towel Bar: B-6806 x length as shown on drawings.

H. Soap Dish: B-680

I. Toiletry Shelf: B-295 (5” x 24”). Install in each toilet compartment.

J. Shower Seat:

a. #1: B-5181 Reversible folding ‘L’ shaped seat.

b. #2: B-5191 Rectangular folding seat.

K. Shower Curtain Rod and Shower Curtain

1. Shower Curtain Rod: B-6107 by lengths shown.

2. Shower Curtain: B-204-2 with B-204-1 curtain hooks, provide quantity as needed for length of curtain.

L. Soap Dispensers (SD).: Supplied by Owner, installed by Contractor.

M. Keys to Locked Accessories: Manufacturer's standard, keyed alike.

N. Mounting Kits: Provided with each unit shall suit wall construction.

O. Dispensing Accessories: Fully loaded and in operating condition at time of completion.

PART 3: EXECUTION

3.01 INSPECTION

A. Check opening scheduled to receive recessed units for correct dimensions, plumbness of blocking or frames, preparation that would affect installation of accessories.

B. Check areas to receive surface mounted units for conditions that would affect quality and execution of work.

C. Verify spacing of plumbing fixtures and toilet partitions that affect installation of accessories.

D. Coordinate blocking requirements with Section 06 10 53, prior to enclosure of walls.

E. Do not begin installation of washroom accessories until openings and surfaces are acceptable.

3.02 INSTALLATION

A. Drill holes according to manufacturer's mounting templates or printed instructions.

B. Mount recessed accessories into wall openings with wood screws through cabinet side into wood blocking, or sheet metal screws into metal frames.

C. Mount surface mounted accessories to back up with toggle bolts, plumb and align.

D. Anchor grab bars to through-wall anchor plates.

3.03 ADJUST AND CLEAN

A. Adjust accessories for proper operation.

B. After completion of installation, clean and polish all exposed surfaces.

C. Deliver keys and instruction sheets to Owner's Representative.

END OF SECTION 10 28 13

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes: All fire extinguishers, cabinets, and brackets and fire blanket as specified and shown on drawings.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Brochure: Submit brochure of materials and installation details.

2. Shop Drawing to indicate location and quantities of all products.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner that will avoid damage. Damaged equipment will be rejected.

PART 2: PRODUCTS

2.01 MANUFACTURER

A. All equipment is specified from the line of J. L. Industries; comparable equipment of Elkhard Brass Mfg. Co., General, Noris, Larsen and Badger are acceptable.

2.02 FIRE EXTINGUISHERS AND CABINETS

A. Provide a UL rated fire extinguisher, cabinet or bracket when "FE" is shown on the drawings per the following table:

Application	Wall Material and/or Rating	Cabinet or Bracket Model	Fire Extinguisher Model
Public Occupied Space	Gypsum board, masonry & concrete non-rated walls.	1027 V10, semi-recessed with 3" return	Cosmic 10E, 4A-60BC
Public Occupied Space Food Preparation Areas	Gypsum board, masonry & concrete non-rated walls.	2027 V10, semi-recessed with 3" return	Saturn 15 Class K
Public Occupied Space	2 hr and under fire-rated gypsum board, masonry & concrete walls (cabinet carries rating)	1027 V10, semi-recessed with 3" return and Fire-FX rated tub	Cosmic 10E, 4A-60BC

Application	Wall Material and/or Rating	Cabinet or Bracket Model	Fire Extinguisher Model
Public Occupied Space	Over 2 hr gypsum board, masonry & concrete walls (wall carries rating)	1027 V10, semi-recessed with 3” return	Cosmic 10E, 4A-60BC
Public Occupied Wood, Metal and Auto Shops	All types	Surface mounted bracket MB818.	Cosmic 5E, 2A-10BC
Non-public Occupied Space (i.e., boiler rooms and mechanical rooms, electrical and data rooms, receiving areas, storage rooms, elevator equipment rooms)	All types	Surface mounted bracket MB818.	Cosmic 5E, 2A-10BC

B. Cabinets shall be clear anodized aluminum with vertical narrow acrylic glazing and black vertical letters stating “FIRE EXTINGUISHER.”

PART 3: EXECUTION

3.01 INSTALLATION

A. Install level and plumb, true to line and in accord with approved installation details.

B. Unless otherwise shown, install 40 lbs. or less extinguishers 4'-6" from floor to top of cabinet, or to nearest horizontal masonry joint, but not higher than 5’-0”. For extinguishers greater than 40 lbs., install top of cabinet no higher than 3’-6”.

C. Check extinguishers for proper charge, operation.

D. Remove and replace damaged, defective or under charged units.

END OF SECTION 10 44 00

SECTION 10 57 13

COAT RACKS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SCOPE

A. Section includes:

1. Coat racks as shown on drawings.

B. Related work specified in other sections:

1. Wood Blocking - Section 06 10 53.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Product data for each type of accessory specified, with installation instructions for each unit built-in or connected to other construction. Include methods of installation for each type of substrate.

2. Shop drawings showing installation and exact length of units required.

3. Samples for initial selection purposes consisting of manufacturer's standard size samples showing full range of colors.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, and lot number. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity; laid flat, blocked off ground to prevent sagging and warping.

B. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1.05 SEQUENCE AND SCHEDULING

A. Sequence accessory installation with other work to minimize possibility of damage and soiling during remainder of construction period.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Magnuson Group, Woodridge, IL, www.magnusongroup.com or equal.

2.02 COAT RACKS

A. WK01 Series hook style wall racks. Lengths as shown on drawings. Color as selected from manufacturer's full range of designer colors.

B. Adjustable brackets.

C. Fasteners: Screws, bolts or other exposed devices of same material as accessory unit.

PART 3: EXECUTION

3.01 INSTALLATION

A. Verify that materials are those specified before installing.

B. Install accessories after other finishing operations, including painting, have been completed.

C. Wall-Mounted Accessory Units: Install accessories complying with manufacturer's printed instruction, using fasteners as recommended by manufacturer as appropriate to substrate.

D. Clean and polish exposed surfaces, using materials and methods recommended by the manufacturer.

3.02 PROTECTION

A. Protect accessories against damage during remainder of construction period, complying with manufacturer's directions.

B. Installed work shall be in true line, level, plumb, in correct relation to adjoining work, and exact height required above floor.

C. Prior to Substantial Completion of this work, test the installation for proper operation, and make ready for operation by the Owner.

END OF SECTION 10 57 13

SECTION 10 75 00

FLAGPOLE

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes: Flagpoles on concrete base as detailed.

B. Related work specified in other sections:

1. Concrete base is in Section 03 30 00.

1.03 SUBMITTALS

A. Shop Drawings: Submitted for approval by Architect, prior to fabrication. Indicate general layout, dimensions, finishes, foundation and base, jointing, anchoring and support systems, trucks, finials, base collar. Refer to Submittals Section for submittal requirements.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with heavy kraft paper, wood strip and steel band or polyethylene wrap and pack in tube prior to shipment.

B. Deliver flagpole in original wrappings and in single piece.

C. Store flagpole, in original wrappings, in area protected from weather, moisture, and damage.

D. Handle flagpole so as to prevent damage or soiling.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Product by Concord Industries specified. Products by American Flagpole-Division of Kearney-National, Inc., Eder Flag Pole Company, Morgan Francis Co., Pole-Tech Co., or Morgan Products are acceptable.

2.02 MATERIALS

A. Model: Sentry concealed halyard system. Metal: Seamless extruded aluminum tubing, 6063-T6 alloy, heat treated and age hardened, mechanical finish, internal type lanyard.

B. Type: Cone tapered, ground set with FC-11 flash collar finished to match pole sized to accommodate butt diameter of flagpole. 30' high. 6" outside diameter at base, 3 1/2" outside diameter at top.

C. 16 gauge galvanized Foundation Sleeve, Support Plate, 3/4" diameter x 18" Lightning Arrestor Spike.

D. Fittings: Include 14 gauge spun gold anodized aluminum 5" ball finial, cast aluminum revolving non-fouling truck assembly, one set #10 5/16 inch white waterproof polypropylene halyards, two chrome swivel snaps per halyard. One 3½" neoprene coated counterweight, and one beaded nylon retainer ring. One internally mounted cam-action cleat with integral sheave, factory mounted.

PART 3: PRODUCTS

3.01 INSPECTION

A. Inspect foundations for proper depth and size of sleeve.

3.02 PREPARATION

A. Paint portions of flagpole below grade with heavy coat of bituminous paint.

3.03 INSTALLATION

A. Install flagpoles, base assemblies, and fittings in compliance with acceptable final shop drawings and manufacturer's instructions.

B. Provide positive lightning ground for each flagpole installation.

3.04 TEST AND ADJUST

A. Check and adjust installed fittings for smooth operation of halyards.

END OF SECTION 10 75 00

SECTION 12 32 16

PLASTIC LAMINATE CASEWORK

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Work includes:

1. Plastic laminate casework, including countertops, hardware and accessories.
2. Plastic laminate lockers with plastic drip pan.

B. Related work specified in other sections:

1. Blocking and Grounds – Section 06 10 53.
2. Sinks, Fittings – Division 22.

1.03 REFERENCES/DEFINITIONS

A. Current edition of the Quality Standards of the Architectural Woodwork Institute (AWI) apply, and are by reference a part of this Specification.

B. Identification of casework components and related products by surface visibility.

1. Open Interiors: Any open storage unit without solid door or drawer fronts, units with full glass insert doors and/or acrylic doors, and units with sliding solid doors.
2. Closed Interiors: Any closed storage unit behind solid door or drawer fronts.
3. Exposed Ends: Any storage unit exterior side surface that is visible after installation.
4. Other Exposed Surfaces: Faces of doors and drawers when closed, and tops of cabinets less than 72 inches above furnished floor.
5. Semi-Exposed Surfaces: Interior surfaces which are visible, bottoms of wall cabinets and tops of cabinets 72 inches or more above finished floor.
6. Concealed Surfaces: Any surface not visible after installation.

1.04 QUALITY ASSURANCE

A. Manufacturer: Minimum of 5 years experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this project.

B. Manufacturer: Provide products certified as meeting or exceeding ANSI-A 161.1-2000 testing standards.

C. Single Source Manufacturer: Casework, countertops and architectural millwork products must all be engineered and built by a single source manufacturer in order to ensure consistency and quality for these related products. Splitting casework, countertops and/or architectural millwork between multiple manufacturers will not be permitted.

1.05 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00, indicate the following:

1. Casework: Elevations and locations of each assembly. Indicate dimensions, thicknesses, surfacing materials, drawers, doors and door swings, sections of typical and special cases. Indicate core materials, edge treatments and construction.

2. Work Surfaces: Plans and locations of each work surface. Indicate dimensions. Indicate locations and sizes of all openings including those for sinks. Indicate provisions for securing work surfaces to cases, windowsills.

B. Submit manufacturer's product data for stock items.

C. Provide samples of base cabinet, wall cabinet, hardware, plastic laminate and edging if requested by Architect.

1.06 PRODUCT HANDLING, STORAGE AND DELIVERY

A. Deliver, store and handle work to prevent damage, staining and disfigurement. Do not store woodwork in wet or damp areas. Jobsite storage areas shall be enclosed, dry, and ventilated.

1.07 WARRANTY

A. All materials to be guaranteed for a period of 5 years from manufacturer's defects and workmanship. Submit in accordance to Section 01 78 23.

PART 2: PRODUCTS

2.01 MANUFACTURER

A. Manufacturers who are AWI members are acceptable with minor deviations from these specifications.

2.02 MATERIALS

A. Lumber and Plywood

1. Plywood for cabinet bases: 3/4" water resistant A-C interior fir plywood with #3 glue.

2. Core Materials:

a. Particleboard up to 7/8 inch thick: Industrial Grade average 45-pound density particleboard, ANSI A 208.1-2009, M-2 requirements.
b. Particleboard 1 inch thick and thicker: Industrial Grade average 45 pound density particle board, ANSI A 208.1-2009, M-2 requirements.
c. Medium Density Fiberboard ¼ inch thick: Average 54-pound density grade, ANSI A208.2-2009 requirements.
d. MR Moisture Resistant Particleboard: Average 45-pound density particleboard, ANSI A208.1 1-2009, M-2 requirements.

2. Cabinet Body Core:

a. Core material shall be formaldehyde free.

3. Hardboard: Tempered hardboard, smooth both sides, minimum 1/4" thick. Meet requirements of Commercial Standard CS-251 and Federal Specifications LLL-B-00810.

4. Plywood for sub-base: Preservative treated exterior grade plywood, ¾" thick.

B. Plastic Laminate:

1. Plastic laminate manufacturers listed below are approved under the following conditions:

a. A manufacturer listed in both the specification and the Material Finish/Color Schedule, on Architectural Drawings is not required to submit a pre-bid approval.
b. Manufacturers listed in this specification, but not in the Material Finish/Color Schedule, on Architectural Drawings shall submit color samples for pre-bid approval by addendum. Refer to Section 01 25 00.
c. When no colors are listed in the Material Finish/Color Schedule, on Architectural Drawings, any manufacturer listed in this specification are not required to submit a pre-bid approval.

2. Products by Wilsonart, Formica, Westinghouse, Pionite and Nevamar are acceptable. Architect reserves the right to select from any of the above manufacturer's if a specific color is not noted in the material finish/color schedule.

3. Decorative Laminates: GREENGUARD Indoor Air Quality Certified

   a. High-pressure decorative laminate VGS (.028), NEMA Test LD 3-2005.
   b. High-pressure decorative laminate HGS (.048), NEMA Test LD 3-2005.
   c. High-pressure decorative laminate HGP (.039), NEMA Test LD 3-2005.
   d. High-pressure cabinet liner CLS (.020), NEMA Test LD 3-2005.
   e. High-pressure backer BKH (.048), (.039), (.028), NEMA Test LD3-2005.
   f. Thermally fused melamine TFM laminate, NEMA Test LD 3-2005 (TFM allowed on casework interiors only.)

4. Color: See Material Finish/Color Schedule, on Architectural Drawings.

C. Edging

1. Counter tops, backsplashes and exposed shelving, cabinet doors and drawers: 3MM PVC. Color: See Material Finish/Color Schedule, on Architectural Drawings.

2. Cabinet body and shelf/shelving edges: 1MM PVC, color matched to drawer/door/shelf face.

D. Hardware

1. Hinges

   a. Five knuckle, epoxy powder coated, institutional grade, 2-3/4 inch overlay type with hospital tip. 0.095 inch thick. ANSI-BHMA standard A156.9, Grade 1.
      1) Doors 48 inches and over in height have 3 hinges per door.
      2) Magnetic door catch with maximum 5 pound pull provided, attached with screws and slotted for adjustment.

2. Pulls: Wire design, 4 inches in chrome coat powder finish.

3. Drawer Slides:

   a. Regular, kneespace and pencil: 100-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature.

   b. Paper storage and file: Full extension, 150-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature.

4. Adjustable Shelf Supports:

   a. Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on 32 mm centers. Each shelf support has 2 integral support pins, 5mm diameter, to interface pre-drilled holes, and to prevent accidental rotation of support. The support automatically adapts to ¾ inch or 1 inch thick shelving and provides non-tip feature for shelving. Supports may be filed fixed if desired. Structural load to 1200 pounds (300 pounds per support) without failure.

5. Locks:

   a. Removable core, disc tumbler, cam style lock with strike. Lock for sliding ¾ inch thick doors is a disc type plunger lock, sliding door type with strike. Lock for sliding glass/acrylic doors is a ratchet type sliding showcase lock.

   b. Elbow catch or chain bolt used to secure inactive door on all locked cabinets.

E. Miscellaneous Materials

1. Coat Hooks

a. Wall mounted:

1. Single coat hooks: LH-365 or Ives 581 satin aluminum.

2. Double coat hooks: LH-366 or Ives 405 satin aluminum.

b. Ceiling or bottom of shelf mounted:

1. Double coat hooks: Ives 580 satin aluminum.

2. Support Members:

a. Countertop support brackets: Epoxy powder coated, 11 gauge steel with integral cleat mount opening and wire management opening.
b. Undercounter support frames: Epoxy powder coated.
c. Legs: Epoxy powder coated.

3. Tote Trays/Drip Pans:

a. Heavy-duty vacuum0formed polypropylene plastic with full top rim and pull. Trays are ivory color, equipped with label holder. Size: 10-1/2" W x 3-1/2" H x 19" D.

b. Tote tray/supply cabinets equipped with injection molded polycarbonate; continuous side rail support glide. Each side rail support glide is adjustable with integral support pins to interface 32mm pre-drilled holes.

c. Locker drip pan model sized to fit snugly in bottom of locker.

2.03 FABRICATION

A. Fabricate casework, countertops and related products to dimensions, profiles, and details shown.

B. All casework panel components must go through a supplemental sizing process after cutting, producing a panel precisely finished in size and square to within 0.010 inches, ensuring strict dimensional quality and structural integrity in the final fabricated product.

C. Cabinet Body Construction:

1. Tops and bottoms are glued and doweled to cabinet sides and internal cabinet components such as fixed horizontals, rails, and verticals. Minimum 6 dowels each joint for 24 inch deep cabinets and a minimum of 4 dowels each joint for 24 inch deep cabinets and a minimum of 4 dowels each joint for 12 inch deep cabinets. (Mechanical or metal hardware fasteners joining cabinet top and bottom panels to the sides will not be accepted.)

a. Tops, bottoms, and sides of all cabinets are particleboard core.

2. Cabinet backs: ¼ inch thick medium density fiberboard panel fully captured by the cabinet top, bottom, and side panels. Finish to match cabinet interior. ¾ inch x 4 inch particleboard rails will be placed behind the back panel at the top and bottom, and doweled to the sides utilizing 10mm hardwood fluted dowels. A third intermediate rail will be included on all cabinets taller than 56 inches. Utilize hot melt glue to further secure back and increase overall strength.

a. Exposed back on fixed or movable cabinets: ¾ inch thick particleboard with the exterior surface finished in VGS laminate as selected.

3. Fixed base and tall units have an individual factory-applied base, constructed of ¾ inch thick plywood. Base is 102mm (nominal 4 inch) high unless otherwise indicated on the drawings.

4. Base units, except sink base units: Full sub-top glued and doweled to cabinet sides. (Mechanical or metal hardware fasteners joining cabinet sub-top panel to the sides will not be accepted.)

    a. Sink base units are provided with open top and a stretcher at the front, attached to the sides. Back to be split removable access panel.

5. Side panels and vertical dividers shall receive adjustable shelf hardware at 32mm line boring centers. Mount door hinges, drawer slides, and pull-out shelves in the line boring for consistent alignment.

6. Exposed and semi exposed edges.

    a. Edging: 1mm PVC machine applied.

7. Adjustable Shelves in Cabinets

    a. Core: Particleboard.

    b. Core Thickness: ¾ inch up to 30 inches wide, 1 inch over 30 inches wide.

    c. Edge: 1mm PVC on Front Edge Only.

8. Interior finish, units with open interiors:

    a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with high-pressure decorative VFS laminate. Use of TFM on exposed ends will not be permitted.

9. Interior finish, units with closed interiors:

    a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with TFM Thermally Fused Melamine laminate.

10. Exposed ends:

    a. Faced with high-pressure decorative VFS laminate. Use of TFM on exposed ends will not be permitted.

11. Wall unit bottom:

    a. Faced with thermally fused melamine laminate.

12. Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), are not permitted.

D. Drawers:

1. Sides, back and sub front: Minimum ½ inch thick particleboard laminated with TFM Thermally Fused Melamine doweled and glued into sides. Top edge banded with 1mm PVC.

2. Drawer bottom: Minimum ½ inch thick particleboard laminated with TFM Thermally Fused Melamine, screwed directly to the bottom edges of drawer box.

3. Paper storage drawers: Minimum ¾ inch thick particleboard sides, back, and sub front laminated with TFM Thermally Fused Melamine. Minimum ½ inch thick particleboard drawer bottoms screwed directly to the bottom edges of the drawer box. Provide PVC angle retaining bar at the rear of the drawer.

E. Door/Drawer Fronts:

1. Core: ¾ inch thick particleboard.

2. High-pressure decorative VGS laminate exterior, balanced with high-pressure cabinet liner CLS. Use of TFM on exterior or interior surfaces of door/drawer fronts will not be permitted.

3. Edges: 3mm PVC, machine applied, external edges and outside corners machine profiled to 1/8 inch radius.

4. Provide double doors in opening in excess of 24 inches wide.

5. Paper storage drawers to be fitted with full width hood at back.

F. Miscellaneous Shelving (not in Cabinets):

1. Core material: 1 inch thick particleboard.

2. High-pressure decorative VGS laminate on both faces.

3. Edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.

4. Vertical and Horizontal Dividers:

a. Tempered hardboard 1/4" thick, smooth both faces. Secured in cabinet with molded plastic clips.

b. Melamine laminated core 3/4" thickness. Secured in cabinet with molded plastic clips or dowels.

2.04 PLASTIC LAMINATE COUNTERTOPS

A. Core:

1. All countertops except at sink elevations: 1-1/18 inch thick ANSI A208. 1-1993 M-2 particleboard.

2. Countertops at sink elevations: 1-1/18 inch thick ANSI A208.1-1993 M-3 moisture resistant (MR) particleboard.

B. Surface: High-pressure decorative HGS/HGP laminate with balanced backer sheeting.

C. Edges, including applied backsplash: 3mm PVC, exposed edges and corners machine profiled to 1/8 inch radius.

D. All countertop joints must be dy fit at the factory to check for consistency in color from one panel to the other and overall finished panel thickness, resulting in a high quality product easy to install.

PART 3: EXECUTION

3.01 COORDINATION

A. Coordinate work of this Section with related work of other sections as necessary to obtain proper installation of all items.

B. Verify site dimensions of cabinet locations in building prior to fabrication. Notify General Contractor or Construction Manager in writing if unsatisfactory conditions are discovered. Proceed only when unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Storage and Protection: Casework shall be protected in transit. Store under cover in a ventilated building not exposed to extreme temperature and humidity changes. Do not store or install casework in building until concrete, masonry and plasterwork is dry.

B. Workmen: Install casework conditioned to average prevailing humidity under the supervision of the manufacturer's representative with factory-trained mechanics authorized by manufacturer.

C. Workmanship

1. Erect casework straight, level and plumb and securely anchor in place. Scribe and closely fit to adjacent work. Cut and fit work around pipes, ducts, etc.

2. Install all items complete and adjust all moving parts to operate smoothly.

3. Leave surface clean and free from defects at time of final acceptance.

D. Clean up:

1. Remove all cartons, debris, sawdust, scraps, etc. and leave spaces clean.

2. Clean cabinets inside and out. Wipe off fingerprints, pencil marks, and surface soil. Clean inside of sawdust and construction debris.

END OF SECTION 12 32 16

SECTION 13 34 21

PRE-ENGINEERED WOOD BUILDING SYSTEM

PART 1: GENERAL

1.01 APPLICABLE DOCUMENTS

A. Bidding Requirements, Conditions of the Contract and pertinent portions of Sections in Division 1 of these Specifications, apply to Work of this Section.

1.02 SUMMARY

A. Section includes:

1. Furnish and install the following:
   a. Factory pre-engineered and field fabricated timber column structure.
   b. Prefinished metal roofing panels, vents, soffits, gutters and downspouts.
   c. Prefinished metal siding panels.
   d. Prefinished interior liner panels.
   e. Skylights.
   f. Weather barrier, insulation and vapor barrier.
   g. Exterior sectional metal overhead doors and exterior hollow metal doors and door frames.
   h. Exterior aluminum clad windows and glazing.
   i. Sealants at joints or transitions between materials as recommended by the manufacturer.
   j. Other miscellaneous materials as typically recommended by the building manufacturer for a complete and weather-tight structure.
2. **Contractor option:** Bidder may propose alternative pre-engineered building systems (wood or steel) to Architect prior to bidding in accordance with Section 01 25 00 Substitutions and Production Options. Proposals shall demonstrate ability to conform to the building design and specficiations.

B. Related work specified in other sections:

1. Section 08 10 00 – Steel Doors and Frames

2. Section 08 36 00 – Sectional Metal Overhead Doors

3. Section 08 40 00 – Aluminum Storefronts and entrances

4. Section 08 71 00 – Finish Hardware

4. Division 26 - Electrical Installation of Outlet and Lights.

1.03 DEFINITIONS AND ABBREVIATIONS

A. Drawings: Contract documents prepared by the Architect.

B. Erection Drawings: Detailed project drawings prepared by the building manufacturer.

C. Primary Framing: Pre-fabricated wood columns and pre-fabricated wood trusses including corner and endwall columns and trusses with required fasteners.

D. Secondary Framing: Wood purlins, girts, splashplank, and bracing.

E. SYP: Southern Yellow Pine

F. PSF: Pine-Spruce-Fir

1.04 REFERENCE STANDARDS

A. Preservative Treated Lumber

1. American Wood Protection Association (AWPA)
   a. Commodity Specification C2 (2001), Preservative Treatment By Pressure Processes
   b. Use Category System U1, User Specification for Treated Wood
   c. UC4A (Important Structural – Ground Contact)
   d. UC4B (Structural Support – Ground Contact)
   e. Items treated under AWPA standards shall bear the quality mark of an independent testing agency or service

2. International Code Council Evaluation Service (ICC-ES)
   a. Items treated under ICC-ES reports shall meet or exceed the applicable standard and shall bear the quality mark of an independent testing agency or service.

3. Federal Specification TT-W-571-J.

B. Framing Lumber
   1. Lumber Grading Rules and Wood Species
      a. National Design Specification for Wood Construction, current edition
      b. Northeastern Lumber Manufacturer's Association, Inc. (NELMA)
      c. Southern Pine Inspection Bureau (SPIB)
      d. West Coast Lumber Inspection Bureau (WCLIB)
      e. Western Wood Products Association (WWPA)

C. Wood Trusses
   1. All lumber used in the design of wood trusses shall be kiln dried to maximum 19% moisture content and graded in accordance with the current grading rules. Design stresses allowed are those listed in the current editions of the respective Lumber Association's grading rules.
   2. The design of wood members shall be in accordance with the formulas published in the 2001 edition of the "National Design Specification for Wood Construction".
   3. Light metal toothed connector plates and joint design shall conform to specifications as set forth in the 2002 edition of Truss Plate Institute's (TPI) "Design Specification for Metal Plate Connected Wood Trusses".
      a. Connector plates shall be fabricated in accordance with applicable ICC-ES standards.
   4. Truss members and joints shall be designed in accordance with TPI-2002.
   5. Comply with TPI "Quality Standard for Metal Plate Connected Wood Trusses".

1.05 REGULATORY REQUIREMENTS

A. Building Code: International Building Code (IBC), 2012 Edition with amendments as required by local jurisdiction.

B. Energy Code: International Energy Conservation Code (IECC), 2012 Edition with amendments as required by local jurisdiction.

C. Contractor shall be responsible for compliance with all applicable building codes and ordinances covering the work.

D. Contractor shall cooperate with authorities having jurisdiction and provide data as requested.

1.06 DESIGN LOADS

A. Design loads shall be per the Building Code indicated under Regulatory Requirements and shall govern in all cases, unless more stringent requirements are included herein.

B. The basic design loads shall include dead, live and wind loads.

C. Vertical Live Loads:

1. Roof shall be designed for a vertical live load of 30 psf.

2. Vertical live load to be in addition to the applicable dead loads and shall be applied to the horizontal projection of the roof.

3. Roof covering, purlins and primary framing member shall be designed for drifting snow and/or sliding snow. Comply with AF&PA "National Design Specification for Wood Construction" (NDS). Drifting and/or sliding snow load shall be a minimum of 60 psf.

D. Wind Loads: The wind load on the structure shall be 20 psf velocity pressure proportioned and applied as horizontal and uplift forces. Comply with AF&PA "National Design Specification for Wood Construction" (NDS).

E. Auxiliary (additional collateral) Loads: Other superimposed dynamic and/or static loads shall be considered as part of the design requirement and combined with the normal design (live and/or wind) loads as prescribed hereafter. The roof framing shall be designed for an auxiliary load of 3 psf to accommodate lighting and electrical distribution systems, overhead doors.

F. Combination of Loads: The combining of normal loads and auxiliary loads for design purposes shall be as prescribed and recommended by the AF&PA "National Design Specification for Wood Construction" (NDS), most recent edition.

G. Perform calculations using diaphragm design analysis. Incorporate bracing as required if building exceeds diaphragm requirements.

1. Comply with AF&PA "National Design Specification for Wood Construction (NDS)."

2. Trusses:

a. Limit deflection for live or snow loads to L/240 for trusses supporting ceilings and to L/180 for overhangs and trusses not supporting ceilings.

b. Comply with appropriate NDS and Truss Plate Institute (TPI) standards.

H. Plywood or Oriented Strand Board Sheathing: Comply with APA "Plywood Design Specification."

I. Expansion/Contraction Provisions: Design clip attachment system to allow for expansion and contraction of metal roofing, due to seasonal temperature variations, without detrimental effect to the roof panels.

J. Veneer Masonry Provisions: At areas to receive veneer masonry provide additional supplemental framing members as necessary to limit deflection to l/600 of the span for supporting members.

1.07 SUBMITTALS

A. Reference Section 01 33 00–Submittal Procedures.

B. Submit the following items:

1. Product Data: Include manufacturer's specifications and installation instructions for building components and accessories.

2. Structural Engineer Certification: Letter signed by a Professional/Structural Engineer, registered to practice in the state of Illinois verifying compliance with specified Design Requirements. Letter must reference specific dead loads, live loads, wind loads, tributary area load reductions (if applicable) collateral loads, seismic loads, end use categories, and governing building code including edition and load applications.

3. Shop Drawings: Provide four (4) complete sets bearing the seal of a Professional/Structural Engineer registered in the State of Illinois. Shop Drawings will be submitted to the authorities having jurisdiction for procurement of building permit(s) The sets shall include:

    a. Complete and detailed shop drawings for concrete footings and foundations, showing all required dimensions, elevations and reinforcing.
    b. Complete and detailed shop and erection drawings for pre-engineered wood building system, showing size and location of each part and component, certifying that the building design meets specified roof and wind loading requirements.
    c. Final rough opening dimensions, coordinated as required with products to be provided under this Specification Section and other Specifications.
    d. Calculations demonstrating compliance with attic venting Building Code requirements.
    e. Truss design drawings, engineering analysis and design data indicating the following:
        1) Slope, depth, span and spacings of trusses
        2) Heel bearing height
        3) Design loading, including live loads, dead loads and concentrated loads.
        4) Axial forces and bending moments of each member.
        5) Design analysis of each joint demonstrating that proper plates have been applied.
        6) Basic plate design values and adjustments to lumber and plate design values for conditions of use.
        7) Plate type, thickness of gauge and size
        8) Lumber size, species and grade for each member
    f. Other information as required by the authorities having jurisdiction to obtain building permit(s).

4. Energy Efficiency: Submit COMcheck report for building envelope demonstrating compliance with Energy Code indicated under Regulatory Requirements.

5. Samples: Standard material samples for all materials requiring color selection. Color charts are not acceptable for selections of materials.

6. Quality Assurance/Control Submittals:

    a. Written Statements/Certificates:

        1) Manufacturer qualifications.
        2) Dealer qualifications.
        3) Installer qualifications.
        4) Manufacturer's third-party truss inspection program.

1.08 QUALITY ASSURANCE

A. All members are to be fabricated in accordance with standard industry practice and to meet Reference Standards and Regulatory Requirements included within these specifications.

B. Structure and structural components shall be designed under direct supervision of a Professional/Structural Engineer registered to practice in the State of Illinois.

C. Contractor shall be responsible for all materials and products provided the Contractor, whether furnished directly by the Contractor or by subcontractor(s) hired by the Contractor.

D. Qualifications:

1. Manufacturer Qualifications: Minimum ten (10) years experience in producing pre-engineered wood buildings of the type specified.

2. Dealer Qualifications: Must be authorized by the manufacturer; state date of Manufacturer authorization granted and expiration of same if any.

3. Installer Qualifications: Minimum one year experience in erection of pre-engineered wood buildings of the type specified and approved by the Manufacturer.

E. Wood Trusses:

1. Manufacturer shall have a third party inspection program to verify compliance with requirements of TPI.

2. Trusses are to be stamped with inspection agency identification.

3. Trusses are to be plant-fabricated, using mechanical or hydraulic fixtures as required to bring members into contact. Plates are to be installed in accordance with manufacturer's instructions.

1.09 FIELD COORDINATION AND MEASUREMENTS

A. Contractor shall coordinate with Others to ensure work by Others is acceptable for installation of products and materials specified under this Section.

B. Field measure and verify site conditions and work by Others to verify that work and components match shop drawings provided under this Section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Arrange to store components and materials on-site, in locations as determined by the General Contractor/Construction Manager.

B. Handle and store all components with care.

C. Handle and store structural components to comply with manufacturer's instructions and TPI recommendations to avoid damage from bending, overturning, or other cause which component is not designed to resist or endure.

D. Store roofing panels, siding panels and other exterior finish materials to allow water to drain freely.

E. Stack materials on platforms, pallets or other structures covered with tarpaulins or other suitable weather-tight ventilated covering.

F. Do not store materials in contact with other materials that may cause staining or discoloration.

G. Do not store materials in direct contact with ground or in standing water.

1.11 WARRANTY

A. The building manufacturer shall supply a warranty to the Owner meeting the following minimum requirements. The warranty period shall start on the date of Substantial Completion. The warranty shall not be prorated.

1. For a period of fifty (50) years:
   a. Repair or replacement costs, including labor and materials, if any preservative treated wood fails due to decay or insect damage.
   b. Repair or replace the building framework, roofing and siding panels damaged by snow loads.

2. For a period of thirty-five (35) years:
   a. Repainting of prefinished metal roofing or siding panels where, under conditions of normal weathering, paint has separated from panels due to flaking or peeling of painted finish.
   b. Repainting of prefinished metal roofing or siding panels where, under conditions of normal weathering, chalking greater than a rating of 8 (ASTM D4212 Method A) or a color change greater than 5 units (ASDM D2244) has occurred.
   c. Repair or repainting of metal wall panels perforated due to deterioration due to red rust.

3. For a period of ten (10) years:
   a. Repainting of prefinished metal roofing or siding panels where, under conditions of normal weathering, the panels exhibit corrosion resulting from red rust greater than ½" from any sheared edge visible in casual observation.

4. For a period of five (5) years:
   a. Repair, or at its discretion, replace free of charge the building framework, including roofing and/or siding panels, if directly damaged by wind loads, unless damage is caused by flying or falling objects.
   b. Repair any roof leaks due to defects in materials or workmanship.

5. For a period of one (1) year:
   a. Repair other building parts that prove to be defective in materials or workmanship.

PART 2: PRODUCTS

2.01 MANUFACTURER

A. Products by Morton Buildings, Inc are specified; 252 West Adams Street, Morton, Illinois 61550; phone (800) 447-7436. Equivalent products by Lester Building Systems are acceptable; 1111 2nd Avenue South, Lester Prairie, MN 55354; phone (320) 395-2531.

B. Other manufacturers may submit for prior approval as described under Substitutions and Product Options information included elsewhere within the Specifications.

2.02 STRUCTURAL FRAMING

A. Primary Framing:

1. Columns: Factory fabricated, laminated using ring shank or wire feed nails per manufacturer's engineered nailing pattern.

   a. Lumber: No. 1 or Better SYP. Kiln dried to 19% maximum moisture content.

   b. Configuration:

      1) Sidewall and Endwall Columns: 3 ply or 4 ply combining 2x6, 2x8, or dimension lumber as required by Structural Design requirements and configured to accept interlocking girts and splashplank.

      2) Corner Columns: 2 ply or 3 ply 2x6 or 2x8 dimension lumber as required by Structural Design requirements and configured to accept interlocking girts and splashplank from side and endwall directions.

   c. Column Anchoring: Factory nailed and glued anchor block attached to base of column as required by Structural Design requirements.

2. Wood Trusses:

   a. Lumber: Top Chord, Bottom Chord and Webs to be SYP of size and grade to meet Structural Design requirements. Constructed of surfaced lumber (S4S) and compliant with SPIB visual and structural grade requirements.

   b. Connector plates shall meet Structural Design requirements and shall be compliant with applicable ICC-ES standards and specifications.

B. Secondary Framing:

1. Purlins and Girts:

a. Lumber: No. 2 or Better SPF dimension lumber kiln dried to 19% maximum moisture content.

b. Configuration: 2x4 or 2x6 as required by Structural Design requirements.

1) Girts: Precision cut to fit.
2) Purlins: Precision cut to fit between trusses flush with top of top chord. Provide 20 gauge galvanized purlin saddle hangers.

c. Spacing: As required by Structural Design requirements. Locate purlins to allow for anchorage of snow guards using mechanical fasteners, or provide additional purlins as required.

2. Baseboard:

a. Lumber: No. 2 or Better SYP, pressure treated with Chromated Copper Arsenate, Type III, to a retention of 0.6 pcf and kiln dried after treating to 19% maximum moisture content.

b. Configuration: 2x8 tongue and groove dimension lumber precision cut to fit between and interlock with columns.

3. Bracing, Wall and Lateral Truss Type:

a. Lumber: No. 2 or Better SPF dimension lumber.

b. Configuration: 2x4 or 2x6 as required by Structural Design requirements.

2.03 PREFINISHED METAL ROOFING AND SIDING PANELS

A. Panel Description: Hi-Rib Panel.

1. Material and Finish

a. Panel substrate shall be 0.019” minimum thickness commercial steel sheet with G90 (zinc) coating per ASTM A653 or AZ55 (aluminum/zinc) coating per ASTM A792.

b. The weather side of the panel shall receive a nominal two-tenths mil polyurethane primer and a nominal eight-tenths mil topcoat of Kynar 500/Hylar 5000 70% polyvinylidene difluoride (PVDF) resin to achieve a total nominal paint film thickness of one mil.

c. The non-weather side paint system shall consist of a two-coat finish with a total nominal thickness of one-half mil.

d. Colors: As selected by Architect from manufacturer’s standard colors

2. Configuration:

a. Roll-formed; 36” coverage width. Provide panels covering up to 38’-9” lengths in single pieces.

b. Corrugations, 7/8” - 1” high, spaced 12 inches on center with 3 low ribs, spaced 3 inches on center between each major corrugation.

c. Form one outboard corrugation as overlapping corrugation.

d. Form opposite outboard corrugation as underneath corrugation with continuous sealant groove.

e. Factory cut to required length.

B. Fasteners: Color coated No. 10 drill screws with ¼” hex head pre-assembled to ½” o.d. dome seal or bond seal galvanized steel and EPDM washers.

C. Accessories:

1. Provide manufacturer’s standard continuous vented roof ridge, eave trims, gable trims, corner trims, and soffit panels and flashings for weather tight construction. Field-fabricate minor flashings as shown on Erection Drawings.

2. Provide manufacturer’s standard gutters and downspouts. Coordinate downspout locations with exterior openings.

3. Closure Strips: Closed cell, 2 pcf density polyethylene foam, premolded to match configuration of panels.

4. Snow Guards: Clear polycarbonate snow guards at spacings as recommended by the manufacturer for the slope and orientation of the roof. Fastened with mechanical fasteners to roof purlins.

5. Eave and rake trim, wall cap, fascia, flashings, etc., shall be provided with a protective coating in accordance with the building manufacturer's standards.

2.04 WEATHER BARRIER, INSULATION AND VAPOR RETARDER

A. Weather barrier as specified in Section 07 65 19.

B. Exterior Wall Insulation: Unfaced fiberglass batt as manufactured by Certain Teed, Johns Manville, and Owens Corning.

1. Thermal resistance: Minimum R-value of 19 per ASTM C518.

2. Conforming to property requirements of ASTM C665, type 1 and ASTM E136.

C. Ceiling Insulation: Formaldehyde-free, blown-in fiberglass as manufactured by Johns Manville and Owens Corning.

1. Thermal resistance: Minimum R-value of 38.

2. Conforming to property requirements of ASTM C764, Type I. ASTM E84.

D. Vapor Retarder: Manufacturers standard, minimum 4 mil polyethelyne sheets.

2.05 INTERIOR PANELS

A. Interior Metal Liner Panels (walls and ceiling):

1. Panel substrate shall be .019” minimum thick commercial steel sheet with a AZ50 (Galvalume) coating ASTM A792.

2. The interior-facing side of the panel shall receive a nominal two tenths mil acrylic primer and a nominal eight tenths mil top coat of white polyester paint to achieve a total nominal paint film thickness of one mil.

3. The hidden (backer) side paint system shall consist of a two coat finish with a total nominal thickness of one half mil.

B. Provide draft stopping as required by Building Code prior to installation of ceiling liner panels.

2.06 DOORS, WINDOWS, OVERHEAD DOORS

A. Hollow Metal Doors and Frames: As specified in Section 08 10 00.

B. Windows: Pella ProLine, Designer Series wood windows are specified. Equivalent products by Marvin Windows are acceptable.

1. Comply with requirements of NWWDA Performance Grade DP15.

2. Sash and Frames: Wood windows with sheet and extruded aluminum cladding and baked-on acrylic coating.

3. Screens: For each operable window provide removeable aluminum-framed screens with aluminum insect screen.

4. Glazing: Manufacturer's standared high performance, low emissivity clear insulated glazing units.

5. Accessories: Provide all necessary fasteners, trim and flashings as required for weatherproof and proper installation

6. Sizes: As indicated on Drawings. Provide custom sizes as required.

7. Color: Architect to select from manufacturers full line of available colors.

C. Overhead Doors: As specified in Section 08 36 00.

D. Accessories: Provide all necessary fasteners, trim, and flashings required for proper installation as recommended by the pre-engineered wood building Manufacturer.

2.07 JOINT SEALANT MATERIALS

A. Sealant: Single Component, Nonsag, Neutral-Curing Silicone joint sealant conforming to ASTM C 920, Type S, Class 100/50, Grade NS.

1. Manufacturers/product:
   a. Dow Corning, 790.
   b. GE/Momentive Performance Materials, SilPruf LM SCS 2700.
   c. Pecora, 890 or 890 FTS
   d. Temco Spectrem 1 or Spectrem 4

2. Colors: As selected by Architect from manufacturers full range of available colors.

PART 3: EXECUTION

3.01 EXAMINATION

A. Coordinate with others for installation of items and anchors to be cast into concrete foundations.

B. Verify that site conditions are acceptable for erection/installation of pre-engineered wood building system.

C. Coordinate with responsible entities to perform corrective work on unsatisfactory conditions.

D. Commencement of work by erector/installer is acceptance of site conditions.

3.02 ERECTION

A. Erect in accordance with manufacturer's instructions and approved shop drawings.

B. Lift and set all materials using methods approved by the manufacturer.

C. Provide temporary erection and wind load bracing to maintain structure plumb and in alignment until installation of permanent bracing and/or roofing and wall coverings are completed.

D. Do not field cut or alter structural members without written approval of Architect, Manufacturer and Professional Structural Engineer responsible for certification of Structural Design.

3.03 INSTALLATION

A. Prefinished Metal Roofing:

1. General: Install in accordance with manufacturer's instructions. Secure to structural framing aligned, level and plumb. Space fasteners as shown on Erection Drawings.

2. Sidelap: Minimum one full corrugation.

3. Endlap: 8 inches for slopes 4:12 to 5:12. Secure together over and to structural members.

4. Accessories: Install as shown on Erection Drawings.

B. Prefinished Metal Siding and Interior Metal Liner Panels:

1. General: Install in accordance with manufacturer's instructions. Secure to structural framing aligned, level and plumb. Space fasteners as shown on Erection Drawings.

2. Sidelap: Minimum one full corrugation.

3. Field cut endwall panels to match roof slope.

4. Accessories: Install as shown on Erection Drawings.

C. Windows:

1. Install materials and systems in accordance with manufacturer's instructions and approved submittal materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

2. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

D. Hollow Metal Doors and Doorframes: As specified in Section 08 10 00.

E. Overhead Doors: As specified in Section 08 36 00.

F. Joint Sealant Materials:

1. Preparation: Clean joints and surfaces to receive sealants of foreign materials.

2. Apply sealant with caulking gun using sufficient pressure to completely fill joints and ensure full contact of sealant to joint sides.

3. Toll surface smooth and uniform, free of ridges, sags and air pockets.

4. Clean sealant from adjacent surfaces.

3.04 CLEANING AND REPAIR

A. Clean surfaces soiled by work as recommended by manufacturer.
B. Touch up repair abrasions and other defects on pre-painted metal panel surfaces with same type of primer and paint as original finish, or replace metal panel. Metal panels that have received repairs/touch-ups which, in the opinion of the Architect, are not aesthetically acceptable are to be replaced by the Contractor at no additional cost.
C. Remove surplus material and debris from site.

END OF SECTION 13 34 21

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Project Manual II

Divisions 21 - 33

Combined Area Fire Training Facility

Village of Buffalo Grove

Buffalo Grove, IL
July 7, 2017

Book 2 of 2

Set No: _____
Comm No: 173013

SECTION 21 05 13

COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2: PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3: EXECUTION (Not Applicable)

END OF SECTION 21 05 13

SECTION 21 05 17
SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2: PRODUCTS

2.01 SLEEVES

A. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

C. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.02 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.
4. Metraflex Company (The).
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Plastic.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.03 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Interior Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 21 05 17

SECTION 21 05 18
ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Escutcheons.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2: PRODUCTS

2.01 ESCUTCHEONS

A. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

C. Split-Plate, Stamped-Steel Type: With chrome-plated finish, exposed-rivet hinge, and spring-clip fasteners.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
e. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.
f. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.

3.02 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 21 05 18

SECTION 21 05 23
GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Two-piece ball valves with indicators.
2. Iron butterfly valves with indicators.
3. Check valves.
4. Iron OS&Y gate valves.
5. Trim and drain valves.

1.03 DEFINITIONS

A. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

B. OS&Y: Outside screw and yoke.

C. SBR: Styrene-butadiene rubber.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Main Level: HAMV - Fire Main Equipment.

a. Level 1: HCBZ - Indicator Posts, Gate Valve.
b. Level 1: HLOT - Valves.

1) Level 3: HLUG - Ball Valves, System Control.
2) Level 3: HLXS - Butterfly Valves.
3) Level 3: HMER - Check Valves.
4) Level 3: HMRZ - Gate Valves.

2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.

a. Level 1: VQGU - Valves, Trim and Drain.

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:

a. Indicator posts.
b. Valves.

1) Gate valves.
2) Check valves.

a) Single check valves.

3) Miscellaneous valves.

C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

D. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
2. ASME B1.20.1 for threads for threaded-end valves.
3. ASME B31.9 for building services piping valves.

E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

F. NFPA Compliance: Comply with NFPA 24 for valves.

G. ure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.

H. Valve Sizes: Same as upstream piping unless otherwise indicated.

I. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.02 TWO-PIECE BALL VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. NIBCO INC.
2. Victaulic Company.

B. Description:

1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
2. Minimum Pressure Rating: 175 psig.

3. Body Design: Two piece.
4. Body Material: Forged brass or bronze.
5. Port Size: Full or standard.
6. Seats: PTFE.
7. Stem: Bronze or stainless steel.
8. Ball: Chrome-plated brass.
9. Actuator: Worm gear or traveling nut.
10. Supervisory Switch: Internal or external.
11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
12. End Connections for Valves NPS 2-1/2: Grooved ends.

2.03 IRON BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anvil International.
2. Globe Fire Sprinkler Corporation.
3. NIBCO INC.
4. Tyco Fire Products LP.
5. Victaulic Company.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Body Design: Lug or wafer.

2.04 CHECK VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anvil International.
2. Globe Fire Sprinkler Corporation.
3. NIBCO INC.
4. Reliable Automatic Sprinkler Co., Inc. (The).
5. Tyco Fire Products LP.
6. Victaulic Company.
7. Viking Corporation.
8. Watts; a Watts Water Technologies company.

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.05 IRON OS&Y GATE VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. NIBCO INC.
2. Victaulic Company.
3. Watts; a Watts Water Technologies company.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged.

2.06 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Potter Roemer LLC.
   e. Tyco Fire Products LP.
   f. Victaulic Company.
   g. Watts; a Watts Water Technologies company.

2. Description:

   a. Pressure Rating: 175 psig.
   b. Body Design: Two piece.
   c. Body Material: Forged brass or bronze.
   d. Port size: Full or standard.
   e. Seats: PTFE.
   f. Stem: Bronze or stainless steel.
   g. Ball: Chrome-plated brass.
   h. Actuator: Handlever.
   i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
   j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. NIBCO INC.
   b. United Brass Works, Inc.

2. Description:

a. Pressure Rating: 175 psig.
b. Body Material: Brass or bronze.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

A. Comply with requirements in the following Sections for specific valve installation requirements and applications:
1. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
2. Section 211316 "Dry-Pipe Sprinkler Systems" for application of valves in dry-pipe, fire-suppression sprinkler systems.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the pipe center.

F. Install valves in position to allow full stem movement.

G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.

I. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION 21 05 23

SECTION 21 05 53

IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

PART 2: PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

E. Pipe-Label Colors:

1. Background Color: Safety Red.
2. Letter Color: White.

2.04 STENCILS

A. Stencils for Piping:

1. Lettering Size: Size letters according to ASME A13.1 for piping.
2. Stencil Material: Fiberboard or metal.
3. Stencil Paint: Safety Red, exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
4. Identification Paint: White, exterior, acrylic enamel. Paint may be in pressurized spray-can form.

2.05 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Fasteners: Brass beaded chain or S-hook.
3. Valve-Tag Color: Safety Red.
4. Letter Color: White.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.06 WARNING TAGS

A. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety Yellow background with black lettering.

PART 3: EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.03 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

A. Piping: Painting of piping is specified in Section 099600 "High-Performance Coatings."

B. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.05 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:
   a. Wet-Pipe Sprinkler System: 1-1/2 inches, round.
   b. Dry-Pipe Sprinkler System: 1-1/2 inches, round.

3.06 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 21 05 53

SECTION 21 11 19
FIRE DEPARTMENT CONNECTIONS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Exposed-type fire-department connections.
2. Flush-type fire-department connections.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection.

PART 2: PRODUCTS

2.01 EXPOSED-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Fire Hose & Cabinet.
2. Elkhart Brass Mfg. Co., Inc.
3. Fire Protection Products, Inc.
4. Fire-End & Croker Corporation.
5. GMR International Equipment Corporation.
6. Guardian Fire Equipment, Inc.

B. Standard: UL 405.

C. Type: Exposed, projecting, for wall mounting.

D. Pressure Rating: 175 psig minimum.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Round, brass, wall type.

I. Outlet: Back, with pipe threads.

J. Number of Inlets: Two.

K. Escutcheon Plate Marking: Similar to "AUTO SPKR."

L. Finish: Polished chrome plated.

M. Outlet Size: NPS 4.

2.02 FLUSH-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Fire Hose & Cabinet.
2. Elkhart Brass Mfg. Co., Inc.
3. GMR International Equipment Corporation.
4. Guardian Fire Equipment, Inc.
5. Potter Roemer LLC.

B. Standard: UL 405.

C. Type: Flush, for wall mounting.

D. Pressure Rating: 175 psig minimum.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Rectangular, brass, wall type.

I. Outlet: With pipe threads.

J. Body Style: Horizontal.

K. Number of Inlets: Two.

L. Outlet Location: Back.

M. Escutcheon Plate Marking: Similar to "AUTO SPKR."

N. Finish: Polished chrome plated.

O. Outlet Size: NPS 4.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire-department connections.

B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install wall-type fire-department connections.

B. Install yard-type fire-department connections in concrete slab support. Comply with requirements for concrete in Section 033000 "Cast-in-Place Concrete."

C. Install two protective pipe bollards on sides of each fire-department connection. Comply with requirements for bollards in Section 055000 "Metal Fabrications."

D. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION 21 11 19

SECTION 21 13 13
WET-PIPE SPRINKLER SYSTEMS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

B. Related Requirements:

1. Section 211119 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.
2. Section 230523 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.03 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig.

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. HVAC hydronic piping.

3. Items penetrating finished ceiling include the following:

   a. Lighting fixtures.
   b. Air outlets and inlets.
   c. Low voltage devices.

4. HVAC ductwork.

B. Qualification Data: For qualified Installer and professional engineer.

C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Fire-hydrant flow test report.

F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

G. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.08 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

   a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.09 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Construction Manager's written permission.

PART 2: PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Sprinkler system design shall be approved by authorities having jurisdiction.

   a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
   b. Sprinkler Occupancy Hazard Classifications:

      1) Automobile Parking Areas: Ordinary Hazard, Group 1.
      2) Building Service Areas: Ordinary Hazard, Group 1.
      3) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
      4) General Storage Areas: Ordinary Hazard, Group 1.
      5) Laundries: Ordinary Hazard, Group 1.
      6) Machine Shops: Ordinary Hazard, Group 2.
      7) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
      8) Office and Public Areas: Light Hazard.
      9) Residential Living Areas: Light Hazard.
      10) Restaurant Service Areas: Ordinary Hazard, Group 1.

2. Minimum Density for Automatic-Sprinkler Piping Design:

   a. Residential (Dwelling) Occupancy: 0.05 gpm over 400-sq. ft. area.
   b. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
   c. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
   d. Ordinary-Hazard, Group 2 Occupancy: [0.20 gpm over 1500-sq. ft.] area.
   e. Special Occupancy Hazard: As determined by authorities having jurisdiction.

3. Maximum Protection Area per Sprinkler: According to UL listing.
4. Maximum Protection Area per Sprinkler:

   a. Residential Areas: 400 sq. ft..
   b. Office Spaces: 225 sq. ft..
   c. Storage Areas: 130 sq. ft..
   d. Mechanical Equipment Rooms: 130 sq. ft..
   e. Electrical Equipment Rooms: 130 sq. ft..
   f. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:

   a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
   b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.

D.

E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.02 STEEL PIPE AND FITTINGS

A. Standard-Weight, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Black-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

D. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

E. Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.

F. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

G. Malleable- or Ductile-Iron Unions: UL 860.

H. Cast-Iron Flanges: ASME 16.1, Class 125.

I. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick.

   a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
   b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.

2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

J. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

K. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International.
   b. Tyco Fire Products LP.
   c. Victaulic Company.

2. Pressure Rating: 175-psig minimum.
3. Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.03 COVER SYSTEM FOR SPRINKLER PIPING

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. DecoShield Systems, Inc.

B. Description: System of support brackets and covers made to protect sprinkler piping.

C. Brackets: Glass-reinforced nylon.

D. Covers: Extruded-PVC sections of length, shape, and size required for size and routing of CPVC piping.

2.04 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Globe Fire Sprinkler Corporation.
   b. Reliable Automatic Sprinkler Co., Inc. (The).
   c. Tyco Fire Products LP.
   d. Victaulic Company.
   e. Viking Corporation.

2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
7. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Reliable Automatic Sprinkler Co., Inc. (The).
   b. Tyco Fire Products LP.

2. Standard: UL 1726.
3. Pressure Rating: 175-psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.05 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International.
   b. Tyco Fire Products LP.
   c. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175-psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.

5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AGF Manufacturing Inc.
   b. Reliable Automatic Sprinkler Co., Inc. (The).
   c. Tyco Fire Products LP.
   d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Elkhart Brass Mfg. Co., Inc.
   b. Fire-End & Croker Corporation.
   c. Potter Roemer LLC.

2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AGF Manufacturing Inc.
   b. Triple R Specialty.
   c. Tyco Fire Products LP.
   d. Victaulic Company.
   e. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aegis Technologies, Inc.
b. CECA, LLC.
c. Corcoran Piping System Co.
d. Merit Manufacturing.

2. Standard: UL 1474.
3. Pressure Rating: 250-psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fivalco Inc.
b. FlexHead Industries, Inc.
c. Gateway Tubing, Inc.
d. Victaulic Company.

2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig minimum.
5. Size: Same as connected piping, for sprinkler.

2.06 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc. (The).
3. Tyco Fire Products LP.
4. Victaulic Company.
5. Viking Corporation.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Residential Applications: UL 1626.
4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

F. Open Sprinklers with Heat-Responsive Element Removed: UL 199.

1. Nominal Orifice: 1/2 inch, with discharge coefficient K.
2. Nominal Orifice: 17/32 inch with discharge coefficient K between 7.4 and 8.2.

G. Sprinkler Finishes: Chrome plated.

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

I. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Reliable Automatic Sprinkler Co., Inc. (The).
   b. Tyco Fire Products LP.
   c. Victaulic Company.
   d. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.07 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fire-Lite Alarms, Inc.; a Honeywell International company.
   b. Notifier.
   c. Potter Electric Signal Company, LLC.

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 6-inch minimum- diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Potter Electric Signal Company, LLC.
   b. System Sensor.
   c. Viking Corporation.
   d. Watts; a Watts Water Technologies company.

2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

D. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Potter Electric Signal Company, LLC.
   b. System Sensor.

c. Tyco Fire Products LP.
d. Viking Corporation.

2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell International company.
b. Kennedy Valve Company; a division of McWane, Inc.
c. Potter Electric Signal Company, LLC.
d. System Sensor.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.08 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AGF Manufacturing Inc.
2. AMETEK, Inc.
3. Ashcroft Inc.
4. Brecco Corporation.
5. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0- to 250-psig minimum.

E. Label: Include "WATER" label on dial face.

PART 3: EXECUTION

3.01 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.02 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Section 221119 "Domestic Water Piping Specialties."

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.03 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

I. Install alarm devices in piping systems.

J. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

K. Install pressure gages on riser or feed main, and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

L. Pressurize and check preaction sprinkler system piping and air compressors.

M. Fill sprinkler system piping with water.

N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.04 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

L. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3.05 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13 or NFPA 13R for supports.

3.06 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.

3.07 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.08 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.09 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.11 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.12 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. CPVC pipe, Schedule 40 CPVC fittings, and solvent-cemented joints may be used for light-hazard and residential occupancies.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
3. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
5. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
6. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

E. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
4. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
5. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

F. Standard-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
4. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
5. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

3.13 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Concealed sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Residential Sprinklers: Dull chrome.
5. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 13

SECTION 21 13 16
DRY-PIPE SPRINKLER SYSTEMS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Specialty valves.
3. Sprinkler specialty pipe fittings.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

B. Related Requirements:

1. Section 211119 "Fire Department Connections" for exposed-, and flush--type fire department connections.
2. Section 210523 "Fire Protection Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.03 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For dry-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For dry-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. HVAC hydronic piping.
3. Items penetrating finished ceiling including the following:

   a. Lighting fixtures.
   b. Air outlets and inlets.

c. Low voltage devices.

4. HVAC ductwork.

B. Qualification Data: For qualified Installer and professional engineer.

C. Field Test Reports and Certificates:

D. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

E. Fire-hydrant flow test report.

F. Field Test Reports:

1. Fire-hydrant flow test report.
2. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

G. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For dry-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.08 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

1.09 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Construction Manager's written permission.

PART 2: PRODUCTS

2.01 SYSTEM DESCRIPTIONS

A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.

2.02 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design dry-pipe sprinkler systems.

D. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:

    a. Automobile Parking Areas: Ordinary Hazard, Group 1.
    b. Building Service Areas: Ordinary Hazard, Group 1.
    c. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
    d. General Storage Areas: Ordinary Hazard, Group 1.
    e. Laundries: Ordinary Hazard, Group 1.
    f. Machine Shops: Ordinary Hazard, Group 2.
    g. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
    h. Office and Public Areas: Light Hazard.
    i. Restaurant Service Areas: Ordinary Hazard, Group 1.

3. Minimum Density for Automatic-Sprinkler Piping Design:

    a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
    b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
    c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
    d. Special Occupancy Hazard: As determined by authorities having jurisdiction.

4. Maximum Protection Area per Sprinkler: According to UL listing.
5. Maximum Protection Area per Sprinkler:

    a. Office Spaces: 225 sq. ft..
    b. Storage Areas: 130 sq. ft..
    c. Mechanical Equipment Rooms: 130 sq. ft..
    d. Electrical Equipment Rooms: 130 sq. ft..
    e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:

    a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
    b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.

2.03 STEEL PIPE AND FITTINGS

A. Standard-Weight, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Galvanized-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

D. Galvanized-Steel Couplings: ASTM A 865/A 865M, threaded.

E. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

F. Malleable- or Ductile-Iron Unions: UL 860.

G. Cast-Iron Flanges: ASME B16.1, Class 125.

H. Plain-End-Pipe Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn or screwed retainer pin to secure pipe in fitting.

I. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International.
   b. Tyco Fire Products LP.
   c. Victaulic Company.

2. Pressure Rating: 175-psig minimum.
3. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.

4. Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
5. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.04 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Dry-Pipe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Tyco Fire Products LP.
   b. Victaulic Company.
   c. Viking Corporation.

2. Standard: UL 260.
3. Design: Differential-pressure type.
4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
5. Air-Pressure Maintenance Device:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Tyco Fire Products LP.
        2) Victaulic Company.
        3) Viking Corporation.

6. Standard: UL 260.
7. Type: Automatic device to maintain minimum air pressure in piping.
8. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig outlet pressure.
9. Air Compressor:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Gast Manufacturing Inc.
        2) General Air Products, Inc.
        3) Viking Corporation.

    b. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
    c. Motor Horsepower: Fractional.
    d. Power: 120-V ac, 60 Hz, single phase.

G. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Reliable Automatic Sprinkler Co., Inc. (The).
    b. Tyco Fire Products LP.

2. Standard: UL 1726.
3. Pressure Rating: 175-psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.05 SPRINKLER PIPING SPECIALTIES

A. General Requirements for Dry-Pipe System Fittings: UL listed for dry-pipe service.

B. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anvil International.
    b. Tyco Fire Products LP.
    c. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175-psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.

5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

C. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AGF Manufacturing Inc.
   b. Reliable Automatic Sprinkler Co., Inc. (The).
   c. Tyco Fire Products LP.
   d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

D. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Elkhart Brass Mfg. Co., Inc.
   b. Fire-End & Croker Corporation.
   c. Potter Roemer LLC.

2. Standard: UL 199.
3. Pressure Rating: 175-psig minimum.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

E. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AGF Manufacturing Inc.
   b. Triple R Specialty.
   c. Tyco Fire Products LP.
   d. Victaulic Company.
   e. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

F. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CECA, LLC.
b. Corcoran Piping System Co.
c. Merit Manufacturing.

2. Standard: UL 1474.
3. Pressure Rating: 250-psig minimum.
4. Body Material: Steel pipe with EPDM O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

G. Flexible Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fivalco Inc.
b. FlexHead Industries, Inc.
c. Gateway Tubing, Inc.
d. Victaulic Company.

2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig minimum.
5. Size: Same as connected piping, for sprinkler.

2.06 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc. (The).
3. Tyco Fire Products LP.
4. Victaulic Company.
5. Viking Corporation.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.
2. Residential Applications: UL 1626.
3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

F. Sprinkler Finishes: Chrome plated.

G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

H. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Reliable Automatic Sprinkler Co., Inc. (The).
b. Tyco Fire Products LP.
c. Victaulic Company.
d. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.07 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell International company.
b. Notifier.
c. Potter Electric Signal Company, LLC.

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 6-inch minimum diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Potter Electric Signal Company, LLC.
b. System Sensor.
c. Tyco Fire Products LP.
d. Viking Corporation.

2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

D. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell International company.
b. Kennedy Valve Company; a division of McWane, Inc.
c. Potter Electric Signal Company, LLC.
d. System Sensor.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

2.08 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AGF Manufacturing Inc.
2. AMETEK, Inc.
3. Ashcroft Inc.
4. Brecco Corporation.
5. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0- to 250-psig minimum.

E. Label: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3: EXECUTION

3.01 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.02 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Connect compressed-air supply to dry-pipe sprinkler piping.

I. Connect air compressor to the following piping and wiring:

1. Pressure gages and controls.
2. Electrical power system.
3. Fire-alarm devices, including low-pressure alarm.

J. Install alarm devices in piping systems.

K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13. Install pressure gages on riser or feed main, and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

L. Drain dry-pipe sprinkler piping.

M. Pressurize and check dry-pipe sprinkler system piping and air compressors.

N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.03 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.04 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install dry-pipe valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

    a. Install air compressor and compressed-air-supply piping.

3.05 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install sprinklers with water supply from heated space. Do not install pendent or sidewall sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.06 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.07 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.08 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.09 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.10 PIPING SCHEDULE

A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

B. Standard-pressure, dry-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3.

C. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3.

D. Standard-pressure, dry-pipe sprinkler system, NPS 5 and NPS 6, shall be one of the following:

1. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3.

3.11 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Dry pendent, recessed, flush, and concealed sprinklers as indicated.
3. Wall Mounting: Dry sidewall sprinklers.
4. Spaces Subject to Freezing: Upright, dry pendent sprinklers; and dry sidewall sprinklers as indicated Insert type.
5. Special Applications: Extended-coverage and quick-response sprinklers where indicated,

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 16

SECTION 22 05 13
COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2: PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3: EXECUTION (Not Applicable)

END OF SECTION 22 05 13

SECTION 22 05 17
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2: PRODUCTS

2.01 SLEEVES

A. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

C. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.02 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.
4. Metraflex Company (The).
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Plastic.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.03 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Interior Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 22 05 17

SECTION 22 05 18
ESCUTCHEONS FOR PLUMBING PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2: PRODUCTS

2.01 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed and exposed-rivet hinge, and spring-clip fasteners.

2.02 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.

g. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.

2. Escutcheons for Existing Piping:

a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with rough-brass finish.
f. Bare Piping in Equipment Rooms: Split-casting brass type with rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.02 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 22 05 18

SECTION 22 05 19
METERS AND GAGES FOR PLUMBING PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.
6. Test plugs.
7. Test-plug kits.
8. Sight flow indicators.

B. Related Requirements:
1. Section 221119 "Domestic Water Piping Specialties" for water meters.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2: PRODUCTS

2.01 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Inc.
2. Miljoco Corporation.
3. Palmer Wahl Instrumentation Group.
4. Trerice, H. O. Co.
5. Watts; a Watts Water Technologies company.
6. Weiss Instruments, Inc.

B. Standard: ASME B40.200.

C. Case: sealed type(s); stainless steel with 3-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass or plastic.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1.5 percent of scale range.

2.02 LIQUID-IN-GLASS THERMOMETERS

A. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Miljoco Corporation.
   b. Palmer Wahl Instrumentation Group.
   c. Watts; a Watts Water Technologies company.
   d. Weiss Instruments, Inc.

2. Standard: ASME B40.200.
3. Case: Plastic; 9-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass or plastic.
8. Stem: Aluminum, brass, or stainless steel and of length to suit installation.

   a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.03 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.04 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ashcroft Inc.
b. Miljoco Corporation.
c. Palmer Wahl Instrumentation Group.
d. Trerice, H. O. Co.
e. Watts; a Watts Water Technologies company.
f. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Stainless steel.
11. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ashcroft Inc.
b. Miljoco Corporation.
c. Palmer Wahl Instrumentation Group.
d. Trerice, H. O. Co.
e. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Sealed type; plastic; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

2.05 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.06 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Miljoco Corporation.
2. Nexus Valve, Inc.
3. Trerice, H. O. Co.
4. Watts; a Watts Water Technologies company.
5. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.07 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Miljoco Corporation.
2. Nexus Valve, Inc.
3. Trerice, H. O. Co.
4. Watts; a Watts Water Technologies company.
5. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

D. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.

E. Carrying Case: Metal or plastic, with formed instrument padding.

2.08 SIGHT FLOW INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ARCHON Industries, Inc.
2. Dwyer Instruments, Inc.
3. Emerson Process Management; Rosemount Division.
4. John C. Ernst Co., Inc.
5. KOBOLD Instruments, Inc. - USA.
6. OPW Engineered Systems; OPW Fluid Transfer Group; a Dover company.
7. Pentair Valves & Controls; Penberthy Brand.

B. Description: Piping inline-installation device for visual verification of flow.

C. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

D. Minimum Pressure Rating: 125 psig.

E. Minimum Temperature Rating: 200 deg F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids.

H. Install test plugs in piping tees.

I. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

J. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.02 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.03 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.04 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Plastic case, industrial-style, liquid-in-glass type.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.05 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.

B. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F.

3.06 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be one of the following:

1. Sealed, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:

1. Sealed, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.

C. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:

1. Sealed, direct-mounted, metal case.
2. Sealed, direct remote-mounted, plastic case.

3.07 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 100 psi.

B. Scale Range for Domestic Water Piping: 0 to 100 psi.

END OF SECTION 22 05 19

SECTION 220523.12
BALL VALVES FOR PLUMBING PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Steel ball valves.

1.03 DEFINITIONS

A. CWP: Cold working pressure.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and soldered ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.5 for flanges on steel valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder-joint connections.
5. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Handlever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.02 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Forged brass.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

2.03 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts; a Watts Water Technologies company.
f. Zurn Industries, LLC.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Bronze or brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

2.04 STEEL BALL VALVES

A. Steel Ball Valves with Full Port, Class 150:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. NIBCO INC.

2. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 285 psig.
c. Body Design: Split body.
d. Body Material: Carbon steel, ASTM A 216, Type WCB.
e. Ends: Flanged or threaded.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.04 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Brass ball valves, two-piece with full port and brass trim.
3. Bronze ball valves, two-piece with full port and bronze or brass trim.

B. Pipe NPS 2-1/2 and Larger:

1. Steel Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Steel ball valves, Class 150 with full port.

END OF SECTION 220523.12

SECTION 220523.14
CHECK VALVES FOR PLUMBING PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Bronze lift check valves.
2. Bronze swing check valves.
3. Iron swing check valves.
4. Iron swing check valves with closure control.
5. Iron, grooved-end swing check valves.

1.03 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.

2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE LIFT CHECK VALVES

A. Bronze Lift Check Valves with Nonmetallic Disc, Class 125, :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Hammond Valve.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 200 psig.
   c. Body Design: Vertical flow.
   d. Body Material: ASTM B 61 or ASTM B 62, bronze.
   e. Ends: Threaded or soldered. See valve schedule articles.
   f. Disc: NBR, PTFE.

2.03 BRONZE SWING CHECK VALVES

A. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. Stockham; Crane Energy Flow Solutions.
   f. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-80, Type 4.
   b. CWP Rating: 200 psig.
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.
   e. Ends: Threaded or soldered. See valve schedule articles.
   f. Disc: PTFE.

B. Bronze Swing Check Valves with Nonmetallic Disc, Class 150:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Hammond Valve.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-80, Type 4.
   b. CWP Rating: 300 psig.
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.
   e. Ends: Threaded or soldered. See valve schedule articles.
   f. Disc: PTFE.

2.04 IRON SWING CHECK VALVES

A. Iron Swing Check Valves with Nonmetallic-to-Metal Seats, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Stockham; Crane Energy Flow Solutions.

2. Description:

   a. Standard: MSS SP-71, Type I.
   b. CWP Rating: 200 psig.
   c. Body Design: Clear or full waterway.
   d. Body Material: ASTM A 126, gray iron with bolted bonnet.
   e. Ends: Flanged or threaded. See valve schedule articles.
   f. Trim: Composition.
   g. Seat Ring: Bronze.
   h. Disc Holder: Bronze.
   i. Disc: PTFE.
   j. Gasket: Asbestos free.

2.05 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Iron Swing Check Valves with Lever- and Spring-Closure Control, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Hammond Valve.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Stockham; Crane Energy Flow Solutions.
   e. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-71, Type I.
   b. CWP Rating: 200 psig.
   c. Body Design: Clear or full waterway.
   d. Body Material: ASTM A 126, gray iron with bolted bonnet.

e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.
h. Closure Control: Factory-installed exterior lever and weight.

2.06 IRON, GROOVED-END SWING CHECK VALVES

A. Iron, Grooved-End Swing Check Valves, 300 CWP:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Victaulic Company.

2. Description:

a. CWP Rating: 300 psig.
b. Body Material: ASTM A 536, ductile iron.
c. Seal: EPDM.
d. Disc: Spring operated, ductile iron or stainless steel.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Lift Check Valves: With stem upright and plumb.

F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.03 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

   a. NPS 2 and Smaller: Bronze swing check valves with nonmetallic disc.
   b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; or iron, center-guided, resilient-seat check valves.
   c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
3. For Copper Tubing, NPS 5 and Larger: Flanged.
4. For Steel Piping, NPS 2 and Smaller: Threaded.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded.
6. For Steel Piping, NPS 5 and Larger: Flanged.
7. For Grooved-End Copper Tubing and Steel Piping: Grooved.

3.05 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze swing check valves with nonmetallic disc, Class 125, with soldered or threaded end connections.

B. Pipe NPS 2-1/2 and Larger:

1. Iron swing check valves with nonmetallic-to-metal seats, Class 125, with threaded or flanged end connections.
2. Iron swing check valves with closure control lever and spring, Class 125, with threaded or flanged end connections.
3. Iron, grooved-end swing check valves, 300 CWP.

END OF SECTION 220523.14

SECTION 220523.15
GATE VALVES FOR PLUMBING PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Bronze gate valves.
2. Iron gate valves.
3. Chainwheels.

1.03 DEFINITIONS

A. CWP: Cold working pressure.

B. NRS: Nonrising stem.

C. OS&Y: Outside screw and yoke.

D. RS: Rising stem.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set gate valves closed to prevent rattling.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.

2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. RS Valves in Insulated Piping: With 2-inch stem extensions.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE GATE VALVES

A. Bronze Gate Valves, NRS, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig.
   c. Body Material: Bronze with integral seat and screw-in bonnet.
   d. Ends: Threaded or solder joint.
   e. Stem: Bronze.
   f. Disc: Solid wedge; bronze.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron, bronze, or aluminum.

2.03 IRON GATE VALVES

A. Iron Gate Valves, NRS, Class 150:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-70, Type I.
   b. CWP Rating: 200 psig.
   c. Body Material: Gray iron with bolted bonnet.
   d. Ends: Flanged.
   e. Trim: Bronze.
   f. Disc: Solid wedge.
   g. Packing and Gasket: Asbestos free.

B. Iron Gate Valves, OS&Y, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-70, Type I.
   b. CWP Rating: 200 psig.
   c. Body Material: Gray iron with bolted bonnet.
   d. Ends: Flanged.
   e. Trim: Bronze.
   f. Disc: Solid wedge.
   g. Packing and Gasket: Asbestos free.

2.04 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries.
3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, chain guides, chain, and attachment brackets for mounting chainwheels directly to hand wheels.

1. Sprocket Rim with Chain Guides: Ductile or cast iron, of type and size required for valve. Include zinc or epoxy coating.
2. Chain: Hot-dip galvanized steel, of size required to fit sprocket rim.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.03 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. Use gate valves for shutoff service only.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.05 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze gate valves, NRS, Class 125 with soldered ends.

B. Pipe NPS 2-1/2 and Larger: Iron gate valves, NRS, Class 125 with flanged ends.

END OF SECTION 220523.15

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.03 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.
4. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.06 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.07 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2: PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.02 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
6. Metallic Coating: Hot-dipped galvanized.

B. Non-MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

6. Coating: Paint.

2.04 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.05 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.06 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.07 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

PART 3: EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099600 "High-Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
5. C-Clamps (MSS Type 23): For structural shapes.
6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
10. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
11. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

a. Light (MSS Type 31): 750 lb.
b. Medium (MSS Type 32): 1500 lb.
c. Heavy (MSS Type 33): 3000 lb.

12. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
14. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2: PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information plus emergency notification instructions.

2.03 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.04 STENCILS

A. Stencils for Piping:

1. Lettering Size: Size letters according to ASME A13.1 for piping.
2. Stencil Material: Fiberboard or metal.
3. Stencil Paint: Exterior, gloss, acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
4. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.05 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.06 WARNING TAGS

A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety yellow background with black lettering.

PART 3: EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.03 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 099600 "High-Performance Coatings."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:

1. Domestic Water Piping

   a. Background: Safety green.
   b. Letter Colors: White.

2. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Safety green.
   b. Letter Color: White.

3.05 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Cold Water: 1-1/2 inches, round.
   b. Hot Water: 1-1/2 inches, round.

2. Valve-Tag Colors:

   a. Cold Water: Natural.
   b. Hot Water: Natural.

3. Letter Colors:

   a. Cold Water: White.
   b. Hot Water: White.

3.06 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Sanitary waste piping exposed to freezing conditions.
5. Storm-water piping exposed to freezing conditions.
6. Roof drains and rainwater leaders.
7. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation."

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Jacket Materials for Pipe: 12 inches long by NPS 2.
3. Sheet Jacket Materials: 12 inches square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.08 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2: PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Block Insulation: ASTM C 552, Type I.
2. Special-Shaped Insulation: ASTM C 552, Type III.
3. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.

4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

H. Mineral-Fiber, Preformed Pipe Insulation:
1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Phenolic:
1. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
2. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
3. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
4. Factory-Applied Jacket: ASJ. Requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1.

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
2. Service Temperature Range: Minus 50 to plus 220 deg F.
3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
4. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.

3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.05 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

2.06 SEALANTS

A. Joint Sealants for Cellular-Glass:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

C. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.07 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.08 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.09 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Adhesive: As recommended by jacket material manufacturer.
   2. Color: White.
   3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

      a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:
   1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

      a. Factory cut and rolled to size.
      b. Finish and thickness are indicated in field-applied jacket schedules.
      c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
      d. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.
      e. Factory-Fabricated Fitting Covers:

         1) Same material, finish, and thickness as jacket.
         2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
         3) Tee covers.
         4) Flange and union covers.
         5) End caps.
         6) Beveled collars.
         7) Valve covers.
         8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

   2. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.

      a. Factory cut and rolled to size.
      b. Material, finish, and thickness are indicated in field-applied jacket schedules.
      c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
      d. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.
      e. Factory-Fabricated Fitting Covers:

         1) Same material, finish, and thickness as jacket.
         2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
         3) Tee covers.
         4) Flange and union covers.
         5) End caps.
         6) Beveled collars.
         7) Valve covers.
         8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Width: 3 inches.
   2. Thickness: 11.5 mils.
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.

6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
   1. Width: 3 inches.
   2. Thickness: 6.5 mils.
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.
   6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. Width: 2 inches.
   2. Thickness: 6 mils.
   3. Adhesion: 64 ounces force/inch in width.
   4. Elongation: 500 percent.
   5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
   1. Width: 2 inches.
   2. Thickness: 3.7 mils.
   3. Adhesion: 100 ounces force/inch in width.
   4. Elongation: 5 percent.
   5. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

A. Bands:
   1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal.
   2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

2.13 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,:
   1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

   1. Verify that systems to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.04 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.05 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.06 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.07 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.08 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.09 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.10 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.11 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.13 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.14 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 3/4 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
d. Phenolic: 1 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
d. Phenolic: thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
d. Phenolic: 1 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1-1/2 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
d. Phenolic: 1 inch thick.

C. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
d. Phenolic: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
d. Phenolic: 1 inch thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1/2 inch thick.

F. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 2 inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

G. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 3/4 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

H. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

I. Hot Service Vents:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

3.15 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

3.16 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:
1. PVC : 20 mils thick.
2. Aluminum, Stucco Embossed: 0.020 inch thick.
3. Painted Aluminum, Stucco Embossed: 0.020 inch thick.
4. Stainless Steel, Type 304 or Type 316, Stucco Embossed: 0.016 inch thick.
5. .

3.17 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 22 07 19

SECTION 22 11 16
DOMESTIC WATER PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Ductile-iron pipe and fittings.
3. Stainless-steel piping
4. PVC pipe and fittings.
5. PP pipe and fittings.
6. Piping joining materials.
7. Encasement for piping.
8. Transition fittings.
9. Dielectric fittings.

1.03 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.04 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.05 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Construction Manager's written permission.

PART 2: PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

C. Comply with NSF Standard 372 for low lead.

2.02 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. NIBCO INC.
   c. Viega LLC.

2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
3. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

H. Appurtenances for Grooved-End Copper Tubing:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International.
   b. Grinnell Mechanical Products.
   c. Shurjoint Piping Products USA Inc.
   d. Victaulic Company.

2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75/B 75M copper tube or ASTM B 584 bronze castings.
3. Mechanical Couplings for Grooved-End Copper Tubing:

   a. Copper-tube dimensions and design similar to AWWA C606.
   b. Ferrous housing sections.
   c. EPDM-rubber gaskets suitable for hot and cold water.
   d. Bolts and nuts.
   e. Minimum Pressure Rating: 300 psig.

2.03 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

E. Appurtenances for Grooved-End, Ductile-Iron Pipe:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Shurjoint Piping Products USA Inc.
   b. Star Pipe Products.
   c. Victaulic Company.

2. Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions that match pipe.
3. Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:

   a. AWWA C606 for ductile-iron-pipe dimensions.
   b. Ferrous housing sections.
   c. EPDM-rubber gaskets suitable for hot and cold water.
   d. Bolts and nuts.

2.04 STAINLESS-STEEL PIPING

A. Potable-water piping and components shall comply with NSF 61 Annex G.

B. Stainless-Steel Pipe: ASTM A 312/A 312M, Schedule 10.

C. Stainless-Steel Pipe Fittings: ASTM A 815/A 815M.

D. Appurtenances for Grooved-End, Stainless-Steel Pipe:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International.
   b. Grinnell Mechanical Products.
   c. Shurjoint Piping Products USA Inc.
   d. Victaulic Company.

2. Fittings for Grooved-End, Stainless-Steel Pipe: Stainless-steel casting with dimensions matching stainless-steel pipe.
3. Mechanical Couplings for Grooved-End, Stainless-Steel Pipe:

   a. AWWA C606 for stainless-steel-pipe dimensions.
   b. Stainless-steel housing sections.
   c. Stainless-steel bolts and nuts.
   d. EPDM-rubber gaskets suitable for hot and cold water.
   e. Minimum Pressure Rating:

      1) NPS 8 and Smaller: 600 psig.

2.05 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 1785, [Schedule 40].

B. PVC Socket Fittings: [ASTM D 2466 for Schedule 40].

C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.

2.06 PP PIPE AND FITTINGS

A. PP Pipe: ASTM F 2389, SDR 11.

B. PVC Socket Fittings: ASTM F 2389.

2.07 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

G. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.08 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105/A21.5.

B. Form: Sheet or tube.

C. Color: Black or natural.

2.09 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

D. Plastic-to-Metal Transition Fittings:
1. Description:

a. PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
b. One end with threaded brass insert and one solvent-cement-socket end.

E. Plastic-to-Metal Transition Unions:
1. Description:

a. PVC four-part union.
b. Brass or stainless-steel threaded end.
c. Solvent-cement-joint plastic end.
d. Rubber O-ring.
e. Union nut.

2.10 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
   1. Standard: ASSE 1079.
   2. Pressure Rating: 125 psig minimum at 180 deg F.
   3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
   1. Standard: ASSE 1079.
   2. Factory-fabricated, bolted, companion-flange assembly.
   3. Pressure Rating: 125 psig minimum at 180 deg F.
   4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:
   1. Nonconducting materials for field assembly of companion flanges.
   2. Pressure Rating: 150 psig.
   3. Gasket: Neoprene or phenolic.
   4. Bolt Sleeves: Phenolic or polyethylene.
   5. Washers: Phenolic with steel backing washers.

PART 3: EXECUTION

3.01 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install domestic water piping level without pitch and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

L. Install piping to permit valve servicing.

M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections.

P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

Q. Install pressure gages on suction and discharge piping for each plumbing pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

R. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

S. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

H. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

I. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Square cut groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

J. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

K. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. PVC Piping: Join according to ASTM D 2855.

L. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.04 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

3.05 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.06 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.

2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

G. Install supports for vertical steel piping every 15 feet.

H. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

I. Install supports for vertical stainless-steel piping every 15 feet.

J. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.07 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.08 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.09 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.

2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be one of the following:

1. Soft copper tube, ASTM B 88, Type L; copper pressure-seal fittings; and pressure-sealed joints.
2. PVC, Schedule 40; socket fittings; and solvent-cemented joints.
3. PP, SDR 11 socket fittings; and fusion-welded joints.

D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:

1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
3. PVC, Schedule 40; socket fittings; and solvent-cemented joints.
4. PP, SDR 11 socket fittings; and fusion-welded joints.

E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:

1. soft copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
2. PVC, Schedule 40; socket fittings; and solvent-cemented joints.
3. PP, SDR 11 socket fittings; and fusion-welded joints.

F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.

H. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6 to NPS 12, shall be one of the following:

1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
2. Stainless-steel Schedule 10 pipe, grooved-joint fittings, and grooved joints.

3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 22 11 16

SECTION 22 11 19
DOMESTIC WATER PIPING SPECIALTIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Wall hydrants.
8. Drain valves.
9. Water-hammer arresters.
10. Air vents.
11. Trap-seal primer valves.
12. Trap-seal primer systems.
13. Flexible connectors.
14. Water meters.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 224300 "Medical Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
4. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
5. Section 224716 "Pressure Water Coolers" for water filters for water coolers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14. Mark "NSF-pw" on plastic piping components.

2.02 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.03 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Fire & Waterworks; A WATTS Brand.
    b. Apollo Valves; Conbraco Industries, Inc.
    c. FEBCO; A WATTS Brand.
    d. WATTS.
    e. Zurn Industries, LLC.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; Conbraco Industries, Inc.
    b. MIFAB, Inc.
    c. WATTS.
    d. Woodford Manufacturing Company.
    e. Zurn Industries, LLC.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Fire & Waterworks; A WATTS Brand.
    b. Apollo Valves; Conbraco Industries, Inc.
    c. FEBCO; A WATTS Brand.
    d. WATTS.
    e. Zurn Industries, LLC.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Accessories:

a. Valves: Ball type, on inlet and outlet.

D. Laboratory-Faucet Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. WATTS.
c. Woodford Manufacturing Company.
d. Zurn Industries, LLC.

2. Standard: ASSE 1035.
3. Size: NPS 1/4 or NPS 3/8 matching faucet size.
4. Body: Bronze.
5. End Connections: Threaded.
6. Finish: Chrome plated.

E. Spill-Resistant Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. WATTS.
c. Zurn Industries, LLC.

2. Standard: ASSE 1056.
3. Operation: Continuous-pressure applications.
4. Accessories:

a. Valves: Ball type, on inlet and outlet.

2.04 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. FEBCO; A WATTS Brand.
c. WATTS.
d. Zurn Industries, LLC.

2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Body: Bronze.
5. End Connections: Union, solder joint.
6. Finish: Chrome plated.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Fire & Waterworks; A WATTS Brand.
b. Apollo Valves; Conbraco Industries, Inc.
c. FEBCO; A WATTS Brand.
d. WATTS.
e. Zurn Industries, LLC.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle third of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Beverage-Dispensing-Equipment Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; Conbraco Industries, Inc.
    b. WATTS.
    c. Zurn Industries, LLC.

2. Standard: ASSE 1022.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

D. Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; Conbraco Industries, Inc.
    b. FEBCO; A WATTS Brand.
    c. WATTS.
    d. Zurn Industries, LLC.

2. Standard: ASSE 1024.
3. Operation: Continuous-pressure applications.
4. Body: Bronze with union inlet.

E. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. WATTS.

2. Standard: ASSE 1032.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

F. Hose-Connection Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; Conbraco Industries, Inc.

b. WATTS.
c. Woodford Manufacturing Company.

2. Standard: ASSE 1052.
3. Operation: Up to 10-foot head of water back pressure.
4. Inlet Size: NPS 1/2 or NPS 3/4.
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least 3-gpm flow.

G. Backflow-Preventer Test Kits:
1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.05 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. WATTS.
c. Zurn Industries, LLC.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. WATTS.
c. Zurn Industries, LLC.

2. Description: Pilot-operated, diaphragm-type, single-seated, main water-control valve.
3. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.06 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.
b. ITT Corporation.
c. NIBCO INC.
d. Schneider Electric USA, Inc.
e. TACO Comfort Solutions, Inc.
f. WATTS.

2. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.

3. Body: Brass or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Armstrong International, Inc.
   b. ITT Corporation.
   c. NIBCO INC.
   d. Schneider Electric USA, Inc.
   e. WATTS.

2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Size: Same as connected piping, but not smaller than NPS 2-1/2.

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

D. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Milwaukee Valve Company.
   c. NIBCO INC.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.07 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Leonard Valve Company.
   c. POWERS; A WATTS Brand.
   d. Symmons Industries, Inc.
   e. TACO Comfort Solutions, Inc.
   f. WATTS.
   g. Zurn Industries, LLC.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Finish: Rough bronze.

B. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Lawler Manufacturing Company, Inc.
   c. Leonard Valve Company.
   d. POWERS; A WATTS Brand.
   e. WATTS.
   f. Zurn Industries, LLC.

2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 110 deg F.

2.08 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

   a. Strainers NPS 2 and Smaller: 0.020 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
   c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.09 OUTLET BOXES

2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg. Co.
   b. MIFAB, Inc.
   c. Woodford Manufacturing Company.
   d. Zurn Industries, LLC.

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.

10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): Two with each wall hydrant.

B. Vacuum Breaker Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg. Co.
   b. WATTS.
   c. Woodford Manufacturing Company.
   d. Zurn Industries, LLC.

2. Standard: ASSE 1019, Type A or Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig.
6. Operation: Loose key.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2 or NPS 3/4.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.11 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.12 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Jay R. Smith Mfg. Co.
   c. MIFAB, Inc.
   d. WATTS.
   e. Zurn Industries, LLC.

2. Standard: ASSE 1010 or PDI-WH 201.

3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.13 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.14 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg. Co.
   b. MIFAB, Inc.
   c. WATTS.
   d. Zurn Industries, LLC.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.15 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Zurn Industries, LLC.

2. Standard: ASSE 1044.
3. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
4. Cabinet: Recessed-mounted steel box with stainless-steel cover.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.

   a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

6. Vacuum Breaker: ASSE 1001.

7. Number Outlets: Coordinatge with floor layout.
8. Size Outlets: NPS 1/2.

2.16 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

C. Install water-control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install Y-pattern strainers for water on supply side of each control valve water pressure-reducing valve solenoid valve and pump.

F. Install water-hammer arresters in water piping according to PDI-WH 201.

G. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

H. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

I. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

J. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.02 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.03 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Carbonated-beverage-machine backflow preventers.
5. Dual-check-valve backflow preventers.
6. Water pressure-reducing valves.
7. Calibrated balancing valves.
8. Supply-type, trap-seal primer valves.
9. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker and reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.05 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 22 11 19

SECTION 22 11 23
DOMESTIC WATER PUMPS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. In-line, sealless centrifugal pumps.

B. Related Sections include the following:

1. Section 221123.13 "Domestic-Water Packaged Booster Pumps" for booster systems.
2. Section 332100 "Water Supply Wells" for well pumps.

1.03 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

1.08 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2: PRODUCTS

2.01 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grundfos Pumps Corp.
2. TACO Comfort Solutions, Inc.

B. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

C. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
2. Casing: Stainbless Steel, with threaded or companion-flange connections.
3. Impeller: Plastic.
4. Motor: Single speed, unless otherwise indicated.

D. Capacities and Characteristics:
1. Minimum Working Pressure: 125 psig.
2. Maximum Continuous Operating Temperature: 220 deg F.
3. Pump Control: Thermostat.
4. Electrical Characteristics:

a. Volts: 120.
b. Phases: Single.
c. Hertz: 60.

2.02 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.03 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 65 to 200 deg F.
3. Enclosure: NEMA 250, Type 4X.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: 120 V, ac.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.02 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install continuous-thread hanger rods and spring hangers with vertical-limit stop of size required to support pump weight.

1. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

D. Install thermostats in hot-water return piping.

3.03 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties."

1. Install pressure gage and snubber at suction of each pump and pressure gage and snubber at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

E. Connect thermostats, to pumps that they control.

3.04 IDENTIFICATION

A. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set thermostats, for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:

   a. Verify bearing lubrication.
   b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
   c. Verify that pump is rotating in the correct direction.

6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.06 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 22 11 23

SECTION 22 12 23
FACILITY INDOOR POTABLE-WATER STORAGE TANKS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Steel, precharged, potable-water storage tanks.

1.03 DEFINITIONS

A. HDPE: High-density polyethylene plastic.

B. LDPE: Low-density polyethylene plastic.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water storage tanks.
   2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.05 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of potable-water storage tank, from manufacturer.

B. Source quality-control reports.

C. Purging and disinfecting reports.

1.06 QUALITY ASSURANCE

A. ASME Compliance for Steel Tanks: Fabricate and label steel, ASME-code, potable-water storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

B. Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," for potable-water storage tanks. Include appropriate NSF marking.

1.07 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2: PRODUCTS

2.01 STEEL, PRECHARGED, POTABLE-WATER STORAGE TANKS

A. Steel, Precharged, Diaphragm, Water Storage Tanks:

   1. Description: Steel, vertical, pressured-rated tank with cylindrical sidewalls and with air-charging valve and air precharge.
   2. Fabricate supports and attachments to tank with reinforcement strong enough to resist tank movement during seismic event when tank supports are anchored to building structure.
   3. Operation: Factory-installed, butyl-rubber diaphragm.

B. Construction: Steel, constructed with nontoxic welded joints, for 150-psig working pressure.

C. Tappings: Factory-fabricated stainless steel, welded to tank before testing and labeling.

1. NPS 2 and Smaller: ASME B1.20.1, with female thread.

D. Exterior Coating: Manufacturer's standard enamel paint.

2.02 SOURCE QUALITY CONTROL

A. Test and inspect potable-water storage tanks according to the following tests and inspections and prepare test reports:
1. Pressure Testing for Non-ASME-Code, Pressure, Potable-Water Storage Tanks: Hydrostatically test to ensure structural integrity and freedom from leaks at pressure of 50 psig above system operating pressure, but not less than 150 psig. Fill tanks with water, vent air, pressurize tanks, disconnect test equipment, hold pressure for two hours with no drop in pressure, and check for leaks.
2. Testing for Nonpressure, Potable-Water Storage Tanks: Fill tanks to water operating level to ensure structural integrity and freedom from leaks. Hold water level for two hours with no drop in water level.

B. Repair or replace tanks that fail test with new tanks, and repeat until test is satisfactory.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install water storage tanks on concrete bases, level and plumb, firmly anchored. Arrange so devices needing servicing are accessible.

B. Anchor tank supports and tanks to substrate.

C. Install tank seismic restraints.

D. Install the following devices on tanks where indicated:
1. Connections to accessories.

E. After installing tanks with factory finish, inspect finishes and repair damages to finishes.

3.02 CONNECTIONS

A. Piping installation requirements are specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to potable-water storage tanks to allow service and maintenance.

C. Connect water piping to water storage tanks with unions or flanges and with shutoff valves. Connect tank drains with shutoff valves and discharge over closest floor drains.

1. General-duty valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

a. Valves NPS 2 and Smaller: Gate or ball.
b. Drain Valves: NPS 3/4 gate or ball valve. Include outlet with, or nipple in outlet with, ASME B1.20.7, 3/4-11.5NH thread for garden-hose service, threaded cap, and chain.

2. Water Piping Connections: Make connections to dissimilar metals with dielectric fittings. Dielectric fittings are specified in Section 221116 "Domestic Water Piping."

3.03 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

A. Perform the following final checks before filling:

1. Verify that air precharge in precharged tanks is correct.
2. Test operation of tank accessories and devices.
3. Verify that pressure relief valves have correct setting.

    a. Manually operate pressure relief valves.
    b. Adjust pressure settings.

B. Filling Procedures: Follow manufacturer's written procedures. Fill tanks with water to operating level.

3.05 CLEANING

A. Clean and disinfect potable-water storage tanks.

B. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, use procedure described in AWWA C652 or as described below:

1. Purge water storage tanks with potable water.
2. Disinfect tanks by one of the following methods:

    a. Fill tanks with water-chlorine solution containing at least 50 ppm of chlorine. Isolate tanks and allow to stand for 24 hours.
    b. Fill tanks with water-chlorine solution containing at least 200 ppm of chlorine. Isolate tanks and allow to stand for three hours.

3. Flush tanks, after required standing time, with clean, potable water until chlorine is not present in water coming from tank.
4. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination made by authorities having jurisdiction shows evidence of contamination.

C. Prepare written reports for purging and disinfecting activities.

END OF SECTION 22 12 23

SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

B. Related Requirements:

1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.
2. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.
3. Section 226600 "Chemical-Waste Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Construction Manager's written permission.

PART 2: PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.02 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.03 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.04 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and CISPI 310.
2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and ASTM C 1540.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.05 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Cast-Iron Drainage Fittings: ASME B16.12, threaded.

B. Steel Pipe Pressure Fittings:

1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. Galvanized-Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

C. Cast-Iron Flanges: ASME B16.1, Class 125.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

2.06 STAINLESS-STEEL PIPE AND FITTINGS

A. Pipe and Fittings: ASME A112.3.1, drainage pattern with socket and spigot ends.

B. Internal Sealing Rings: Elastomeric gaskets shaped to fit socket groove.

2.07 DUCTILE-IRON PIPE AND FITTINGS

A. Ductile-Iron, Mechanical-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Ductile-Iron, Push-on-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot ends unless grooved or flanged ends are indicated.

2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Gaskets: AWWA C111/A21.11, rubber.

2.08 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

E. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.09 ABS PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

C. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

D. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

E. Solvent Cement: ASTM D 2235.

2.10 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

D. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

E. Adhesive Primer: ASTM F 656.

F. Solvent Cement: ASTM D 2564.

2.11 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:

a. Standard: ASTM C 1173.

b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
c. End Connections: Same size as and compatible with pipes to be joined.
d. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:

a. Standard: ASTM C 1460.
b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
c. End Connections: Same size as and compatible with pipes to be joined.

4. Pressure Transition Couplings:

a. Standard: AWWA C219.
b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
c. Center-Sleeve Material: Manufacturer's standard.
d. Gasket Material: Natural or synthetic rubber.
e. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. Dielectric Unions:

a. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig minimum at 180 deg F.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

2. Dielectric Flanges:

a. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 125 psig minimum at 180 deg F.
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

3. Dielectric-Flange Insulating Kits:

a. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig.
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

2.12 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

PART 3: EXECUTION

3.01 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.02 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.

2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Install steel piping according to applicable plumbing code.

O. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.

P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

Q. Install aboveground ABS piping according to ASTM D 2661.

R. Install aboveground PVC piping according to ASTM D 2665.

S. Install underground ABS and PVC piping according to ASTM D 2321.

T. Install engineered soil and waste and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

U. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

   a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

   a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
   b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

3. Install drains in sanitary waste gravity-flow piping.

   a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

V. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

W. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    c. Do not use pipe sections that have cracked or open welds.

E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

F. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

G. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

H. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.04 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:

    a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
    b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.05 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Install backwater valves in accessible locations.
3. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.06 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.

I. Install supports for vertical steel piping every 15 feet.

J. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2: 84 inches with 3/8-inch rod.

2. NPS 3: 96 inches with 1/2-inch rod.
3. NPS 4: 108 inches with 1/2-inch rod.
4. NPS 6: 10 feet with 5/8-inch rod.

K. Install supports for vertical stainless-steel piping every 10 feet.

L. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

M. Install supports for vertical copper tubing every 10 feet.

N. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

O. Install supports for vertical ABS and PVC piping every 48 inches.

P. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.07 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Comply with requirements for backwater valves cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
7. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.08 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.09 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.
5. Copper Type DWV tube, copper drainage fittings, and soldered joints.
6. Cellular-core ABS pipe, ABS socket fittings, and solvent-cemented joints.
7. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
8. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.
5. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings gaskets, and gasketed joints.
5. Copper Type DWV tube, copper drainage fittings, and soldered joints.

    a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.

6. Cellular-core ABS pipe, ABS socket fittings, and solvent-cemented joints.
7. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
8. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

E. Aboveground, vent piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Extra Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
4. Solid wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Extra Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; coupled joints.
3. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.

END OF SECTION 22 13 16

SECTION 22 13 19
SANITARY WASTE PIPING SPECIALTIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Cleanouts.
   2. Roof flashing assemblies.
   3. Through-penetration firestop assemblies.
   4. Miscellaneous sanitary drainage piping specialties.

1.03 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene.

B. FOG: Fats, oils, and greases.

C. PVC: Polyvinyl chloride.

1.04 ACTION SUBMITTALS

A. Shop Drawings:

   1. Show fabrication and installation details for frost-resistant vent terminals.
   2. Wiring Diagrams: Power, signal, and control wiring.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

PART 2: PRODUCTS

2.01 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing, and marked for intended location and application.

2.02 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Jay R. Smith Mfg. Co.
      b. MIFAB, Inc.
      c. Watts; a Watts Water Technologies company.

d. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg. Co.
b. Watts; a Watts Water Technologies company.
c. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Inside calk.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Light Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg. Co.
b. MIFAB, Inc.
c. Watts; a Watts Water Technologies company.
d. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:

a. Brass.
b. Countersunk head.
c. Drilled and threaded for cover attachment screw.
d. Size: Same as or not more than one size smaller than cleanout size.

6. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.

2.03 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Company.

b. Thaler Metal Industries Ltd.
c. Zurn Industries, LLC.

2. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

a. Open-Top Vent Cap: Without cap.

2.04 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve-and-stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

2.05 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564 rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

a. NPS 2: 4-inch- minimum water seal.
b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install backwater valves in building drain piping.

1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

F. Assemble open drain fittings and install with top of hub 2 inches above floor.

G. Install deep-seal traps on floor drains and other waste outlets, if indicated.

H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

J. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

K. Install wood-blocking reinforcement for wall-mounting-type specialties.

L. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.03 FLASHING INSTALLATION

A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.

C. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

D. Set flashing on floors and roofs in solid coating of bituminous cement.

E. Secure flashing into sleeve and specialty clamping ring or device.

F. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."

G. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.04 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.05 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.06 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 221319.13
SANITARY DRAINS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Floor drains.
2. Channel drainage systems.

1.03 DEFINITIONS

A. ABS: Acrylonitrile-butadiene styrene.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene.

D. PE: Polyethylene.

E. PP: Polypropylene.

F. PVC: Polyvinyl chloride.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2: PRODUCTS

2.01 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.02 FLOOR DRAINS

A. Cast-Iron Floor Drains FD-1, SD-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Zurn.
   b. J. R. Smith
   c. Mifab.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.

11. Sediment Bucket: Not required.
12. Top or Strainer Material: Nickel bronze.
13. Top of Body and Strainer Finish: Polished bronze.
14. Top Shape: Square.
15. Dimensions of Top or Strainer: 6 inch by 6 inch.
16. Top Loading Classification: Light Duty.
17. Funnel: Not required.
18. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
19. Trap Material: Not required.
20. Trap Pattern: Not required.
21. Trap Features: Not required.

B. Cast-Iron Floor Drains FD-2:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Zurn.
   b. J. R. Smith
   c. Mifab.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
11. Sediment Bucket: Polypropylene.
12. Top or Strainer Material: Gray iron.
13. Top of Body and Strainer Finish: Gray Iron.
14. Top Shape: Round.
15. Dimensions of Top or Strainer: 12 inch diameter.
16. Top Loading Classification: Heavy Duty.
17. Funnel: Not required.
18. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
19. Trap Material: Not required.
20. Trap Pattern: Not required.
21. Trap Features: Not required

2.03 CHANNEL DRAINAGE SYSTEMS

A. HDPE or PE Channel Drainage Systems TD-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Zurn.
   b. J. R. Smith
   c. Mifab.
2. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
3. Channel Sections: Interlocking-joint, HDPE or PE modular units, with end caps. Include flat, rounded, or inclined bottom, with level invert and with outlets in number, sizes, and locations indicated.

   a. Dimensions: 4 incheswide. Include number of units required to form total lengths indicated.

4. Grates: With slots or perforations and widths and thickness that fit recesses in channel sections.

    a. Material: Gray iron.

5. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
6. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inchesor Less: Equivalent to 1 percent slope, but not less than 1/4-inchtotal depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inchesor Larger: Equivalent to 1 percent slope, but not greater than 1-inchtotal depression.

4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.

    a. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

B. Install trench drains at low points of surface areas to be drained.

1. Set grates of drains flush with finished surface, unless otherwise indicated.

C. Install FRP channel drainage system components on support devices, so that top will be flush with adjacent surface.

D. Install plastic channel drainage system components on support devices, so that top will be flush with adjacent surface.

E. Install open drain fittings with top of hub 2 inches above floor.

3.02 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.

C. Comply with requirements in Section 221323 "Sanitary Waste Interceptors" for grease interceptors, grease-removal devices, oil interceptors, sand interceptors, and solid interceptors.

D. Install piping adjacent to equipment to allow service and maintenance.

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.03 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319.13

SECTION 22 13 23
SANITARY WASTE INTERCEPTORS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Oil interceptors.

1.03 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. PP: Polypropylene plastic.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of metal and plastic interceptor. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   1. Piping connections. Include size, location, and elevation of each.
   2. Interface with underground structures and utility services.

PART 2: PRODUCTS

2.01 OIL INTERCEPTORS

A. Cast-Iron or Steel Oil Interceptors: Factory-fabricated; with removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Jay R. Smith Mfg. Co.
      b. MIFAB, Inc.
      c. Rockford Sanitary Systems, Inc.
      d. Zurn Industries, LLC.

   2. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
   3. Extension: Cast-iron or steel shroud, full size of interceptor, extending from top of interceptor to grade.
   4. Cover: Cast iron or steel, with steel reinforcement to provide ASTM C 890, A-03, walkway load.
   5. Comply with requirements in Section 231113 "Facility Fuel-Oil Piping" for waste-oil storage tank and piping.

B. Plastic Oil Interceptors: Removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Schier Products Company.
b. Zurn Industries, LLC.

2. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
3. Extension: Plastic shroud, full size of interceptor, extending from top of interceptor to grade.
4. Cover: 1/4" Diamond plate steel.

C. Capacities and Characteristics:
1. Cleanout: Integral or field installed on outlet.
2. Vent Pipe Size: 2 NPS.
3. Mounting: Recessed, flush with floor.
4. Flow-Control Fitting: Not required.

PART 3: EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.02 INSTALLATION

A. Equipment Mounting:
1. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

B. Install precast concrete interceptors according to ASTM C 891.

C. Set interceptors level and plumb.

D. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

E. Set tops of grating frames and grates flush with finished surface.

F. Set metal and plastic interceptors level and plumb.

G. Set tops of metal interceptor covers flush with finished surface in pavements.

H. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

3.03 CONNECTIONS

A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.04 IDENTIFICATION

A. Identification materials and installation are specified in Section 312000 "Earth Moving."

1. Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
2. Use warning tapes or detectable warning tape over ferrous piping.
3. Use detectable warning tape over nonferrous piping and over edges of underground structures.

B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1. Oil interceptors.

3.05 PROTECTION

A. Protect sanitary waste interceptors from damage during construction period.

B. Repair damage to adjacent materials caused by sanitary waste interceptor installation.

END OF SECTION 22 13 23

SECTION 22 34 00
FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.

1.03 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

   1. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of commercial, gas-fired, domestic-water heater, from manufacturer.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.07 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

   1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: Three years.
2) Controls and Other Components: One year(s).

PART 2: PRODUCTS

2.01 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Heat Transfer Products, Inc.
b. Lochinvar, LLC.
c. PVI; A WATTS Brand.
d. Smith, A. O. Corporation.
e. State Industries.

2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Description: Manufacturer's proprietary design to provide at least 90 percent combustion efficiency at optimum operating conditions.
4. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

5. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
e. Jacket: Steel with enameled finish.
f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
g. Temperature Control: Adjustable thermostat.
h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

2.02 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Smith, A. O. Corporation.
   c. State Industries.

2. d. TACO Comfort Solutions, Inc.Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
   b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

   a. Working-Pressure Rating: 150 psig.
   b. Capacity Acceptable: 4 gal. minimum.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

D. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

   1. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."

E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.

G. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

   1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

2.03 SOURCE QUALITY CONTROL

A. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

PART 3: EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

C. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping."

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

F. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

G. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

H. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

I. Fill domestic-water heaters with water.

J. Charge domestic-water compression tanks with air.

3.02 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Section 231123 "Facility Natural-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.05 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION 22 34 00

SECTION 22 41 00
RESIDENTIAL PLUMBING FIXTURES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Faucets.
2. Kitchen sinks.
3. Supply fittings.
4. Waste fittings.

B. Related Requirements:

1. Section 224213.13 "Commercial Water Closets."
2. Section 224216.13 "Commercial Lavatories."
3. Section 224216.16 "Commercial Sinks."
4. Section 224223 "Commercial Showers."

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.

B. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For plumbing fixtures and faucets to include in emergency, operation, and operation and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2: PRODUCTS

2.01 KITCHEN SINKS

A. Kitchen Sinks SK-1: Two bowl, counter mounted, stainless steel.

1. Stainless-Steel Kitchen Sinks:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Elkay Manufacturing Co.
        2) Just Manufacturing.
        3) Advance Tabco

2. Fixture:
    a. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel kitchen sinks.
    b. Metal Thickness: 18 guage.

    c. Left Bowl:

        1) Drain: 3-1/2-inchgrid.

            a) Location: Near back of bowl.

    d. Right Bowl:

        1) Drain: 3-1/2-inchgrid.

            a) Location: Near back of bowl.

3. Faucet: SF-1.
4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
5. Waste Fittings: Comply with requirements in "Waste Fittings" Article, except include continuous waste for multibowl sinks.

    a. Disposer: Not required.
    b. Dishwasher Air-Gap Fitting: Not required.
    c. Hot-Water Dispenser: Not required.

2.02 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Sink Faucets SF-1: Solid brass, kitchen sink.

1. General-Duty, Solid-Brass Faucets:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Chicago Faucet.
        2) Delta Faucet Company.
        3) Moen Incorporated.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

4. Kitchen Sink Option: Separate hand spray complying with ASSE 1025.
5. Finish: Polished chrome plate.
6. Maximum Flow Rate: 1.5 gpmunless otherwise indicated.
7. Mixing Valve: Two-lever handle.
8. Backflow-Prevention Device for Hand Spray: Not required.
9. Centers: 8 inches.
10. Mounting: Deck, concealed.
11. Handle(s): Wrist blade, 4 inches.
12. Spout Type: Swivel gooseneck.
13. Spout Outlet: Aerator.
14. Drain: Grid.

2.03 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Kitchen Sink Supply Fittings:

1. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.
2. Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.

   a. Operation: Loose key.

3. Risers:

   a. Size: NPS 1/2 for kitchen sinks.
   b. Material: Chrome-plated, soft-copper flexible tube riser.

2.04 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2straight tailpiece for standard kitchen sinks Trap:

1. Size: NPS 1-1/2for kitchen sinks.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated-brass or -steel wall flange.

2.05 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing-fixture installation.

B. Examine walls, floors, cabinets, and counters for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install plumbing fixtures level and plumb according to roughing-in drawings.

B. Install counter-mounting fixtures in and attached to casework.

C. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball or gate valves if supply stops are not specified with fixture. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

D. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

E. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes unless otherwise indicated.

F. Install hot-water dispensers in back top surface of sink or in countertop with spout over sink.

G. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

H. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

I. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.04 ADJUSTING

A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.

B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed plumbing fixtures and fittings.

D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 41 00

SECTION 224213.13
COMMERCIAL WATER CLOSETS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.
4. Supports.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for residential water closets.

1.03 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

B. Remote Water Closet: Located more than 30 feetfrom other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2: PRODUCTS

2.01 WALL-MOUNTED WATER CLOSETS

A. Water Closets WC-1: Wall mounted, top spud, accessible.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Standard America.
    b. Crane Plumbing, L.L.C.
    c. Gerber Plumbing Fixtures LLC.
    d. Kohler Co.

2. Bowl:

    a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
    b. Material: Vitreous china.
    c. Type: Siphon jet.
    d. Style: Flushometer valve.
    e. Height: Standard.
    f. Rim Contour: Elongated.
    g. Water Consumption: 1.28 gal. per flush.
    h. Spud Size and Location: NPS 1-1/2; top.

3. Flushometer Valve: FV-1.
4. Toilet Seat: TS-1.
5. Support: Water closet carrier.
6. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.

2.02 FLUSHOMETER VALVES

A. Hard-Wired, Solenoid-Actuator, Piston Flushometer Valves FV-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Zurn Industries.
    b. Sloan Valve Company.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig).
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: **Exposed**.
9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
10. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Consumption: 1.28 gal per flush.
12. Minimum Inlet: NPS 1.
13. Minimum Outlet: NPS 1-1/4.

2.03 TOILET SEATS

A. Toilet Seats TS-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Bemis Manufacturing Company.
    b. Church Seats; Bemis Manufacturing Company.
    c. Olsonite Seat Co.

2. Standard: IAPMO/ANSI Z124.5.

3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

2.04 SUPPORTS

A. Water Closet Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Zurn Industries.
   b. J. R. Smith
   c. Mifab

2. Standard: ASME A112.6.1M.
3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install actuators in locations that are easy for people with disabilities to reach.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.04 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.05 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 224216.13
COMMERCIAL LAVATORIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.
3. Supports.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for residential lavatories.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

PART 2: PRODUCTS

2.01 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory L-1: Vitreous china, wall mounted, with back.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard.
b. Kohler.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For wall hanging.
c. Nominal Size: Oval, 19 by 16 inches.
d. Faucet-Hole Punching: One hole.
e. Faucet-Hole Location: Top.
f. Color: White.
g. Mounting Material: Chair carrier.

3. Faucet: LF-1.
4. Support: Type II, concealed-arm lavatory carrier. Include rectangular, steel uprights.
5. Lavatory Mounting Height: Handicapped/elderly according to ICC A117.1.

2.02 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets LF-1: Automatic-type, hard-wired, electronic-sensor-operated, mixing, solid-brass valve.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Sloan
b. Chicago Faucet

2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: Single hole.
6. Body Material: Commercial, solid brass.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 0.5 gpm.
9. Mounting Type: Deck, concealed.
10. Spout: Rigid type.
11. Spout Outlet: Aerator.
12. Drain: Not part of faucet.

2.03 SUPPORTS

A. Type II Lavatory Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Zurn Industries
b. J. R. Smith
c. Mifab

2. Standard: ASME A112.6.1M.

2.04 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2.
2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

2.05 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.

2.06 SUPPORTS

A. Type II Lavatory Carrier:

1. Standard: ASME A112.6.1M.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.03 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.05 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

SECTION 224216.16
COMMERCIAL SINKS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Service basins.
2. Sink faucets.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for residential sinks.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
2. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2: PRODUCTS

2.01 SERVICE BASINS

A. Service Basins MB-1: Terrazzo, floor mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fiat Products.
   b. Florestone Products Co., Inc.
   c. Stern-Williams Co., Inc.

2.

3. Fixture:

    a. Standard: IAPMO PS 99.
    b. Shape: Square.
    c. Nominal Size: 24 by 24 inches.
    d. Height: 12 inches.
    e. Tiling Flange: Not required.
    f. Rim Guard: On all top surfaces.
    g. Color: Not applicable.
    h. Drain: Grid with NPS 3outlet.

4. Mounting: On floor and flush to wall.
5. Faucet: MBF-1.

2.02 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets MBF-1: Manual type, two-lever-handle mixing valve.

1. Commercial, Solid-Brass Faucets.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Chicago Faucets; Geberit Company.
        2) Delta Faucet Company.
        3) Moen Incorporated.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. Body Type: Centerset.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 2.2 gpm.
8. Handle(s): Wrist blade, 4 inches.
9. Mounting Type: Back/wall, exposed.
10. Spout Type: Rigid, solid brass with wall brace.
11. Vacuum Breaker: Required for hose outlet.
12. Spout Outlet: Hose thread according to ASME B1.20.7.

2.03 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.03 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

SECTION 22 42 23
COMMERCIAL SHOWERS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Individual shower receptors.
2. Shower faucets.
3. Grout.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for residential showers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for showers.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For shower faucets to include in maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2: PRODUCTS

2.01 SHOWER FAUCETS

A. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.

B. Shower Faucets SV-1:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Chicago Faucet.
2) Delta Faucet Company.
3) Moen Incorporated.

2. Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and shower head.
3. Faucet:

    a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
    b. Body Material: Solid brass.
    c. Finish: Polished chrome plate.
    d. Shower-Arm, Flow-Control Fitting: 1.5 gpm.
    e. EPA WaterSense: Required.
    f. Mounting: Concealed.
    g. Operation: Single-handle, twist or rotate control.
    h. Antiscald Device: Integral with mixing valve.
    i. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

4. Supply Connections: NPS 1/2.
5. Shower Head:

    a. Standard: ASME A112.18.1/CSA B125.1.
    b. Type: Hamdshower with standard 24” stainless steel slide bar.
    c. Shower Head Material: Metallic with chrome-plated finish.
    d. Spray Pattern: Adjustable.
    e. Integral Volume Control: Required.
    f. Shower-Arm, Flow-Control Fitting: 1.5 gpm.
    g. Temperature Indicator: Integral with faucet.

2.02 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before shower installation.

B. Examine walls and floors for suitable conditions where showers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Assemble shower components according to manufacturers' written instructions.

B. Install showers level and plumb according to roughing-in drawings.

C. Install water-supply piping with stop on each supply to each shower faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with shower. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

D. Install shower flow-control fittings with specified maximum flow rates in shower arms.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheons requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

3.04 ADJUSTING

A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

A. After completing installation of showers, inspect and repair damaged finishes.

B. Clean showers, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of showers and basins for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 23

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2: PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.05 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3: EXECUTION (Not Applicable)

END OF SECTION 23 05 13

SECTION 23 05 17
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Sleeves.
2. Grout.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2: PRODUCTS

2.01 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.02 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.02 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than NPS 6: Sleeve-seal fittings.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

   b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.

4. Interior Partitions:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
   b. Piping NPS 6> and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 23 05 17

SECTION 23 05 18
ESCUTCHEONS FOR HVAC PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Escutcheons.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2: PRODUCTS

2.01 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with rough-brass finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with rough-brass finish.

2. Escutcheons for Existing Piping:

   a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with rough-brass finish.
   f. Bare Piping in Equipment Rooms: Split-casting brass type with rough-brass finish.

3.02 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 23 05 18

SECTION 230523.12
BALL VALVES FOR HVAC PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Steel ball valves.
4. Iron ball valves.

1.03 DEFINITIONS

A. CWP: Cold working pressure.

B. SWP: Steam working pressure.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for solder-joint connections.

6. ASME B31.1 for power piping valves.
7. ASME B31.9 for building services piping valves.

C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valve Actuator Types:
1. Handlever: For quarter-turn valves smaller than NPS 4.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

B. Brass Ball Valves, Three-Piece with Full Port and Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Three piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.03 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.

h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

B. Bronze Ball Valves, Three-Piece with Full Port Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Three piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.04 STEEL BALL VALVES

A. Steel Ball Valves with Full Port and Stainless-Steel Trim, Class 150:

1. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 285 psig.
c. Body Design: Split body.
d. Body Material: Carbon steel, ASTM A 216, Type WCB.
e. Ends: Flanged.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

2.05 IRON BALL VALVES

A. Iron Ball Valves, Class 125:

1. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 200 psig.
c. Body Design: Split body.
d. Body Material: ASTM A 126, gray iron.
e. Ends: Flanged.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5and Larger: Flanged ends.
4. For Steel Piping, NPS 2and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

END OF SECTION 230523.12

SECTION 230523.16
PLUG VALVES FOR HVAC PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Lubricated plug valves.
2. Eccentric plug valves.

1.03 DEFINITIONS

A. CWP: Cold working pressure.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set plug valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B31.1 for power piping valves.
5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valve Actuator Types: Wrench. Furnish Owner with one wrench for every five plug valves, for each size square plug-valve head.

2.02 LUBRICATED PLUG VALVES

A. Class 125, Lubricated Plug Valves with Threaded Ends:

1. Description:

a. Standard: MSS SP-78, Type I single gland.
b. NPS 2-1/2 to NPS 4, CWP Rating: 200 psig.
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short venturi.
e. Plug: Cast iron or bronze with sealant groove.

B. Class 125, Lubricated Plug Valves with Flanged Ends:

1. Description:

a. Standard: MSS SP-78, Type I single gland or Type II regular gland.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
e. Pattern: Regular or short venturi.
f. Plug: Cast iron or bronze with sealant groove.

C. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:

1. Description:

a. Standard: MSS SP-78, Type IV.
b. NPS 2-1/2 to NPS 4, CWP Rating: 200 psig.
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short venturi.
e. Plug: Cast iron or bronze with sealant groove.

D. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:

1. Description:

a. Standard: MSS SP-78, Type IV.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short venturi.
e. Plug: Cast iron or bronze with sealant groove.

2.03 ECCENTRIC PLUG VALVES

A. 175 CWP, Eccentric Plug Valves with Resilient Seating.
1. Description:

a. Standard: MSS SP-108.
b. CWP Rating: 175 psigminimum.
c. Body and Plug: ASTM A 48/A 48M, gray iron; ASTM A 126, gray iron; or ASTM A 536, ductile iron.
d. Bearings: Oil-impregnated bronze or stainless steel.
e. Ends: Flanged.
f. Stem-Seal Packing: Asbestos free.

g. Plug, Resilient-Seating Material: Suitable for potable-water service unless otherwise indicated.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements for valve tags and schedules in Section 230553 "Identification for HVAC Piping and Equipment."

3.03 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Plug valves.

B. If valves with CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. Select valves with the following end connections:

1. For Copper Tubing, NPS 2and Smaller: Threaded ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For Grooved-End Copper Tubing and Steel Piping except Steam and Steam Condensate Piping: Valve ends may be grooved.

END OF SECTION 230523.16

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Fastener systems.
3. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-protection piping.
3. Division 23 Section " Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
4. Division 23 Section " Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
5. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.03 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.04 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.05 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

B. Welding certificates.

1.06 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Globe Pipe Hanger Products, Inc.
3. Grinnell Corp.
4. Approved equal.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.03 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.
f. Approved equal.

B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.
g. Approved equal.

2.04 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.05 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3: EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

L. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.02 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

D. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

E. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

F. Install lateral bracing with pipe hangers and supports to prevent swaying.

G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

H. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

J. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.

7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.06 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 05 29

SECTION 230548.13
VIBRATION CONTROLS FOR HVAC

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Elastomeric hangers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
   2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.

B. Shop Drawings:

   1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
   2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For each vibration isolation device.

   1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For testing agency.

C. Welding certificates.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2: PRODUCTS

2.01 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

   1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.

2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 VIBRATION CONTROL DEVICE INSTALLATION

A. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

END OF SECTION 230548.13

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Duct labels.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

1.04 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2: PRODUCTS

2.01 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick for labels up to 20 sq. in. or 8 inches in length, and 1/8 inch thick for larger labels, and having predrilled holes for attachment hardware.
2. Letter Color: White, unless otherwise noted.
3. Background Color: Black, unless otherwise noted.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 3/8 inch.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, owner assigned maintenance number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.03 DUCT LABELS

A. Material and Thickness: Self-Adhesive flexible vinyl labels, permanent-adhesive backing.

B. Letter Color: Black**,** unless otherwise noted.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 3/8 inch.

G. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

PART 3: EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

C. Identify rooftop unit, condensing unit, exhaust fans, unit heaters, smoke dampers, and heat transfer equipment with stick-on, laminated plastic nameplates. Install nameplate on the equipment and on the equipment starter. Identify the name of the equipment as listed on the drawing and coordinate with the owner for additional requirement.

D. Equipment manuals: Furnish three sets of manuals in bound form containing all submittal data, parts lists, installation instructions, maintenance and operation instructions, and lubrication instructions for each piece of equipment and all apparatus

3.03 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Refrigerant Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

2. Natural Gas:

   a. Background Color: Yellow.
   b. Letter Color: Black.

3.04 DUCT LABEL INSTALLATION

A. Install plastic-laminated self-adhesive duct labels with permanent adhesive on air ducts

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.05 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.03 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.04 SUBMITTALS

A. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 15 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.05 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by NEBB and TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by NEBB or TABB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.06 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.07 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2: PRODUCTS (Not Applicable)

PART 3: EXECUTION

3.01 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following:

1. Approved by Engineer

3.02 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.03 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.04 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP)] units.

3.05 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.06 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

   a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

   a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
   b. Measure static pressure directly at the fan outlet or through the flexible connection.
   c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
   d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

   a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.07 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.08 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Air pressure drop.

4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.09 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.10 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.11 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.

10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.

f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

G. Gas-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.12 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Verify that balancing devices are marked with final balance position.
e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.13 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 07 13
DUCT INSULATION

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply air.
2. Indoor, concealed supply, return, and exhaust air duct located in unconditioned space.
3. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
4. Outdoor, exposed supply and return.

B. Related Sections:

1. Division 23 Section "Metal Ducts" for duct liners.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

C. Qualification Data: For qualified Installer.

D. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.07 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2: PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

   a. CertainTeed Corp.; SoftTouch Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Friendly Feel Duct Wrap.
   d. Manson Insulation Inc.; Alley Wrap.
   e. Owens Corning; SOFTR All-Service Duct Wrap.
   f. No Substitutions.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

   a. CertainTeed Corp.; Commercial Board.
   b. Johns Manville; 800 Series Spin-Glas.
   c. Knauf Insulation; Insulation Board.
   d. Manson Insulation Inc.; AK Board.
   e. Owens Corning; Fiberglas 700 Series.
   f. No Substitutions.

2.02 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. Tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide the following:

    a. Johns Manville; Super Firetemp M.
    b. No Substitutions.

B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide the following:

    a. CertainTeed Corp.; FlameChek.
    b. Johns Manville; Firetemp Wrap.
    c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
    d. Thermal Ceramics; FireMaster Duct Wrap.
    e. 3M; Fire Barrier Wrap Products.
    f. Unifrax Corporation; FyreWrap.
    g. No Substitutions.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    d. Mon-Eco Industries, Inc.; 22-25.
    e. No Substitutions.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    d. Mon-Eco Industries, Inc.; 22-25.
    e. No Substitutions.

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide the following:

    a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.

b. Vimasco Corporation; 749.
c. No Substitutions.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
b. Eagle Bridges - Marathon Industries; 501.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
d. Mon-Eco Industries, Inc.; 55-10.
e. No Substitutions.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
b. Eagle Bridges - Marathon Industries; 570.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
d. No Substitutions.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.
f. No Substitutions.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.05 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements, provide the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
    b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    c. Vimasco Corporation; 713 and 714.
    d. No Substitutions.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.06 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    b. Eagle Bridges - Marathon Industries; 405.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
    d. Mon-Eco Industries, Inc.; 44-05.
    e. No Substitutions.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

2.07 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.08 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Metal Jacket:
1. Products: Subject to compliance with requirements, provide the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
    b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.

c. RPR Products, Inc.; Insul-Mate.
d. No Substitutions.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.

2.09 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide the following:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
e. No Substitutions.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.
e. No Substitutions.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
c. No Substitutions.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal.

3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

   a. Products: Subject to compliance with requirements, provide the following:

      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; CD.
      3) Midwest Fasteners, Inc.; CD.
      4) Nelson Stud Welding; TPA, TPC, and TPS.
      5) No Substitutions.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

   a. Products: Subject to compliance with requirements, provide the following:

      1) AGM Industries, Inc.; CHP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.
      5) No Substitutions.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products: Subject to compliance with requirements, provide the following:

      1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
      2) GEMCO; Perforated Base.
      3) Midwest Fasteners, Inc.; Spindle.
      4) No Substitutions.

   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products: Subject to compliance with requirements, provide the following:

      1) GEMCO; Nylon Hangers.
      2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
      3) Approved Equal.

   b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.

c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide the following:

1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
2) GEMCO; Peel & Press.
3) Midwest Fasteners, Inc.; Self Stick.
4) No Substitutions.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements**,** provide the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.
5) No Substitutions.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Manufacturers: Subject to compliance with requirements, provide the following:

1) GEMCO.
2) Midwest Fasteners, Inc.
3) Approved Equal.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide the following:

a. C & F Wire.
b. Approved Equal.

2.11 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping"firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.05 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for minimum 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for minimum 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.

e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.06 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.07 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.08 FINISHES

A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

   a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum jackets.

3.09 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective work if sample inspection reveals noncompliance with requirements.

3.10 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply air.
2. Indoor, concealed supply, return, and exhaust located in unconditioned space, such as ductwork located in the attic above the building insulation.
3. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
4. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
5. Indoor, concealed oven and warewash exhaust.
6. Indoor, exposed oven and warewash exhaust.
7. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
8. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.0-lb/cu. ft nominal density.

B. Concealed, rectangular, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.0-lb/cu. ft. nominal density.

3.12 DUCT LOCATED IN ATTIC, DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Concealed, round and flat-oval, supply, return, and exhaust-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 2 inches and 1.0-lb/cu. ft. nominal density.

C. Concealed, rectangular, supply, return, and exhaust-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 2 inches and 1.0-lb/cu. ft. nominal density.

3.13 OUTDOOR, ABOVE GROUND, DUCT AND PLENUM INSULATION SCHEDULE

A. Mineral-Fiber Blanket: 2 inches and 1.0-lb/cu. ft. nominal density with aluminum jacket.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None.

D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION 23 07 13

SECTION 230923.16
GAS INSTRUMENTS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes the Following Gas Instruments:

1. Single-point oxygen monitoring system.

1.03 DEFINITIONS

A. NDIR: Nondispersive infrared.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
2. Installation instructions, including factor affecting performance.
3. Product description with complete technical data, performance curves, product specification sheets.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include diagrams for power, signal, and control wiring.
3. Number-coded identification system for unique identification of wiring, cable, and tubing ends.

C. Samples: For each exposed product installed in finished space.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plan drawings and corresponding product installation details, drawn to scale, on which wall-mounted instruments located in finished space are shown and coordinated with each other, showing relationship to light switches, fire alarm devices, and other installed devices using input from installers of the items involved.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas instruments to include in operation and maintenance manuals.

PART 2: PRODUCTS

2.01 MULTIPOINT CARBON-MONOXIDE MONITORING SYSTEM

A. Description:

1. Each sampling point shall monitor any variation in the carbon-monoxide concentration level.
2. Each sampling point shall be individually piped to the monitoring system.

3. Provide sampling point with a 0.3-micron filter.
4. Each sampling point shall be an alarm point.
5. A dual-head diaphragm pump shall draw an air sample through piping system and through a microprocessor-controlled sequencer feeding an analyzer with a new sample every 15 seconds.
6. Sample time shall be adjustable in 1 second increments from zero to 60 minutes.
7. Span and zero calibration gas shall be automatically initiated by the microprocessor. System shall also provide manual initiation of span and zero calibration gas.
8. Analyzer output shall be corrected by the microprocessor.
9. Monitoring system shall have 8 sample points.
10. System shall operate on 120-V ac, single-phase, 60-Hz power.
11. Final adjustment; calibration, testing, and startup of the system shall be performed by a trained representative of manufacturer.

B. Analyzer:

1. Analyzer shall operate using principle of nondispersive infrared absorption.
2. Sampling response time shall be within 10 seconds.
3. Zero drift and span drift shall be less than 1 percent of full scale within a 24-hour period.
4. Repeatability shall be within 1 percent of full scale.
5. Accuracy shall be within 1 percent of full scale.
6. Calibration range shall be zero to 500 ppm.
7. Digital display on analyzer face with scale shall be in ppm.
8. Temperature shall be compensated from 30 to 120 deg Fambient temperature.

C. Control and Display:

1. Each sample shall send a 4-20 mA output signal proportional to the highest concentration.
2. Alphanumeric visual display of current analyzer concentration reading shall be in ppm or another industry-accepted measurement.
3. Visual indication for sample analyzing, sample high-concentration alarm, analyzer malfunction, and calibration.
4. Any number and configuration of sample points shall be capable of being bypassed.
5. Each sample point shall be capable of being manually sampled through an override feature.
6. System parameters shall be stored in nonvolatile memory.
7. Provide at least an eight-hour battery backup of current alarm status. Battery shall be rechargeable.

D. Enclosure:

1. NEMA 250, Type 1.
2. Hinged and locking door, full size of face.
3. House all system components. Multiple adjoining enclosures are acceptable if joined to a common support structure.

E. Calibration Equipment:

1. Provide equipment necessary to automatically and manually calibrate the system, including, but not be limited to, the following:

    a. Regular assembly.
    b. Zero cap.
    c. Calibration cap.
    d. Two cylinders filled with calibration gas.
    e. Instruction book.
    f. Carrying case.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.

C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Furnish and install products required to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Properly support instruments, tubing, piping, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to seismic loads.

D. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by using excessive force or oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

E. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.03 ELECTRICAL POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."

C. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

3.04 INSTRUMENTS, GENERAL INSTALLATION REQUIREMENTS

A. Mounting Location:

1. .Install gas switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
2. Mount switches and transmitters not required to be mounted within system control panels on walls, floor-supported freestanding pipe stands, or floor-supported structural support frames. Use manufacturer's mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.

B. Mounting Height:

1. Mount instruments in user-occupied space to match mounting height of light switches unless otherwise indicated on Drawings. Mounting height shall comply with codes and accessibility requirements.
2. Mount switches and transmitters located in mechanical equipment rooms and other similar space not subject to code, state, and federal accessibility requirements within a range of 42 to 72 inchesabove the adjacent floor, grade, or service catwalk or platform.

    a. Make every effort to mount at 60 inches.

C. Seal penetrations to ductwork, plenums, and air-moving equipment to comply with duct static-pressure class and leakage and seal classes indicated, using neoprene gaskets or grommets.

3.05 CARBON-MONOXIDE MONITORING SYSTEM

A. Install sample points in monitored area to provide accurate measurement of gas concentration.

B. Install exposed sampling points with a finished appearance consistent with other materials in space. Submit proposed products to be installed for review and approval.

C. Individually install each sample point to the carbon-monoxide monitoring system.

D. Install tubing in a minimum size of NPS 3/8.

E. Use compression fittings at connections to equipment.

F. If not indicated on Drawings, locate carbon-monoxide monitoring system in a secured and serviceable location accessible to authorized personnel.

G. Support carbon-monoxide monitoring system from floor or wall. Support floor-mounted systems using a structural channel frame. Provide mounting brackets.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install engraved phenolic nameplate with instrument identification on face.

3.07 CHECKOUT PROCEDURES

A. Check out installed products before continuity tests, leak tests, and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that impact performance.

D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.

3.08 ADJUSTMENT, CALIBRATION, AND TESTING

A. Description:

1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
2. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.
3. For each analog instrument, perform a three-point calibration test for both linearity and accuracy.
4. Equipment and procedures used for calibration shall comply with instrument manufacturer's written recommendations.
5. Provide diagnostic and test equipment for calibration and adjustment.
6. Field instruments and equipment used to test and calibrate installed instruments shall have an accuracy of at least twice the instrument accuracy being calibrated. For example, an installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
7. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.

8. If, after calibration, indicated performance cannot be achieved, replace out-of-tolerance instruments.
9. Comply with field-testing requirements and procedures in ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.

B. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.

C. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact.

D. Meters: Check sensors at zero, 50, and 100 percent of Project design values.

E. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

F. Switches: Calibrate switches to make or break contact at set points indicated.

G. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistance source.

3.09 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include semiannual preventive maintenance, repair or replacement of worn or defective components, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain instrumentation and control devices.

B. Coordinate gas instrument demonstration video with operation and maintenance manuals and classroom instruction for use by Owner in operating, maintaining, and troubleshooting.

C. Record videos on DVD disks.

D. Owner shall have right to make additional copies of video for internal use without paying royalties.

END OF SECTION 230923.16

SECTION 230923.19
MOISTURE INSTRUMENTS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes moisture switches, sensors, and transmitters.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
2. Product description with complete technical data, performance curves, and product specification sheets.

B. Shop Drawings:

1. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.
3. Include number-coded identification system for unique identification of wiring, cable, and tubing ends.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: To include in operation and maintenance manuals.

PART 2: PRODUCTS

2.01 MOISTURE SWITCHES

A. Humidistat for Duct Applications:

1. Description:

   a. Two-position control.
   b. Field-adjustable set point.
   c. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Performance:

   a. Relative Humidity Range: 15 to 95 percent.
   b. Relative Humidity Differential: 5 percent.
   c. Ambient Temperature: 40 to 135 deg F.
   d. Voltage: 120-V ac.
   e. Current: 7.2 FLA.
   f. Switch Type: SPDT snap switch.

3. Construction:

a. Enclosure: Metal, NEMA 250, Type 1.
b. Electrical Connections: Screw terminals.

B. Humidistat for Space Applications:

1. Description:

a. Two-position control.
b. Field-adjustable set point.
c. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Performance:

a. Relative Humidity Range: 10 to 90 percent.
b. Relative Humidity Differential: 5 percent.
c. Ambient Temperature: 40 to 135 deg F
d. Voltage: 24-V ac.
e. Pilot Duty: 60 VA.
f. Switch Type: SPDT snap switch.

3. Construction:

a. Enclosure: Plastic, NEMA 250, Type 1.
b. Electrical Connections: Cable, 6 inches long.

2.02 MOISTURE SENSORS AND TRANSMITTERS

A. Sensors and Transmitters with Digital Display:

1. Performance:

a. Accuracy including non-linearity, hysteresis, and repeatability: Within 2 percent from zero to 90 percent relative humidity and within 2.5 percent from 90 to 100 percent relative humidity when operating between 60 to 77 deg F.
b. Relative Humidity Range: Zero to 100 percent.
c. Factory calibrated and NIST traceable with certificate included.

2. Construction:

a. Provide housing with integral sensor for room applications.
b. Provide housing with remote sensor probe for ducted applications.

1) Duct Sensor Body: 300 series stainless steel or chrome-plated aluminum, at least 2 inches long for duct-mounted applications.
2) Provide sensor with cable for field installation in conduit.
3) For duct-mounted applications, thread the sensor assembly for connection to a threaded mounting flange.

c. Provide general-purpose humidity sensor unless application requires special requirements. Provide sensor with sintered stainless-steel filter for duct applications.
d. Housing shall be ABS/PC plastic or powder-coated aluminum.
e. Housing Classification: NEMA 250, Type 4 or 4X.
f. Provide housing with wall-mounting plate.

3. Output Signal: 2-wire, 4- to 20-mA output signal with a drive capacity of at least 500 ohms at 24-V dc.
4. Provide unit with a digital display of relative humidity in percent.

B. Sensor and Transmitter without Display:

1. Performance:

a. Accuracy including non-linearity, hysteresis, and repeatability: Within 2 percent from zero to 90 percent relative humidity and within 3 percent from 90 to 95 percent relative humidity when operating at 68 deg F.
b. Relative Humidity Range:

1) Duct: Zero to 100 percent.
2) Space: Zero to 95 percent relative.

c. Factory calibrated and NIST traceable with certificate included.

2. Construction for Space Applications:

a. Housing with integral sensor.
b. Housing shall be ABS plastic or powder-coated aluminum.
c. Enclosure: NEMA 250, Type 4.
d. Provide housing with a wall-mounting plate.

3. Construction for Duct and Equipment Applications:

a. Housing with integral sensor.
b. Duct Sensor Body: 300 series stainless steel.
c. Provide sensor with sintered stainless-steel filter for duct applications.
d. Housing shall be cast aluminum.
e. Enclosure: NEMA 250, Type 4.

4. Output Signal: Two-wire, 4- to 20-mA output signal with drive capacity of at least 500 ohms at 24-V dc.

C. Sensor and Transmitter without Display:

1. Performance:

a. Relative Humidity Range: Zero to 100 percent.
b. Accuracy: Within 2 or 3 percent.
c. Operating Temperatures: Minus 30 to 130 deg F.
d. Hysteresis: Within 1 percent.

2. Construction:

a. Duct-type sensor for duct-mounted applications. Integral-type sensor for room or space applications.
b. Sensor Body: 300 series stainless steel, 6 inches long for duct-mounted applications.
c. For outdoor and duct applications, install circuitry in a NEMA 250, Type 4 or 4X enclosure.

3. Output Signal:

a. Two-wire, 4- to 20-mA output signal with a drive capacity of at least 600 ohms at 24-V dc.
b. Non-interacting zero and span adjustments.

D. Combination Humidity and Temperature Sensor and Transmitter with Display:

1. Description:

a. Factory package consisting of humidity and temperature sensor, digital display, keypad user interface, installation hardware, interconnecting sensor cabling, installation instructions, and operating manual.
b. Each transmitter shall be individually calibrated and provided with NIST traceable calibration certifications.
c. Provide a service cable for connecting to a notebook computer and Microsoft Windows compatible software.

2. Display:

a. Alphanumeric display of the following on the face of the enclosure:

1) Percent relative humidity.
2) Absolute humidity.
3) Mixing ratio.
4) Dry-bulb temperature.
5) Wet-bulb temperature.
6) Dew point temperature.
7) Enthalpy.

b. Visual display of measurement trends, and minimum and maximum values over a one-year period.

3. Electronics Enclosure:

a. Integral to sensors for wall- (room-)mounted applications and remote from temperature and humidity sensors for duct and equipment applications.
b. NEMA 250, Type 4 or 4X.
c. Labeled terminal strip for field wiring connections.

4. Programming:

a. Transmitter parameters shall be field programmable through keypad on the face of the enclosure.
b. Programmed parameters shall be stored in nonvolatile EEPROM.

5. Output Signals:

a. Three Analog Outputs: 4 to 20 mA or zero to 10-V dc for each output. Option to use a serial communication interface.

6. Temperature Sensor:

a. Temperature range matched to application, but not less than minus 40 to 140 deg F.
b. Within 0.5 deg F accuracy over the temperature range of 50 to 100 deg F and within 1 deg F over the remainder of the range.
c. Provide duct installation kit for duct applications.

7. Humidity Sensor:

a. Relative Humidity Measurement Range: Zero to 100 percent.
b. Response time in still air within 40 seconds.
c. Accuracy including non-linearity, hysteresis, and repeatability:

1) For Temperature Between 59 and 77 Deg F and Relative Humidity between Zero and 90 Percent: Within 1 percent.
2) For Temperature between 59 and 77 Deg F and Relative Humidity between 90 and 100 Percent: Within 1.7 percent.

3) For Temperature between Minus 4 and 104 Deg F: Within 1 percent plus 0.008 times relative humidity reading.
4) For Temperature between Minus 40 and 356 Deg F: Within 1.5 percent plus 0.015 times the relative humidity reading.

d. Sintered, stainless-steel filter, protecting sensor.
e. Provide duct installation kit for duct applications.

8. Power Supply:

a. Field Power: 120-V ac, 60 Hz unless otherwise required by the application.
b. Internal Power: As required by transmitter.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Install products level, plumb, parallel, and perpendicular with building construction.

B. Properly support instruments, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to a 50 lb force.

C. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

D. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.03 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."

C. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

3.04 MOISTURE INSTRUMENTS INSTALLATION

A. Mounting Location: Rough-in instrument-mounting locations before setting instruments and routing, cable, wiring, tubing, and conduit to final location.

B. Mounting Height:

1. Mount instruments in user-occupied space to match mounting height of light switches unless otherwise indicated on Drawings. Mounting height shall comply with codes and accessibility requirements.
2. Mount switches and transmitters located in mechanical equipment rooms and other similar space not subject to code, state, and Federal accessibility requirements within a range of 42 to 72 inches above the adjacent floor, grade, or service catwalk or platform.

    a. Make every effort to mount at 60 inches.

3.05 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install engraved phenolic nameplate with instrument identification on face of ceiling directly below instruments concealed above ceilings.

3.06 CHECKOUT PROCEDURES

A. Check installed products before continuity tests and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that impact performance.

3.07 ADJUSTMENT, CALIBRATION, AND TESTING

A. Description:

1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
2. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.
3. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.
4. Equipment and procedures used for calibration shall meet instrument manufacturer's written instructions.
5. Provide diagnostic and test equipment for calibration and adjustment.
6. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. For example, an installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
7. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.
8. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.
9. Comply with field-testing requirements and procedures indicated by ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.

B. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistance source.

C. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact.

D. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

E. Switches: Calibrate switches to make or break contact at set points indicated.

F. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistance source.

3.08 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include semiannual preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.09 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain instrumentation and control devices.

B. Coordinate video with operation and maintenance manuals and classroom instruction for use by Owner in operating, maintaining, and troubleshooting.

C. Record videos on DVD disks.

D. Owner shall have right to make additional copies of video for internal use without paying royalties.

END OF SECTION 230923.19

SECTION 230923.27
TEMPERATURE INSTRUMENTS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Air temperature sensors.

1.03 DEFINITIONS

A. HART (Highway Addressable Remote Transducer) Protocol: The global standard for sending and receiving digital information across analog wires between smart devices and control or monitoring systems through bidirectional communication that provides data access between intelligent field instruments and host systems. A host can be any software application from a technician's hand-held device or laptop to a plant's process control, asset management, safety, or other system using any control platform.

B. RTD: Resistance temperature detector.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
3. Product description with complete technical data, performance curves, and product specification sheets.
4. Installation operation and maintenance instructions, including factors affecting performance.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Include number-coded identification system for unique identification of wiring, cable, and tubing ends.

C. Samples: For each exposed product installed in finished space.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plan drawings and corresponding product installation details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Product installation location shown in relationship to room, duct, pipe, and equipment.
2. Wall-mounted instruments located in finished space showing relationship to light switches, fire-alarm devices, and other installed devices.
3. Sizes and locations of wall access panels for instruments installed behind walls.
4. Sizes and locations of ceiling access panels for instruments installed in inaccessible ceilings.

B. Product Certificates: For each product requiring a certificate.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

D. Field quality-control reports.

PART 2: PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Environmental Conditions:

1. Instruments shall operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.

    a. If instrument alone cannot meet requirement, install instrument in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, filtered, and ventilated as required by instrument and application.

2. Instruments and accessories shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Instruments not available with integral enclosures complying with requirements indicated shall be housed in protective secondary enclosures. Instrument's installed location shall dictate following NEMA 250 enclosure requirements:

    a. Outdoors, Protected: Type 3.
    b. Outdoors, Unprotected: Type 4.
    c. Indoors, Heated with Filtered Ventilation: Type 1.
    d. Indoors, Heated with Non-Filtered Ventilation: Type 2.

    e. Indoors, Heated and Air Conditioned: Type 1.

    f. Mechanical Equipment Rooms: Type 1.

    g. Localized Areas Exposed to Washdown: Type 4.
    h. Within Duct Systems and Air-Moving Equipment Not Exposed to Possible Condensation: Type 2.
    i. Within Duct Systems and Air-Moving Equipment Exposed to Possible Condensation: Type 4.
    j. Hazardous Locations: Explosion-proof rating for condition.

2.02 AIR TEMPERATURE SENSORS

A. Platinum RTDs: Common Requirements:

1. 100 or 1000 ohms at zero deg C and a temperature coefficient of 0.00385 ohm/ohm/deg C.
2. Two-wire, PTFE-insulated, 22-gage stranded copper leads.
3. Performance Characteristics:

    a. Range: Minus 50 to 275 deg F.
    b. Interchangeable Accuracy: At 32 deg Fwithin 0.5 deg F.
    c. Repeatability: Within 0.5 deg F.
    d. Self-Heating: Negligible.

4. Transmitter Requirements:

    a. Transmitter required for each 100-ohm RTD.
    b. Transmitter optional for 1000-ohm RTD, contingent on compliance with end-to-end control accuracy.

B. Platinum RTD, Single-Point Air Temperature Duct Sensors:

1. 100 or 1000 ohms.
2. Temperature Range: Minus 50 to 275 deg F
3. Probe: Single-point sensor with a stainless-steel sheath.
4. Length: As required by application to achieve tip at midpoint of air tunnel, up to 18 inches.
5. Enclosure: Junction box with removable cover; NEMA 250, Type 1 for indoor applications and Type 4 for outdoor applications.
6. Gasket for attachment to duct or equipment to seal penetration airtight.
7. Conduit Connection: 1/2-inch.

C. Platinum RTD, Air Temperature Averaging Sensors:

1. 100 or 1000 ohms.
2. Temperature Range: Minus 50 to 275 deg F
3. Multiple sensors to provide average temperature across entire length of sensor.
4. Rigid probe of aluminum, brass, copper, or stainless-steel sheath.
5. Flexible probe of aluminum, brass, copper, or stainless-steel sheath and formable to a 4-inch radius.
6. Length: As required by application to cover entire cross section of air tunnel.
7. Enclosure: Junction box with removable cover; NEMA 250, Type 1 for indoor applications and Type 4 for outdoor applications.
8. Gasket for attachment to duct or equipment to seal penetration airtight.
9. Conduit Connection: 1/2-inch.

D. Platinum RTD Outdoor Air Temperature Sensors:

1. 100 or 1000 ohms.
2. Temperature Range: Minus 50 to 275 deg F
3. Probe: Single-point sensor with a stainless-steel sheath.
4. Solar Shield: Stainless steel.
5. Enclosure: NEMA 250, Type 4 or 4X junction box or combination conduit and outlet box with removable cover and gasket.
6. Conduit Connection: 1/2-inchtrade size.

E. Platinum RTD Space Air Temperature Sensors:

1. 100 or 1000 ohms.
2. Temperature Range: Minus 50 to 212 deg F
3. Sensor assembly shall include a temperature sensing element mounted under a flush, brushed-aluminum cover.
4. Provide a mounting plate that is compatible with the surface shape that it is mounted to and electrical box used.
5. Concealed wiring connection.

F. Thermal Resistors (Thermistors): Common Requirements:

1. 10,000 ohms at 25 deg C and a temperature coefficient of 23.5 ohms/ohm/deg C.
2. Two-wire, PTFE-insulated, 22-gage stranded copper leads.
3. Performance Characteristics:

    a. Range: Minus 50 to 275 deg F.
    b. Interchangeable Accuracy: At 77 deg Fwithin 0.5 deg F.
    c. Repeatability: Within 0.5 deg F.
    d. Drift: Within 0.5 deg F over 10 years.
    e. Self-Heating: Negligible.

4. Transmitter optional, contingent on compliance with end-to-end control accuracy.

G. Thermistor, Single-Point Duct Air Temperature Sensors:

1. Temperature Range: Minus 50 to 275 deg F
2. Probe: Single-point sensor with a stainless-steel sheath.

3. Length: As required by application to achieve tip at midpoint of air tunnel, up to 18 inches.
4. Enclosure: Junction box with removable cover; NEMA 250, Type 1 for indoor applications and Type 4 for outdoor applications.
5. Gasket for attachment to duct or equipment to seal penetration airtight.
6. Conduit Connection: 1/2- inch trade size

H. Thermistor Averaging Air Temperature Sensors:

1. Temperature Range: Minus 50 to 275 deg F
2. Multiple sensors to provide average temperature across entire length of sensor.
3. Rigid probe of aluminum, brass, copper, or stainless-steel sheath.
4. Flexible probe of aluminum, brass, copper, or stainless-steel sheath and formable to a 4-inchradius.
5. Length: As required by application to cover entire cross section of air tunnel.
6. Enclosure: Junction box with removable cover; NEMA 250, Type 1 for indoor applications and Type 4 for outdoor applications.
7. Gasket for attachment to duct or equipment to seal penetration airtight.
8. Conduit Connection: 1/2-inch trade size.

I. Thermistor Outdoor Air Temperature Sensors:

1. Temperature Range: Minus 50 to 275 deg F
2. Probe: Single-point sensor with a stainless-steel sheath.
3. Solar Shield: Stainless steel.
4. Enclosure: NEMA 250, Type 4 or 4X junction box or combination conduit and outlet box with removable cover and gasket.
5. Conduit Connection: 1/2-inch trade size.

J. Thermistor Space Air Temperature Sensors:

1. Temperature Range: Minus 50 to 212 deg F
2. Sensor assembly shall include a temperature sensing element mounted under a flush, brushed-aluminum cover.
3. Provide a mounting plate that is compatible with the surface shape that it is mounted to and electrical box used.
4. Concealed wiring connection.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.

C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPERATURE INSTRUMENT APPLICATIONS

A. Air Temperature Sensors:

1. Duct: Thermistor.
2. Outdoor: Thermistor.
3. Space: Thermistor.

3.03 INSTALLATION, GENERAL

A. Install products level, plumb, parallel, and perpendicular with building construction.

B. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

C. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.04 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."

C. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

3.05 TEMPERATURE INSTRUMENT INSTALLATIONS

A. Mounting Location:

1. Roughing In:

a. Outline instrument mounting locations before setting instruments and routing cable, wiring, tubing, and conduit to final location.
b. Provide independent inspection to confirm that proposed mounting locations comply with requirements indicated and approved submittals.

1) Indicate dimensioned locations with mounting height for all surface-mounted products on Shop Drawings.
2) Do not begin installation without submittal approval of mounting location.

c. Complete installation rough-in only after confirmation by independent inspection is complete and approval of location is documented for review by Owner and Architect on request.

B. Special Mounting Requirements:

1. Protect products installed outdoors from solar radiation, building and wind effect with stand-offs and shields constructed of Type 316 stainless.
2. Temperature instruments having performance impacted by temperature of mounting substrate shall be isolated with an insulating barrier located between instrument and substrate to eliminate effect. Where instruments requiring insulation are located in finished space, conceal insulating barrier in a cover matching the instrument cover.

C. Mounting Height:

1. Mount temperature instruments in user-occupied space to match mounting height of light switches unless otherwise indicated on Drawings. Mounting height shall comply with codes and accessibility requirements.

2. Mount switches and transmitters located in mechanical equipment rooms and other similar space not subject to code or state and Federal accessibility requirements within a range of 42 to 72 inches above the adjacent floor, grade, or service catwalk or platform.

    a. Make every effort to mount at 60 inches.

D. Seal penetrations to ductwork, plenums, and air-moving equipment to comply with duct static-pressure class and leakage and seal classes indicated using neoprene gaskets or grommets.

E. Space Temperature Sensor Installation:

1. Conceal assembly in an electrical box of sufficient size to house sensor and transmitter, if provided.
2. Install electrical box with a faceplate to match sensor cover if sensor cover does not completely cover electrical box.
3. In finished areas, recess electrical box within wall.
4. In unfinished areas, electrical box may be surface mounted if electrical light switches are surface mounted. Use a cast-aluminum electric box for surface-mounted installations.
5. Align electrical box with other electrical devices such as visual alarms and light switches located in the vicinity to provide a neat and well-thought-out arrangement. Where possible, align in both horizontal and vertical axis.

F. Outdoor Air Temperature Sensor Installation:

1. Mount sensor in a discrete location facing north.
2. Protect installed sensor from solar radiation and other influences that could impact performance.
3. If required to have a transmitter, mount transmitter remote from sensor in an accessible and serviceable location indoors.

G. Single-Point Duct Temperature Sensor Installation:

1. Install single-point-type, duct-mounted, supply- and return-air temperature sensors. Install sensors in ducts with sensitive portion of the element installed in center of duct cross section and located to sense near average temperature. Do not exceed 24 inchesin sensor length.
2. Install return-air sensor in location that senses return-air temperature without influence from outdoor or mixed air.
3. Rigidly support sensor to duct and seal penetration airtight.
4. If required to have transmitter, mount transmitter remote from sensor at accessible and serviceable location.

H. Averaging Duct Temperature Sensor Installation:

1. Install averaging-type air temperature sensor for temperature sensors located within air-handling units, similar equipment, and large ducts with air tunnel cross-sectional area of 20 sq. ft. and larger.
2. Install sensor length to maintain coverage over entire cross-sectional area. Install multiple sensors where required to maintain the minimum coverage.
3. Fasten and support sensor with manufacturer-furnished clips to keep sensor taut throughout entire length.
4. If required to have transmitter, mount transmitter in an accessible and serviceable location.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install engraved phenolic nameplate with instrument identification.

3.07 CLEANING

A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.

B. Wash and shine glazing.

C. Polish glossy surfaces to a clean shine.

3.08 CHECK-OUT PROCEDURES

A. Check installed products before continuity tests, leak tests, and calibration.

B. Check temperature instruments for proper location and accessibility.

C. Verify sensing element type and proper material.

D. Verify location and length.

E. Verify that wiring is correct and secure.

3.09 ADJUSTMENT, CALIBRATION, AND TESTING

A. Description:

1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
2. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.
3. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.
4. Equipment and procedures used for calibration shall meet instrument manufacturer's written instructions.
5. Provide diagnostic and test equipment for calibration and adjustment.
6. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. For example, an installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
7. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.
8. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.
9. Comply with field-testing requirements and procedures indicated by ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements and to supplement requirements indicated.

B. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistance source.

C. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact.

D. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

E. Switches: Calibrate switches to make or break contact at set points indicated.

F. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistance source.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections.

B. Prepare test and inspection reports.

3.11 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.12 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include semiannual preventive maintenance, repair or replacement of worn or defective components, cleaning and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain temperature instruments.

B. Provide a complete set of instructional videos covering each product specified and installed and showing the following:

1. Operation and maintenance requirements and procedures.
2. Troubleshooting procedures.

C. Coordinate video with operation and maintenance manuals and classroom instruction for use by Owner in operating, maintaining, and troubleshooting.

D. Record videos on DVD disks.

E. Owner shall have right to make additional copies of video for internal use without paying royalties.

END OF SECTION 230923.27

SECTION 230923.43
WEATHER STATIONS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes weather stations connected to direct-digital controls for HVAC.

1.03 DEFINITIONS

A. I/O: Input/output.

B. RS-232: A TIA standard for asynchronous serial data communications between terminal devices.

C. RS-485: A TIA standard for multipoint communications using two twisted pairs.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating control signal over range, electrical power requirements, and limitations of ambient operating environment including temperature and humidity.
3. Product description with complete technical data, performance curves, and product specification sheets.
4. Installation operation and maintenance instructions including factors affecting performance.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Include number-coded identification system for unique identification of wiring, cable, and tubing ends.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For weather stations to include in operation and maintenance manuals.

PART 2: PRODUCTS

2.01 WEATHER STATION

2.02 Description:

1. Weather station shall measure and record wind speed and direction, air temperature and relative humidity, barometric pressure, solar radiation, and rain.
2. Design weather station for applications with minimal visual impact, high reliability, and a long interval between routine servicing.

3. Weather station shall use solid-state sensors with no moving parts.
4. Weather station shall not be impaired by heavy snowfall or freezing conditions that produce rime ice. Provide a thermostatically controlled heater element in the sensor head that keeps the wind sensor elements and the precipitation sensor surface free of snow and ice to minus 62 deg F
5. Weather station shall directly connect to host device, or wirelessly connect to a host device through a fully integrated, industrial-grade, 916-MHz spread spectrum radio-frequency communications technology. Where required by application, replace 916-MHz radio-frequency components with 922-MHz and 2.4-GHz radio-frequency components to comply with local, regional, and national radio-frequency licensing requirements.
6. RS-232 serial data I/O shall be located on the bottom of the weather station and used as a second serial communications port, for programming and testing the system, or for direct data downloads using a personal computer or personal digital assistant.
7. Weather station shall be provided with a mounting system supplied by weather station manufacturer that is suitable for the installation.

B. Sensor Technology:

1. Wind speed and direction shall use acoustic techniques. Sensor shall consist of three equally spaced ultrasonic transducers in a horizontal plane. Values of any two array paths shall enable computation of both wind speed and direction, and a signal processing technique shall enable the measurement to be calculated using the two array paths of the best quality.
2. Rain shall be measured using a stainless-steel piezometric impact surface that counts the raindrops and measures their acoustic signature, integrating that information to provide a near-real-time value for rainfall amount and rate.
3. Air-temperature and relative-humidity sensors shall be combined in an integrated, user-replaceable unit that requires no calibration.

    a. Relative humidity sensor shall be a thin-polymer, capacitive sensor.
    b. Air-temperature sensor shall be a capacitive ceramic sensor.

C. Performance:

1. Air Temperature:

    a. Range: Minus 60 to 140 deg F.
    b. Accuracy: Within 0.9 deg F.
    c. Resolution: 0.1 deg F.

2. Relative Humidity:

    a. Range: Zero to 100 percent.
    b. Accuracy: Within 3 percent over the range of zero to 90 percent and within 5 percent between 90 to 100 percent.
    c. Resolution: 0.1 percent.

3. Data Storage: 60 days of hourly data.

D. Output Signals:

1. RS-232 or RS-485 serial interface directly from weather station to host.
2. In applications that cannot accept a serial signal, provide a serial-to-analog converter.
3. Serial-to-Analog Converter:

    a. Serial converter designed to add analog outputs for measuring instruments that have only serial output.
    b. Configure to give analog outputs from all measuring sensors and calculated parameters.
    c. Each converter shall have four analog outputs with a 4- to 20-mA signal.
    d. Provide multiple converters for applications requiring more points.
    e. Converter requires a 24-V dc power supply.

E. Communication Interface:

1. Weatherproof serial cables shall be used to connect the RS-232 I/O on the weather station. Cables shall use nickel-plated brass DB-9 connectors for corrosion resistance and include a Sanoprene jacket suitable for both high-ultraviolet and direct-burial environments.
2. An RF4xx spread spectrum radio-frequency transceiver shall be provided with every wireless weather station.

F. Unit shall be provided with a 120-V ac, 60-Hz power supply, a serial cable, and an antenna.

G. Software:

1. Data Transfer Protocols, Software, and Data Interface Hardware: Weather stations that communicate using a proprietary protocol shall be provided with a software development kit to enable a qualified software developer in development of software drivers for third-party devices or software.
2. Manufacturer shall submit description and pricing information of software application offerings for weather station management, data acquisition and logging, report generation, and data display for review and consideration.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install products level, plumb, parallel, and perpendicular with building construction.

B. Properly support weather station, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to forces that are consistent with building code structural design requirements.

C. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

3.03 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."

C. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install engraved phenolic nameplate with instrument identification.

3.05 ADJUSTMENT, CALIBRATION, AND TESTING

A. Description:

1. Calibrate each weather station installed that is not factory calibrated and provided with calibration documentation.
2. Provide a written description of proposed field procedures and equipment used for calibrating. Submit procedures before calibration and adjustment.
3. For each analog signal, make a three-point test of calibration for both linearity and accuracy.
4. Equipment and procedures used for calibration shall comply with instrument manufacturer's written instructions.
5. Provide diagnostic and test equipment for calibration and adjustment.
6. Field instruments and equipment used to test and calibrate installed weather stations shall have accuracy at least twice the instrument accuracy being calibrated. For example, an installed weather station with a signal accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
7. Calibrate each weather station according to instrument instruction manual supplied by manufacturer.
8. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.
9. Comply with field-testing requirements and procedures indicated by ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements and to supplement requirements indicated.

B. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistance source.

C. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Prepare test and inspection reports.

3.07 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

3.08 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include semiannual preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.09 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain weather stations.

B. Provide a complete set of instructional videos covering each product specified and installed and showing the following:

1. Software programming.
2. Calibration and test procedures.
3. Operation and maintenance requirements and procedures.
4. Troubleshooting procedures.

C. Coordinate video with operation and maintenance manuals and classroom instruction for use by Owner in operating, maintaining, and troubleshooting.

D. Record videos on DVD disks.

E. Owner shall have right to make additional copies of video for internal use without paying royalties.

END OF SECTION 230923.43

SECTION 23 11 23
FACILITY NATURAL-GAS PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.04 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Dielectric fittings.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot.
2. Detail mounting, supports, and valve arrangements for pressure regulator assembly.

1.06 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

C. Qualification Data: For qualified professional engineer.

D. Welding certificates.

E. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.08 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.10 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

1.11 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 083113 "Access Doors and Frames."

PART 2: PRODUCTS

2.01 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

1. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. OmegaFlex, Inc.
    b. Parker Hannifin Corporation; Parflex Division.
    c. Titeflex.
    d. Tru-Flex Metal Hose Corp.

2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
3. Coating: PE with flame retardant.

    a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

        1) Flame-Spread Index: 25 or less.
        2) Smoke-Developed Index: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
5. Striker Plates: Steel, designed to protect tubing from penetrations.
6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
7. Operating-Pressure Rating: 5 psig.

2.02 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.03 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.04 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. BrassCraft Manufacturing Company; a Masco company.
   b. Conbraco Industries, Inc.; Apollo Div.
   c. Lyall, R. W. & Company, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. BrassCraft Manufacturing Company; a Masco company.
   b. Conbraco Industries, Inc.; Apollo Div.
   c. Lyall, R. W. & Company, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Lee Brass Company.
   b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Flowserve.
   b. Homestead Valve; a division of Olson Technologies, Inc.
   c. McDonald, A. Y. Mfg. Co.
   d. Milliken Valve Company.

e. Mueller Co.; Gas Products Div.
f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.05 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Canadian Meter Company Inc.
b. Eaton Corporation; Controls Div.
c. Harper Wyman Co.
d. Maxitrol Company.
e. SCP, Inc.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 2 psig.

2.06 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Hart Industries International, Inc.

d. Jomar International Ltd.
e. Matco-Norca, Inc.
f. McDonald, A. Y. Mfg. Co.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
h. Wilkins; a Zurn company.

2. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Matco-Norca, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Wilkins; a Zurn company.

2. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 125 psig minimum at 180 deg F.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

2.07 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.03 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

    a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

    a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage ports upstream and downstream from each line regulator.

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.04 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.05 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

3.06 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.07 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.08 LABELING AND IDENTIFYING

A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.09 PAINTING

A. Comply with requirements in Section 099113 "Exterior Painting" for painting exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

   a. Prime Coat: Alkyd anticorrosive metal primer.
   b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
   c. Topcoat: Exterior alkyd enamel.
   d. Color: Gray.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

D. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be the following:

1. Steel pipe with steel welding fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.

D. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

B. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, lubricated plug valve.

C. Valves in branch piping for single appliance shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.

2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

END OF SECTION 23 11 23

SECTION 23 31 13
METAL DUCTS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.03 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.04 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

D. Welding certificates.

E. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2: PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. Spiral Manufacturing Co., Inc.
f. No Substitutions.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.04 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation; Insulation Group.
b. Johns Manville.
c. Knauf Insulation.
d. Owens Corning.
e. No Substitutions.

2. Maximum Thermal Conductivity:

a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

a. Fan discharges.
b. Intervals of lined duct preceding unlined duct.

8. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.05 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.06 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3: EXECUTION

3.01 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling

equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire and / or smoke-rated interior partitions and exterior walls, install fire and / or dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.04 DUCT SEALING

A. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.05 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.06 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.07 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.08 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.09 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Dishwasher Exhaust Ducts: Stainless Steel.
2. Dryer Exhaust Ducts: Aluminum.
3. Kitchen Grease Exhaust Ducts: Carbon-Steel Sheets.

B. Supply Ducts:

1. Ducts Connected to Constant-Volume Air-Handling Units:

   a. Pressure Class: Positive 3-inch wg.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 6.
   d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Equipment Not Listed Above:

   a. Pressure Class: Positive 2-inch wg.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 6.
   d. SMACNA Leakage Class for Round and Flat Oval: 6.

C. Return Ducts:

1. Ducts Connected to Air-Handling Units:

   a. Pressure Class: Positive or negative 2-inch wg.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 6.
   d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Equipment Not Listed Above:

   a. Pressure Class: Positive or negative 2-inch wg.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 6.

d. SMACNA Leakage Class for Round and Flat Oval: 6.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Commercial Kitchen Hoods:

a. 16 gauge, Carbon-Steel Sheets.
b. Pressure Class: Positive or negative 3-inch wg.
c. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
d. Leakage Class: Liquid tight with light test.

3. Ducts Connected to Dishwasher Hoods:

a. Type 304, stainless-steel sheet.
b. Exposed to View: No. 4 finish.
c. Concealed: No. 2D finish.
d. Welded seams and flanged joints with watertight EPDM gaskets.
e. Pressure Class: Positive or negative 2-inch wg.
f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
g. SMACNA Leakage Class: 3.

4. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

2. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Galvanized.

3. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

F. Liner (Acoustical):

1. Return Air Ducts: Fibrous glass, Type I, 1 inch thick.
2. Exhaust Air Ducts: Fibrous glass, Type I, 1 inch thick.
3. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 1 inch thick.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

   a. Velocity 1000 fpm or Lower: 90-degree tap.
   b. Velocity 1000 to 1500 fpm: Conical tap.
   c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Control dampers.
3. Flange connectors.
4. Turning vanes.
5. Remote damper operators.
6. Duct-mounted access doors.

B. Related Requirements:

1. Section 233346 "Flexible Ducts" for insulated and non-insulated flexible ducts.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2: PRODUCTS

2.01 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and paint grip finish for exposed ducts.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inchminimum diameter for lengths 36 inches or less; 3/8-inchminimum diameter for lengths longer than 36 inches.

2.03 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Standard leakage rating, with linkage outside airstream.
2. Suitable for horizontal or vertical applications.
3. Frames:

    a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized-steel, 0.064 inchthick.

5. Blade Axles: Stainless steel.
6. Bearings:

    a. Oil-impregnated stainless-steel sleeve.
    b. Dampers in ducts with pressure classes of 3-inch wgor less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

1. Standard leakage rating, with linkage outside airstream.
2. Suitable for horizontal or vertical applications.
3. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:

   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.

5. Blade Axles: Stainless steel.
6. Bearings:

   a. Stainless-steel sleeve.
   b. Dampers in ducts with pressure classes of 3-inch wgor less shall have axles full length of damper blades and bearings at both ends of operating shaft.

2.04 CONTROL DAMPERS

A. Low-leakage rating**,** with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

B. Frames:

1. Hat shaped.
2. 0.125 inch extruded aluminum.
3. Mitered and welded corners.

C. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. Opposed-blade design.
3. Aluminum.
4. 0.0747-inch-thick dual skin.
5. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch-diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F

E. Bearings:

1. Molded synthetic.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.05 FLANGE CONNECTORS

A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

2.06 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Single wall.

E. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.07 REMOTE DAMPER OPERATORS

A. Description: Cable system designed for remote manual damper adjustment.

B. Cable: Stainless steel.

C. Wall-Box Mounting: Recessed.

D. Wall-Box Cover-Plate Material Stainless steel or PVC.

2.08 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
   d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.09 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

F. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Compliance with ASHRAE/IESNA 90.1-2004 includes Section 6.4.3.3.3 - "Shutoff Damper Controls," restricts the use of backdraft dampers, and requires control dampers for certain applications. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install duct security bars. Construct duct security bars from 0.164-inch steel sleeve, continuously welded at all joints and 1/2-inch-diameter steel bars, 6 inches o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch steel angle to 4 sides and both ends of sleeve. Connect duct

security bars to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. At drain pans and seals.
3. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
4. At each change in direction and at maximum 50-foot spacing.
5. Upstream from turning vanes.
6. Control devices requiring inspection.
7. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

O. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

P. Install duct test holes where required for testing and balancing purposes.

Q. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Inspect turning vanes for proper and secure installation.
4. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 33 46
FLEXIBLE DUCTS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Non-insulated flexible ducts.
2. Insulated flexible ducts.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For flexible ducts.

1. Include plans showing locations and mounting and attachment details.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from installers of the items involved.

PART 2: PRODUCTS

2.01 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."

D. Comply with ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

2.02 NON-INSULATED FLEXIBLE DUCTS

A. Non-Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wgnegative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.

2.03 INSULATED FLEXIBLE DUCTS

A. Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.

2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-Value: Comply with ASHRAE/IES 90.1 .

2.04 FLEXIBLE DUCT CONNECTORS

A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

B. Non-Clamp Connectors: Adhesive plus sheet metal screws.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.

C. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inchlengths of flexible duct clamped or strapped in place.

D. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

E. Install duct test holes where required for testing and balancing purposes.

F. Installation:

1. Install ducts fully extended.
2. Do not bend ducts across sharp corners.
3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
5. Install flexible ducts in a direct line, without sags, twists, or turns.

G. Supporting Flexible Ducts:

1. Suspend flexible ducts with bands 1-1/2 incheswide or wider and spaced a maximum of 48 inchesapart. Maximum centerline sag between supports shall not exceed 1/2 inchper 12 inches.
2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 incheso.c.

END OF SECTION 23 33 46

SECTION 23 34 13
AXIAL HVAC FANS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Tubeaxial fans.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, furnished specialties, and accessories for each fan.
2. Certified fan performance curves with system operating conditions indicated.
3. Certified fan sound-power ratings.
4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
5. Material thickness and finishes, including color charts.
6. Dampers, including housings, linkages, and operators.
7. Fan speed controllers.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

B. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For axial fans to include in emergency, operation, and maintenance manuals.

PART 2: PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. AMCA Compliance:

1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.

2. Operating Limits: Classify according to AMCA 99.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 TUBEAXIAL FANS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Twin City Fan

   b. Greenheck
   c. Loren cook.

B. Description: Fan wheel and housing, factory-mounted motor with direct drive, an inlet cone section, and accessories.

C. Housings: Steel with flanged inlet and outlet connections.

D. Wheel Assemblies: Cast aluminum, machined and fitted to shaft.

E. Accessories:
1. Swingout Construction: Assembly allowing entire fan section to swing out from duct for cleaning and servicing, of same material as housing.
2. Horizontal Support: Pair of supports bolted to fan housing, of same material as housing.
3. Vertical Support: Short duct section with welded brackets bolted to fan housing, of same material as housing.
4. Inlet Screen: Wire-mesh screen on fans not connected to ductwork, of same material as housing.
5. Shaft Seal: Elastomeric seal and Teflon wear plate, suitable for up to 300 deg F.

F. Factory Finishes:

1. Sheet Metal Parts: Prime coat before final assembly.
2. Exterior Surfaces: Baked-enamel finish coat after assembly.

2.03 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."

PART 3: EXECUTION

3.01 INSTALLATION

A. Install axial fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting:
1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

E. Install units with clearances for service and maintenance.

F. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.02 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.04 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

END OF SECTION 23 34 13

SECTION 23 34 16
CENTRIFUGAL HVAC FANS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes: For each product.

1. Airfoil centrifugal fans.
2. Backward-inclined centrifugal fans.
3. Forward-curved centrifugal fans.
4. Plenum fans.
5. Plug fans.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Include rated capacities, furnished specialties, and accessories for each fan.
2. Certified fan performance curves with system operating conditions indicated.
3. Certified fan sound-power ratings.
4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
5. Material thickness and finishes, including color charts.
6. Dampers, including housings, linkages, and operators.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

B. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

PART 2: PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. AMCA Compliance:

1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
2. Operating Limits: Classify according to AMCA 99.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 BACKWARD-INCLINED CENTRIFUGAL FANS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Twin City Fan.
   b. Greenheck
   c. Loren Cook.

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
3. Factory-installed and -wired disconnect switch.

C. Housings:

1. Formed panels to make curved-scroll housings with shaped cutoff.
2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
3. Horizontally split, bolted-flange housing.
4. Spun inlet cone with flange.
5. Outlet flange.

D. Backward-Inclined Wheels:

1. Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades, and fastened to shaft with set screws.
2. Welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate.

E. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Prelubricated and Sealed Shaft Bearings:

1. Self-aligning, pillow-block-type ball bearings.

G. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Companion Flanges: Rolled flanges for duct connections of same material as housing.
3. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
4. Spark-Resistant Construction: AMCA 99.

5. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.

2.03 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.04 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."

PART 3: EXECUTION

3.01 INSTALLATION

A. Install centrifugal fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting:
   1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

E. Install units with clearances for service and maintenance.

F. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.02 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   3. Verify that cleaning and adjusting are complete.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
   5. Adjust belt tension.

6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. See Section 230593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
10. Remove and replace malfunctioning units and retest as specified above.

D. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 23 34 16

SECTION 233713.13
AIR DIFFUSERS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Rectangular and square ceiling diffusers.
   2. Louver face diffusers.
   3. Linear slot diffusers.

B. Related Requirements:

   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
   2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   1. Ceiling suspension assembly members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   5. Duct access panels.

B. Source quality-control reports.

PART 2: PRODUCTS

2.01 RECTANGULAR AND SQUARE CEILING DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Titus.
   2. Metal aire
   3. Nailor
   4. Price.

B.

C. Devices shall be specifically designed for variable-air-volume flows.

D. Material: Steel.

E. Finish: Baked enamel, white.

F. Face Size: 24 by 24.

G. Face Style: Plaque.

H. Mounting: T-bar.

I. Pattern: Adjustable.

J. Accessories:
   1. Sectorizing baffles.

2.02 LOUVER FACE DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Titus.
   2. Metal aire
   3. Nailor
   4. Price.

B.

C. Devices shall be specifically designed for variable-air-volume flows.

D. Material: Steel.

E. Finish: Baked enamel, white.

F. Mounting: Surface.

G. Pattern: Adjustable core style.

H. Accessories:

   1. Square to round neck adaptor.
   2. Adjustable pattern vanes.
   3. Throw reducing vanes.
   4. Equalizing grid.

2.03 LINEAR SLOT DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Titus.
   2. Metal aire
   3. Nailor
   4. Price.

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material - Shell: Steel, insulated.

D. Material - Pattern Controller and Tees: Aluminum.

E. Finish - Face and Shell: Baked enamel, black.

F. Finish - Pattern Controller: Baked enamel, black.

G. Finish - Tees: Baked enamel, white.

H. Slot Width: 3/4 inch.

I. Number of Slots: Two.

J. Length: 48 inches.

K. Accessories: T-bar on both sides.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install diffusers level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

SECTION 233713.23
REGISTERS AND GRILLES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Fixed face registers and grilles.

B. Related Requirements:

   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
   2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified. Smallest size register and grille indicated.

C. Samples for Initial Selection: For registers and grilles with factory-applied color finishes. Smallest size register and grille indicated.

D. Samples for Verification: For registers and grilles, in manufacturer's standard sizes to verify color selected. Smallest size register and grille indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   1. Ceiling suspension assembly members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   5. Duct access panels.

B. Source quality-control reports.

PART 2: PRODUCTS

2.01 REGISTERS

A. Adjustable Blade Face Register :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Titus.

b. Metal aire
c. Nailor
d. Price.

2. Material: Steel, Aluminum, or Stainless steel.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
5. Core Construction: Integral.
6. Rear-Blade Arrangement: Vertical spaced 1/2 inchapart.
7. Frame: 1 inch wide.
8. Mounting: Countersunk screw.
9. Accessories:

a. Rear-blade gang operator.

B. Fixed Face Register:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Titus.
   b. Metal aire
   c. Nailor
   d. Price.
2. Material: Steel or Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
5. Face Arrangement: Perforated core.
6. Core Construction: Integral.
7. Frame: 1 inch wide.
8. Mounting: Countersunk screw.

2.02 GRILLES

A. Fixed Face Grille :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Titus.
   b. Metal aire
   c. Nailoi
   d. Price.
2. Material: Steel or Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal; spaced 1/2 inch apart.
5. Face Arrangement: Perforated core.
6. Core Construction: Integral.
7. Frame: 1 inchide.
8. Mounting: Countersunk screw or Lay in.

2.03 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 23 41 00
PARTICULATE AIR FILTRATION

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Pleated panel filters.
   2. Filter gages.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Provide one complete set(s) of filters for each filter bank. If system includes prefilters, provide only prefilters.
   2. Provide one container(s) of red oil for inclined manometer filter gage.

PART 2: PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance:

   1. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."
   2. Comply with ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.

B. Comply with NFPA 90A and NFPA 90B.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 PLEATED PANEL FILTERS

A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.

B. Filter Unit Class: UL 900, Class 1.

C. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.

1. Media shall be coated with an antimicrobial agent.
2. Separators shall be bonded to the media to maintain pleat configuration.
3. Welded-wire grid shall be on downstream side to maintain pleat.
4. Media shall be bonded to frame to prevent air bypass.
5. Support members on upstream and downstream sides to maintain pleat spacing.

D. Filter-Media Frame: Cardboard frame with perforated metal retainer sealed or bonded to the media.

E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
1. MERV Rating: 8 when tested according to ASHRAE 52.2.

2.03 FILTER GAGES

A. Diaphragm-type gage with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.

1. Diameter: 4-1/2 inches.
2. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1.0-Inch wg or Less: 0- to 1.0-inch wg.
3.

B. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

PART 3: EXECUTION

3.01 INSTALLATION

A. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

B. Install filters in position to prevent passage of unfiltered air.

C. Install filter gage for each filter bank.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

E. Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.

F. Coordinate filter installations with duct and air-handling-unit installations.

3.02 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Air filter will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.03 CLEANING

A. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 23 41 00

SECTION 23 51 23
GAS VENTS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Listed double-wall vents.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for product.

B. Shop Drawings: For vents.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of hangers and seismic restraints.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Sample Warranty: For special warranty.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents.

B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

PART 2: PRODUCTS

2.01 LISTED TYPE B AND BW VENTS

A. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B or 550 deg Fcontinuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.

B. Construction: Inner shell and outer jacket separated by at least a 1/4-inchairspace.

C. Inner Shell: ASTM A 666, Type 430 stainless steel.

D. Outer Jacket: Aluminized steel.

E. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.

2.02 LISTED TYPE L VENTS

A. Description: Double-wall metal vents tested according to UL 641 and rated for 570 deg F continuously or 1700 deg Ffor 10 minutes; with neutral or negative flue pressure complying with NFPA 211.

B. Construction: Inner shell and outer jacket separated by at least a 1-inchairspace filled with high-temperature, mineral-wool insulation.

C. Inner Shell: ASTM A 666, Type 304 stainless steel.

D. Outer Jacket: Aluminized steel.

E. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Round chimney top designed to exclude 98 percent of rainfall.

2.03 LISTED SPECIAL GAS VENTS

A. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg Fcontinuously, with positive or negative flue pressure complying with NFPA 211.

B. Construction: Inner shell and outer jacket separated by at least a 1/2-inchairspace.

C. Inner Shell: ASTM A 959, Type 29-4C stainless steel.

D. Outer Jacket: Aluminized steel.

E. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATION

A. Listed Type B and BW Vents: Vents for certified gas appliances.

B. Listed Type L Vent: Vents for low-heat appliances.

C. Listed Special Gas Vent: Condensing gas appliances.

3.03 INSTALLATION OF LISTED VENTS

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

B. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

C. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

D. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

E. Lap joints in direction of flow.

3.04 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

END OF SECTION 23 51 23

SECTION 235533.16
GAS-FIRED UNIT HEATERS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes gas-fired unit heaters.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of gas-fired unit heater.

1. Include rated capacities, operating characteristics, and accessories.

B. Shop Drawings: For gas-fired unit heaters. Include plans, elevations, sections, and attachment details.

1. Prepare by or under the supervision of a qualified professional engineer detailing fabrication and assembly of gas-fired unit heaters, as well as procedures and diagrams.
2. Design Calculations: Calculate requirements for selecting vibration isolatorsand for designing vibration isolation bases.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
4. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which equipment will be attached.
2. Items penetrating roof and the following:

   a. Vent and gas piping rough-ins and connections.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas-fired unit heaters to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.07 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace heat exchanger of gas-fired unit heater that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 MANUFACTURERS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Modine.
    b. Sterling
    c. Reznor

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 MANUFACTURED UNITS

A. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.

B. Gas Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

C. Type of Venting: Indoor, separated combustion, power vented.

D. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.

1. External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.
2. Discharge Louvers: Independently adjustable, horizontal blades.
3. Discharge Nozzle: Discharge at 25 to 65 degreesfrom horizontal.

E. Accessories:

1. Four-point suspension kit.
2. Power Venter: Centrifugal aluminized-steel fan, with stainless-steel shaft; 120-V ac motor.
3. Concentric, Terminal Vent Assembly: Combined combustion-air inlet and power-vent outlet with wall or roof caps. Include adapter assembly for connection to inlet and outlet pipes, and flashing for wall or roof penetration.

F. Heat Exchanger: Aluminized steel.

G. Burner Material: Aluminized steel with stainless-steel inserts.

H. Propeller Unit Fan:

1. Formed-steel propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.
2. Fan-Blade Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.

I. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Enclosure Materials: Rolled steel.

J. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

1. Gas Control Valve: Two stage.
2. Ignition: Electronically controlled electric spark with flame sensor.
3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
4. Vent Flow Verification: Flame rollout switch.
5. Control transformer.
6. High Limit: Thermal switch or fuse to stop burner.
7. Thermostat: Devices and wiring are specified in Section 230923.27 "Temperature Instruments."

8. Wall-Mounted Thermostat:

    a. Two stage.
    b. Fan on-off-automatic switch.
    c. 24-V ac.
    d. 50 to 90 deg F operating range.

K. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install and connect gas-fired unit heaters and associated gas and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written instructions.

3.02 EQUIPMENT MOUNTING

A. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to gas-fired unit heater, allow space for service and maintenance.

C. Gas Piping: Comply with Section 231123 "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.

D. Vent Connections: Comply with Section 235123 "Gas Vents."

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

    1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    2. Verify bearing lubrication.
    3. Verify proper motor rotation.
    4. Test Reports: Prepare a written report to record the following:

        a. Test procedures used.
        b. Test results that comply with requirements.
        c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Gas-fired unit heater will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.05 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gas-fired unit heaters.

END OF SECTION 235533.16

SECTION 237416.13
PACKAGED, LARGE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes packaged, large-capacity, rooftop air conditioning units (RTUs) with the following components and accessories:

1. Casings.
2. Fans.
3. Motors.
4. Coils.
5. Refrigerant circuit components.
6. Air filtration.
7. Gas furnaces.
8. Dampers.
9. Electrical power connections.
10. Controls.
11. Accessories
12. Roof curbs.

1.03 DEFINITIONS

A. DDC: Direct-digital controls.

B. ECM: Electronically commutated motor.

C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

D. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, large-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

E. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

F. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.04 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

1. Factory selection calculations for each antimicrobial ultraviolet lamp installation.

B. Shop Drawings:

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Include diagrams for power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which RTUs will be attached.
2. Wall openings.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) of filters for each unit.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 SYSTEM DESCRIPTION

A. AHRI Compliance:

1. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with AHRI 270 for testing and rating sound performance for RTUs.
3. Comply with AHRI 1060 for testing and rating performance for air-to-air exchanger.

B. AMCA Compliance:

1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
2. Damper leakage tested in accordance with AMCA 500-D.
3. Operating Limits: Classify according to AMCA 99.

C. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.

2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

E. NFPA Compliance: Comply with NFPA 90A or NFPA 90B.

F.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Daikin Applied
2. AAON
3. Trane
4. Carrier.
5.

2.03 CASINGS

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Double-Wall Construction: Fill space between walls with 1 inchfoam insulation and seal moisture tight for R-7 performance.

C. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.

D. Inner Casing Fabrication Requirements:

1. Inside Casing: G-90-coated galvanized steel, 0.034 inchthick.

E. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071, Type I.
2. Thickness: 1 inch.
3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

F. Condensate Drain Pans: Fabricated using stainless 0.025 inch thick steel sheet, a minimum of 2 inches deep, and complying with ASHRAE 62.1 for design and construction of drain pans.

1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
2. Drain Connections: Threaded nipple.

G. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.04 FANS

A. Supply-Air Fans: Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

1. Direct-Driven Supply-Air Fans: Motor shall be resiliently mounted in the fan inlet.

B. Condenser-Coil Fan: Variable-speed propeller, mounted on shaft of permanently lubricated ECM motors.

2.05 MOTORS

A. Comply with Section 230513 "Common Motor Requirements for HVAC Equipment" and the requirements of this Article.

B. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

C. Service Factor: 1.15.

D. Efficiency: Premium efficient.

2.06 COILS

A. Supply-Air Refrigerant Coil:

1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
2. Coil Split: Interlaced.
3. Condensate Drain Pan: Stainless steel formed with pitch and drain connections complying with ASHRAE 62.1.

B. Outdoor-Air Refrigerant Coil:

1. Aluminum plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.

C. Hot-Gas Reheat Refrigerant Coil:

1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
2. Suction-discharge bypass valve.

2.07 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: Two.

B. Compressor: Hermetic, variable speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief.

C. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.
10. Hot-gas reheat solenoid valve modulating with a replaceable magnetic coil.
11. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.08 AIR FILTRATION

A. Minimum arrestance and a minimum efficiency reporting value according to ASHRAE 52.2.

B. Pleated Panel Filters:

1. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.
2. Filter Unit Class: UL 900, Class 1.
3. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.
   a. Media shall be coated with an antimicrobial agent.
   b. Separators shall be bonded to the media to maintain pleat configuration.
   c. Welded-wire grid shall be on downstream side to maintain pleat.
   d. Media shall be bonded to frame to prevent air bypass.
   e. Support members on upstream and downstream sides to maintain pleat spacing.

2.09 GAS FURNACES

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.

1. CSA Approval: Designed and certified by and bearing label of CSA.

B. Burners: Stainless steel.

1. Fuel: Natural gas.
2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.

C. Heat-Exchanger and Drain Pan: Stainless steel.

D. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve.

E. Safety Controls:

1. Gas Control Valve: Modulating.
2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.10 DAMPERS

A. Outdoor- and Return-Air Mixing Dampers: Opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage or gears and interconnect so dampers operate simultaneously.

1. Leakage Rate: As required by ASHRAE/IES 90.1.
2. Damper Motor: Modulating with adjustable minimum position.
3. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IES 90.1, with bird screen and hood.

B. Barometric relief dampers.

2.11 ELECTRICAL POWER CONNECTIONS

A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.12 CONTROLS

A. Electronic Controller:

1. Controller shall have volatile-memory backup.
2. Safety Control Operation:

   a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
   b. Firestats: Stop fan and close outdoor-air damper if air greater than 130 deg Fenters unit. Provide additional contacts for alarm interface to fire alarm control panel.

c. Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Section 284621.11 "Addressable Fire-Alarm Systems."
d. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 deg F.

3. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
4. Unoccupied Period:

a. Heating Setback: Plus 10 deg F.
b. Cooling Setback: System off.
c. Override Operation: Two hours.

5. Supply Fan Operation:

a. Occupied Periods: Run fan continuously.
b. Unoccupied Periods: Cycle fan to maintain setback temperature.

6. Refrigerant Circuit Operation:

a. Occupied Periods: Cycle or stage compressors to match compressor output to cooling load to maintain discharge temperature and humidity. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
b. Unoccupied Periods: Cycle compressors and condenser fans for heating to maintain setback temperature.
c. Switch reversing valve for heating or cooling mode on air-to-air heat pump.

7. Hot-Gas Reheat-Coil Operation:

a. Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles compressor.
b. Unoccupied Periods: Reheat not required.

8. Gas Furnace Operation:

a. Occupied Periods: Modulate burner to maintain room temperature.
b. Unoccupied Periods: Cycle burner to maintain setback temperature.

9. Economizer Outdoor-Air Damper Operation:

a. Morning warm up, cool down, and building outdoor air flush cycles.
b. Occupied Periods: Open to 33 percent fixed minimum intake, and maximum 100 percent of the fan capacity. Controller shall permit air-side economizer operation when outdoor air is less than 60 deg F. Use mixed-air temperature and select between outdoor-air and return-air enthalpy to adjust mixing dampers. During economizer cycle operation, lock out cooling.
c. Unoccupied Periods: Close outdoor-air damper and open return-air damper.

10. Terminal-Unit Relays:

a. Provide heating- and cooling-mode changeover relays compatible with terminal control system required in Section 233600 "Air Terminal Units" and Section 230923 "Direct Digital Control (DDC) System for HVAC."

2.13 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

C. Remote potentiometer to adjust minimum economizer damper position.

D. Factory- or field-installed demand-controlled ventilation.

E. Safeties:

1. Smoke detector.
2. Condensate overflow switch.
3. Phase-loss protection.
4. High and low pressure control.
5. Gas furnace airflow-proving switch.

F. Hail guards of galvanized steel, painted to match casing.

G. Door switches to disable heating or reset set point when open.

H. Outdoor air intake weather hood with moisture eliminator.

2.14 ROOF CURBS

A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

a. Materials: ASTM C 1071, Type I or II.
b. Thickness: 2 inches.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

a. Liner Adhesive: Comply with ASTM C 916, Type I.
b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
d. Liner Adhesive: Comply with ASTM C 916, Type I.

B. Curb Dimensions: Height of 24 inches.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Roof Curb: Install on roof structure or concrete base, level and secure, according to AHRI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof

Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

B. Equipment Mounting:

1. Install RTUs on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete.
2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

3.03 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap and indirect connection to grade.

B. Install piping adjacent to RTUs to allow service and maintenance.

1. Gas Piping: Comply with applicable requirements in Section 231123 "Facility Natural-Gas Piping"Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

C. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
3. Install return-air duct continuously through roof structure.

D. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inchhigh.
3. Locate nameplate where easily visible.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. RTU will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

3.06 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 237416.13

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

PART 2: PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Alpha Wire.
2. Belden Inc.
3. Encore Wire Corporation.
4. General Cable Technologies Corporation.
5. Southwire Incorporated.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

2.02 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Gardner Bender.
3. Hubbell Power Systems, Inc.
4. Ideal Industries, Inc.
5. Ilsco; a branch of Bardes Corporation.
6. NSi Industries LLC.
7. O-Z/Gedney; a brand of the EGS Electrical Group.
8. 3M; Electrical Markets Division.
9. Tyco Electronics.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.03 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3: EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper.

B. Branch Circuits: Copper.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Feeders: Type THHN-2, THWN-2 copper, single conductors in raceway.

B. All branch circuits and control wiring: Type THHN-2, THWN-2, copper, single conductors in raceway.

C. Ground Wires: Copper only

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material .

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.05 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.08 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 05 19

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes: Grounding systems and equipment.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2: PRODUCTS

2.01 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding; if wood, use pressure-treated fir, cypress, or cedar.

D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.02 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.03 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet in diameter.

PART 3: EXECUTION

3.01 APPLICATIONS

A. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.02 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.03 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 12 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

3.04 LABELING

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.05 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.05 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.06 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2: PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3: EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" and Section 099600 "High Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.

1.03 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.04 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2: PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney; a brand of EGS Electrical Group.
6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company; a division of John Maneely Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. FMC: Comply with UL 1; zinc-coated steel or aluminum.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

   a. Material: Steel.
   b. Type: compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

I. Joint Compound for IMC, GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.
6. Condux International, Inc.
7. Electri-Flex Company.
8. Kraloy.
9. Lamson & Sessions; Carlon Electrical Products.
10. Niedax-Kleinhuis USA, Inc.
11. RACO; a Hubbell company.
12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company.
3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.04 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Mono-Systems, Inc.
   b. Panduit Corp.
   c. Wiremold / Legrand.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Hubbell Incorporated; Wiring Device-Kellems Division.
   b. Mono-Systems, Inc.
   c. Panduit Corp.
   d. Wiremold / Legrand.

2.05 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Adalet.
2. Cooper Technologies Company; Cooper Crouse-Hinds.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman; a Pentair company.
7. Hubbell Incorporated; Killark Division.
8. Kraloy.
9. Milbank Manufacturing Co.
10. Mono-Systems, Inc.
11. O-Z/Gedney; a brand of EGS Electrical Group.
12. RACO; a Hubbell Company.
13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.
15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
16. Thomas & Betts Corporation.
17. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

J. Gangable boxes are prohibited.

PART 3: EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: IMC.
3. Underground Conduit: RNC, Type EPC-80-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Unfinished area, Not Subject to Physical Damage: EMT.
2. Exposed, Finished area: Surface raceway.
3. Exposed and Subject to Severe Physical Damage: IMC.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 1/2-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install surface raceways only where indicated on Drawings.

3.02 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inchesof enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-footintervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from RNC to GRC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Surface Raceways:

1. Install surface raceway with a minimum 2-inchradius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations.

W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Z. Locate boxes so that cover or plate will not span different building finishes.

AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

CC. Set metal floor boxes level and flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.04 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.05 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.06 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 44
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

PART 2: PRODUCTS

2.01 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

   a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
   b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Advance Products & Systems, Inc.
   b. CALPICO, Inc.
   c. Metraflex Company (The).
   d. Pipeline Seal and Insulator, Inc.
   e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.03 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Presealed Systems.

2.04 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.05 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3: EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

    a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
    b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 05 44

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Identification of power and control cables.
2. Identification for conductors.
3. Underground-line warning tape.
4. Equipment identification labels.
5. Miscellaneous identification products.

1.03 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.04 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2: PRODUCTS

2.01 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.

2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE.

2.02 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.03 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.04 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3: EXECUTION

3.01 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Identify all junction boxes with panel name and circuits present in the box.

C. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

D. Apply identification devices to surfaces that require finish after completing finish work.

E. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

J. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded conductors.

a. Color shall be factory applied.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

C. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

D. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Install underground-line warning tape for cables in raceway.

E. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
e. Label all starters, equipment, RTU's, Chillers, etc with the panel name and circuits serving them.

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchboards.
e. Emergency system boxes and enclosures.
f. Enclosed switches.
g. Enclosed circuit breakers.
h. Enclosed controllers.
i. Variable-speed controllers.
j. Push-button stations.
k. Power transfer equipment.
l. Contactors.
m. Remote-controlled switches, dimmer modules, and control devices.
n. Battery-inverter units.
o. Power-generating units.
p. Monitoring and control equipment.

END OF SECTION 26 05 53

SECTION 260573.13
SHORT-CIRCUIT STUDIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.03 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.04 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Short-circuit study input data, including completed computer program input data sheets.
2. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.
    b. Revised single-line diagram, reflecting field investigation results and results of short-circuit study.

1.05 INFORMATIONAL SUBMITTALS

A. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.06 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Short-Circuit Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Short-Circuit Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2: PRODUCTS

2.01 COMPUTER SOFTWARE

A. Comply with IEEE 399 and IEEE 551.

B. Analytical features of fault-current-study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.02 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Comments and recommendations for system improvements, where needed.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data: As described in "Power System Data" Article in the Evaluations.

G. Short-Circuit Study Output:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. Calculated asymmetrical fault currents:

1) Based on fault-point X/R ratio.
2) Based on calculated symmetrical value multiplied by 1.6.
3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3: EXECUTION

3.01 EXAMINATION

A. Obtain all data necessary for the conduct of the study.

1. Verify completeness of data supplied on the one-line diagram. Call any discrepancies to the attention of Architect.
2. For equipment provided that is Work of this Project, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For relocated equipment and that which is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support the short-circuit study. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.

6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.02 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin short-circuit current analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To system low-voltage load buses where fault current is 10 kA or less.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:

1. Electric utility's supply termination point.
2. Incoming switchgear.
3. Unit substation primary and secondary terminals.
4. Low-voltage switchgear.
5. Motor-control centers.
6. Control panels.
7. Standby generators and automatic transfer switches.
8. Branch circuit panelboards.
9. Disconnect switches.

3.03 ADJUSTING

A. Make minor modifications to equipment as required to accomplish compliance with short-circuit study.

3.04 DEMONSTRATION

A. Train Owner's operating and maintenance personnel in the use of study results.

END OF SECTION 260573.13

SECTION 26 24 16
PANELBOARDS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.04 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

B. Infrared Scan results.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

1.07 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.08 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.09 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Finishes:

   a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   b. Back Boxes: Galvanized steel.

4. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.

2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.02 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents. Breakers shall be selected, as required to provide a complete selectively coordinated system, at no additional cost to the project.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
    e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
    f. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

B. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

B. Mount top of trim 90 inches above finished floor unless otherwise indicated.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install overcurrent protective devices and controllers not already factory installed.

    1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

H. Comply with NECA 1.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Perform the following infrared scan tests and inspections and prepare reports:
   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each Panelboard. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
   c. Instruments and Equipment:
      1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action. Include colored pictures of all devices scanned.

3.05 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated by the results of the coordination study.

END OF SECTION 26 24 16

SECTION 26 27 13
ELECTRICITY METERING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes equipment for electricity metering by utility company.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For electricity-metering equipment.

1. Dimensioned plans and sections or elevation layouts.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.05 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electrical service.

1.06 COORDINATION

A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:

1. Comply with requirements of utilities providing electrical power services.
2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2: PRODUCTS

2.01 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Meters will be furnished by utility company.

B. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.

C. Meter Sockets: Comply with requirements of electrical-power utility company.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

END OF SECTION 26 27 13

SECTION 26 27 26
WIRING DEVICES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Snap switches.

1.03 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

B. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.03 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide the following:

   a. Cooper; 5351 (single), CR5362 (duplex).
   b. Hubbell; HBL5351 (single), HBL5352 (duplex).
   c. Leviton; 5891 (single), 5352 (duplex).
   d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.04 GFCI RECEPTACLES

A. General Description:

1. Straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements**,** provide the following:

   a. Cooper; VGF20.
   b. Hubbell; GFR5352L.
   c. Pass & Seymour; 2095.
   d. Leviton; 7590.

2.05 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide the following:
   a. Single Pole:

      1) Cooper; AH1221.
      2) Hubbell; HBL1221.
      3) Leviton; 1221-2.
      4) Pass & Seymour; CSB20AC1.
   b. Two Pole:

      1) Cooper; AH1222.
      2) Hubbell; HBL1222.
      3) Leviton; 1222-2.
      4) Pass & Seymour; CSB20AC2.
   c. Three Way:

      1) Cooper; AH1223.
      2) Hubbell; HBL1223.
      3) Leviton; 1223-2.
      4) Pass & Seymour; CSB20AC3.
   d. Four Way:

1) Cooper; AH1224.
2) Hubbell; HBL1224.
3) Leviton; 1224-2.
4) Pass & Seymour; CSB20AC4.

2.06 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.07 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3: EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles.

3.03 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 26 27 26

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.03 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

B. Infrared Scan results.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.08 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2: PRODUCTS

2.01 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary contacts – for tie into elevator controller for interlock.

2.02 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

2.03 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.03 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
   c. Instruments and Equipment:
      1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies Enclosed Switches and circuit breakers included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action. Include colored pictures of all devices scanned.

END OF SECTION 26 28 16

SECTION 26 43 13
SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.03 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.02 SERVICE ENTRANCE SUPPRESSOR

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. SPDs: Comply with UL 1449, Type 2.

1. SPDs with the following features and accessories:
   a. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
   b. Indicator light display for protection status.
   c. Surge counter.

C. Comply with UL 1283.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 208Y/120 V.
3. Line to Line: 1000 V for 208Y/120 V.

F. SCCR: Equal or exceed 100 kA.

G. Inominal Rating: 20 kA.

2.03 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

2.04 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3: EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.02 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.03 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 26 43 13

SECTION 26 51 00
INTERIOR LIGHTING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Exit signs.
3. Lighting fixture supports.

1.03 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
4. Energy-efficiency data.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
4. Ceiling-mounted projectors.
5. Structural members to which suspension systems for lighting fixtures will be attached.
6. Other items in finished ceiling including the following:

    a. Air outlets and inlets.
    b. Speakers.
    c. Sprinklers.

d. Smoke and fire detectors.
e. Occupancy sensors.
f. Access panels.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.07 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

1.08 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.02 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

F. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.

d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
f. CCT and CRI for all luminaires.

2.03 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

2.04 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3: EXECUTION

3.01 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires**,** independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least twp independent support rods or wires from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.02 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

END OF SECTION 26 51 00

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Poles and accessories.

B. Related Sections:

1. Section 265100 "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.03 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. LER: Luminaire efficacy rating.

D. Luminaire: Complete lighting fixture, including ballast housing if provided.

E. Pole: Luminaire support structure, including tower used for large area illumination.

F. Standard: Same definition as "Pole" above.

1.04 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf, distributed as stated in AASHTO LTS-4-M.

C. Ice Load: Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4-M Ice Load Map.

D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles 50 feet high or less is 100 mph.

   a. Wind Importance Factor: 1.0.
   b. Minimum Design Life: 25 years.
   c. Velocity Conversion Factors: 1.0.

1.05 ACTION SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.

4. Luminaire materials.
5. Materials, dimensions, and finishes of poles.
6. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
7. Anchor bolts for poles.

1.06 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.08 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with IEEE C2, "National Electrical Safety Code."

D. Comply with NFPA 70 and all local ordinances.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

B. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.02 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

a. Color: As selected from manufacturer's standard catalog of colors.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

a. Color: Dark bronze.

2.03 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

2.04 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; one-piece construction up to 40 feet in height with access handhole in pole wall.

1. Shape: Round, tapered or Square, straight.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
3. Match pole material and finish.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

E. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

a. Color: As indicated by manufacturer's designations.

PART 3: EXECUTION

3.01 LUMINAIRE INSTALLATION

A. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

B. Adjust luminaires that require field adjustment or aiming

3.02 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches.
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
3. Trees: 15 feet from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

D. Raise and set poles using web fabric slings (not chain or cable).

3.03 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.04 GROUNDING

A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.05 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

END OF SECTION 26 56 00

SECTION 27 11 00
COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Telecommunications equipment racks and cabinets.
3. Grounding.

B. Related Requirements:

1. Section 271500 "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

1.03 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. LAN: Local area network.

C. RCDD: Registered Communications Distribution Designer.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

PART 2: PRODUCTS

2.01 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Hubbell Premise Wiring.

B. Wall-Mounted Racks: Modular-type, steel construction.
1. Provide wall mounted rack for patch panels

2.02 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with J-STD-607-A.

2.03 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3: EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

D. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.02 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-B, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.03 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.04 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.

D. Labels shall be preprinted or computer-printed type.

END OF SECTION 27 11 00

SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. UTP cabling.
2. Coaxial cable.
3. Multiuser telecommunications outlet assemblies.
4. Cable connecting hardware, patch panels, and cross-connects.
5. Telecommunications outlet/connectors.
6. Cabling system identification products.
7. Cable management system.

1.03 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

D. EMI: Electromagnetic interference.

E. IDC: Insulation displacement connector.

F. LAN: Local area network.

G. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.

H. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

I. RCDD: Registered Communications Distribution Designer.

J. UTP: Unshielded twisted pair.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For coaxial cable, include the following installation data for each type used:

   a. Nominal OD.
   b. Minimum bending radius.
   c. Maximum pulling tension.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. Cabling administration drawings and printouts.
3. Wiring diagrams to show typical wiring schematics, including the following:

    a. Cross-connects.
    b. Patch panels.
    c. Patch cords.

4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

1.06 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

B. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
    1. Test each pair of UTP cable for open and short circuits.

1.10 WARRANTY

A. Hubbell Certified installer to provide mission critical 25 year system warranty. Must provide test results using a level 3 tester, as built drawings

PART 2: PRODUCTS

2.01 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.
4. Splitters shall not be installed as part of the optical fiber cabling.

B. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

2.02 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Grounding: Comply with J-STD-607-A.

2.03 UTP CABLE

A. Basis of Design Manufacturer: Hubbell Premise Wiring

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following
1. Berk-Tek; a Nexans company.
2. CommScope, Inc.
3. Superior Essex Inc.

C. Description: 100-ohm, 4-pair UTP 6,
1. Hubbell #C6RPB for blue.
2. Comply with ICEA S-90-661 for mechanical properties.
3. Comply with TIA/EIA-568-B.1 for performance specifications.
4. Comply with TIA/EIA-568-B.2, Category 6e.
5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
   a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.

2.04 UTP CABLE HARDWARE

A. Basis of Design Manufacturer: Hubbell Premise Wiring

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Systemax.
2. Panduit Corp.

C. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
1. Number of Jacks per Field: One for each four-pair UTP cable indicated.
2. Hubbell #UDX48E

E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals. Hubbell #HXJ6B for blue, Hubbell #HXJ6Y for yellow, Hubbell #HXJ6GN for green, Hubbell #HXJ6OR for orange.

F. Patch Cords: Factory-made, 4-pair cables in 6 foot (provide 2/3 total quantity required) and 8 foot (provide 1/3 total quantity required) lengths; terminated with 8-position modular plug at each end. Provide a patch cord for each 4 pair cable termination.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.
3. Six Foot: Hubbell #HC606B for blue
4. Eight Foot: Hubbell #HC608B for blue

2.05 COAXIAL CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Alpha Wire Company.
2. Belden Inc.
3. Coleman Cable, Inc.
4. CommScope, Inc.
5. Draka Cableteq USA.

B. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

C. RG-6/U (plenum rated): NFPA 70, Type CATVP

1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
3. Jacketed with black PVC or PE.
4. Suitable for indoor installations.
5. Plenum Ceiling Rated

D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
1. Number of Jacks per Field: One for each Coaxial cable indicated.
2. Hubbell #UDX48E

E. Jacks and Jack Assemblies: Modular, F connector. Hubbell #SFFX.

F. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Plenum Rated: Type CATVP, complying with NFPA 262.

2.06 COAXIAL CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Emerson Network Power Connectivity Solutions.
2. Leviton Commercial Networks Division.
3. Siemon Co. (The).

B. Coaxial-Cable Connectors: Type F, 75 ohms.

C. Terminate cables in Mechanical room at splitter/amplifier

2.07 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.

B. Workstation Outlets: Four-port-connector assemblies mounted in single faceplate.

1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
2. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.
3. Legend: Machine printed, in the field, using adhesive-tape label.

2.08 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with J-STD-607-A.

2.09 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.10 SOURCE QUALITY CONTROL

A. Factory test UTP cables according to TIA/EIA-568-B.2.

B. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3: EXECUTION

3.01 WIRING METHODS

A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal pathways and cables except in unfinished spaces.

1. Install plenum cable in all areas.

B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
2. Install lacing bars and distribution spools.
3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.02 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.03 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-B, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.04 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.05 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Administration Class: 1.
2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.

C. Cable and Jack Colors shall be as follows:
1. Data = Blue

D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

F. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.06 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

4. UTP Performance Tests:

a. Test for each outlet. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:

1) Wire map.
2) Length (physical vs. electrical, and length requirements).
3) Insertion loss.
4) Near-end crosstalk (NEXT) loss.
5) Power sum near-end crosstalk (PSNEXT) loss.
6) Equal-level far-end crosstalk (ELFEXT).
7) Power sum equal-level far-end crosstalk (PSELFEXT).
8) Return loss.
9) Propagation delay.
10) Delay skew.

5. Coaxial Cable Tests: Conduct tests according to Section 274133 "Master Antenna Television System."
6. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.

a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 27 15 00

SECTION 28 31 11
DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Remote annunciator.
7. Addressable interface device.
8. Digital alarm communicator transmitter.
9. Radio alarm transmitter.

1.03 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.04 SYSTEM DESCRIPTION

A. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire-alarm system design.

1.06 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

   a. Frequency of testing of installed components.
   b. Frequency of inspection of installed components.
   c. Requirements and recommendations related to results of maintenance.
   d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.09 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. GAMEWELL; a Honeywell company.
2. NOTIFIER; a Honeywell company.
3. Silent Knight; a Honeywell company.
4. Firelite
5. Simplex

2.02 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.
6. Heat detectors in elevator shaft and pit.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Recall elevators to primary or alternate recall floors.
6. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Elevator shunt-trip supervision.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.03 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
b. Include a real-time clock for time annotation of events on the event recorder and printer.

2. Addressable initiation devices that communicate device identity and status.

a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.

2. Serial Interfaces: Two RS-232 ports for printers.

D. Notification Appliance Circuit: Operation shall sound in a temporal pattern.

E. Elevator Recall:

1. Smoke detectors at the following locations shall initiate automatic elevator recall.

a. Elevator lobby detectors except the lobby detector on the designated floor.
b. Smoke detector in elevator machine room.
c. Smoke detectors in elevator hoistway.

2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

F. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

G. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station. Verify if phone connection or radio connection is required by the AHJ.

I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

J. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

K. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.04 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.

2.05 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated **and power-on status**.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

   a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
   b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
   c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.

e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

3. Each sensor shall have multiple levels of detection sensitivity.
4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
5. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.06 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.07 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output:
   a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

2.08 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.09 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall to circuit-breaker shunt trip for power shutdown.

2.10 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.11 RADIO ALARM TRANSMITTER

A. Transmitter shall comply with NFPA 1221 and shall be listed and labeled by an NRTL.

B. Comply with 47 CFR 90.

C. Description: Manufacturer's standard commercial product; factory assembled, wired, tested, and ready for installation and operation.

1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
3. Normal Power Input: 120-V ac.
4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
5. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.

D. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:

1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
6. Local Fire-Alarm-System Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

PART 3: EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

C. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.

3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix Ain NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

F. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

G. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

3.02 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated air-conditioning duct systems.
4. Alarm-initiating connection to elevator recall system and components.
5. Alarm-initiating connection to activate emergency lighting control.
6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
9. Supervisory connections at elevator shunt trip breaker.
10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
11. Supervisory connections at fire-pump engine control panel.

3.03 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.04 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.05 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

   a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
   b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 28 31 11

SECTION 31 10 00 - SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removing surface debris.
   2. Excavating topsoil.

B. Related Sections:
   1. Section 02 41 16 - Structure Demolition: Removing underground storage tanks and designated utilities.
   2. Section 31 22 13 - Rough Grading.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Areas for temporary construction and field offices

1.3 REFERENCES

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

1.4 QUALITY ASSURANCE

A. Conform to applicable code for environmental requirements, disposal of debris, burning debris on site, and use of herbicides.

B. Perform Work in accordance with IEPA, NPDES and Municipalities.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify existing plant life designated to remain is tagged or identified.

3.2 PREPARATION

A. Call Municipality and J.U.L.I.E. for Utility Line Information service not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.
   2. Contact Private Utility Locator for location of Private utilities not Located by Municipality or J.U.L.I.E.

3.3 PROTECTION

A. Protect utilities indicated to remain, from damage.

B. Protect trees, plant growth, and features designated to remain, as final landscaping per plans.

C. Protect bench marks, survey control points, and existing structures from damage or displacement.

3.4 CLEARING

A. Per SSRB Section 201

3.5 REMOVAL

A. Per SSRB Section 201

B. Do Not Disrupt Public Utilities without permit from agency having jurisdiction.

C. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

D. Do not burn or bury materials on site. Leave site in clean condition.

3.6 TOPSOIL EXCAVATION

A. Excavate topsoil from project area without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site.

D. Remove excess topsoil not intended for reuse, from site.

END OF SECTION

SECTION 312213 - ROUGH GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cutting, grading, filling, rough contouring, compacting, site for building pads.

B. Related Sections:
   1. Section 311000 - Site Clearing: Excavating topsoil.
   2. Section 312317 - Trenching: Trenching and backfilling for utilities.
   3. Section 329119 - Landscape Grading: Finish grading with topsoil to contours.

1.2 REFERENCES

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

   1. Sections 205 Embankment and Section 204 Borrow and Furnished Excavation

1.3 QUALITY ASSURANCE

B. Perform Work in accordance with Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB) Sections 204 and 205

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials per Section 205 SSRB

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

A. Call J.U.L.I.E. Line Information service at 1-800-892-0123 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Protect utilities indicated to remain from damage.

D. Protect plant life, lawns, and other features remaining as portion of final landscaping.

E. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 EXCAVATION

A. Excavate material per Section 204 SSRB

3.4 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Place fill material in conformance with Section 205 SSRB

C. Repair or replace items indicated to remain damaged by excavation or filling.

3.5 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

3.6 FIELD QUALITY CONTROL

A. Compact Material as specified in Section 205.06 SSRB

B. Structural Fill: In Conformance with Section 205 SSRB

END OF SECTION 312213

SECTION 312316 - EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavating for paving, roads, and parking areas.
   2. Excavating for slabs-on-grade.
   3. Excavating for landscaping.

B. Related Sections:
   1. Section 312213 - Rough Grading: Topsoil and subsoil removal from site surface.
   2. Section 312317 - Trenching: Excavating for utility trenches.
   3. Section 312323 - Fill.

1.2 REFERENCES

A. IEPA and Municipal Standards for Soil Erosion and Sediment Control.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with State and Municipal Department of Public Work's standard.

PART 2 - PRODUCTS

2.1 Not Used.

PART 3 - EXECUTION

3.1 PREPARATION

A. Call J.U.L.I.E. Utility Line Information service at 811 not less than three working days before performing Work.

B. Identify required lines, levels, contours, and datum locations.

C. Unclassified Excavation
   1. All suitable material removed in the excavation shall be used as far as practicable in the formation of embankments, subgrades, and shoulders and at such other places as may be indicated on the drawings or as directed by the Engineer.
   2. The Engineer will designate materials that are unsuitable.

3. The Contractor shall furnish disposal areas for the unsuitable and/or excess material excess material except where the Engineer permits the use of such material in the widening or flattening of fill slopes.

D. Undercut Excavation

1. When the Engineer determines that the native soil materials in areas where fills are to be placed are undesirable in their location or condition, the Engineer may require the Contractor to remove the undesirable material and backfill with approved material properly compacted.
2. When the Engineer determines that the finished graded cross-section contains materials which are undesirable in their location or condition, the Engineer may require the Contractor to remove the undesirable material and backfill with approved material properly compacted to the finished graded section.
3. Contractor shall conduct undercut operations such that excavation and hauling operations cause the lease disturbance and destruction to the unstable and surrounding subgrade materials.
4. Cost for undercuts shall include sawcut and removal of pavement (if any), removal of unsuitable material to the satisfaction of Engineer and placement of backfill materials including stone or other suitable fill material as determined by Engineer. Contractor shall remove all unsuitable material from site.

3.2 EXCAVATION

A. Excavate to accommodate paving and construction operations.

B. Slope banks with machine to angle of repose or less until shored.

C. Grade top perimeter of excavation to prevent surface water from draining into excavation.

D. Trim excavation. Remove loose matter.

E. Notify Architect/Engineer of unexpected subsurface conditions.

F. Correct areas over excavated as specified in Section 312323.

G. Remove unsuitable material from site.

H. Remove excavated material from site.

I. Stockpile excavated material to be re-used in area designated on site in accordance with Section 312200.

3.3 FIELD QUALITY CONTROL

A. Request visual inspection of bearing surfaces by Geotechnical Engineer or inspection agency before installing subsequent work.

3.4 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION 312316

SECTION 312316.13 - TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating trenches for utilities from 5 feet outside building to utility service.
2. Compacted fill from top of utility bedding to subgrade elevations.
3. Backfilling and compaction.

B. Related Sections:
1. Section 312213 - Rough Grading: Topsoil and subsoil removal from site surface.
2. Section 312323 - Fill: General backfilling.
3. Section 329119 - Landscape Grading: Filling of topsoil over backfilled trenches to finish grade elevation.
4. Section 334100 - Storm Utility Drainage Piping: Storm sewer piping and bedding from building to utility service.

1.2 REFERENCES

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

B. Municipal Subdivision and Development Control Regulations.

1.3 SUBMITTALS

A. Section 013000 – Administrative Requirements for Submittals.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Municipality

B. Perform work in conformance with Section 542.04 SSRB

1.5 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Per Section 312323 Fill and Per Section 542.04 SSRB

B. Granular Fill: Per Sections 1003.04 SSRB and 542.04 SSRB

PART 3 - EXECUTION

3.1 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION

A. Call J.U.L.I.E. Line Information service at 1-800-892-0123 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 TRENCHING

A. Trenching as Specified in Section 542.04 a & b, SSRB

3.4 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. Backfill trenches per Section 542.04 of SSRB

3.5 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

C. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.6 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

3.7 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION 312316.13

SECTION 312323 - FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Section 312213 - Rough Grading: Site filling.
   2. Section 312316 - Excavation.
   3. Section 312317 - Trenching: Backfilling of utility trenches.
   4. Section 329119 - Landscape Grading: Filling of topsoil and to finish grade elevation.

1.2 REFERENCES

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

1.3 QUALITY ASSURANCE

B. Perform Work in accordance with Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Fill Materials: Per Section 205 SSRB

2.2 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

2.3 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Preparation of existing ground surface per Section 205.03 SSRB

D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

2.4 BACKFILLING

A. Backfill areas to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Place fill material in conformance with Section 205.04 SSRB

D. Employ placement method that does not disturb or damage other work.

E. Maintain optimum moisture content of backfill materials to attain required compaction density.

F. Make gradual grade changes. Blend slope into level areas.

G. Remove surplus backfill materials from site.

H. Leave fill material stockpile areas free of excess fill materials.

2.5 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling: Plus or minus 1 inch from required elevations.

C. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

D. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

2.6 FIELD QUALITY CONTROL

A. Compact material as specified in Section 205.06 SSRB.

B. Proof roll compacted fill surfaces under paving.

2.7 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic.

2.8 SCHEDULE

A. Fill in conformance with Section 205 SSRB.

END OF SECTION 312323

SECTION 32 11 23 - AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aggregate base course.
   2. Paving aggregates.

B. Related Sections:
   1. Section 31 22 00 - Grading: Preparation of site for base course.
   2. Section 31 23 16.13 - Trenching: Compacted fill over utility trenches under base course.
   3. Section 31 23 23 - Fill: Topsoil fill at areas adjacent to aggregate base course.
   4. Section 31 23 23 - Fill: Compacted fill under base course.
   5. Section 32 12 16 - Asphalt Paving: Binder and finish asphalt courses.
   6. Section 32 13 13 - Concrete Work: Finish concrete surface course.
   7. Section 33 05 13 - Manholes and Structures: Manholes including frames.
   8. Section 31 22 13 - Rough Grading: Preparation of site for base course.

1.2 REFERENCES

A. (SSRBC) - Standard Specifications for Road and Bridge Construction, adopted by the Illinois Department of Transportation on January 1, 2012, including applicable current Supplemental Specifications and Special Provisions.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Compaction Density Test Reports

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with (SSRBC) - Standard Specifications for Road and Bridge Construction, adopted by the Illinois Department of Transportation on January 1, 2012, including applicable current Supplemental Specifications and Special Provisions.

PART 2 PRODUCTS

2.1 AGGREGATE MATERIALS

A. Subbase Granular Material: CA6 SSRBC Section 311.

B. Base Aggregate: CA6 SSRBC Section 351, Type B

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting. SSRBC Section 301.

B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.3 DELIVERY STORAGE AND HANDLING

A. When necessary, store materials onsite in advance of need.

B. When aggregate materials need to be stored on site, locate stockpiles in a location away from vehicle and pedestrian traffic and to minimize disturbance.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

3.4 SEQUENCING AND SCHEDULING

A. Schedule, sequence and coordinate the work of this section, and prior and subsequent portions of the work, in accordance with the requirements of Section 01 32 00 – Construction Scheduling.

3.5 INSTALLATION SSRBC 351

A. Under Bituminous Concrete Paving

B. Under Portland Cement Concrete Paving

C. Place aggregate in maximum 4 inch layers and roller compact to specified density.

D. Level and contour surfaces to elevations and gradients indicated.

E. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

F. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

G. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.6 TOLERANCES

A. Flatness: Maximum variation of ¼ inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 90% as specified on plans.

C. Variation From Design Elevation: Within ½ inch.

3.7 FIELD QUALITY CONTROL

A. See Section 01 40 00- Quality Control.

B. Compaction density testing will be performed on compacted aggregate base course in accordance with SSRBC Section 351.

C. If test indicate work does not meet specified requirements, remove work, replace and retest.

D. Proof roll compacted aggregate at all surfaces.

3.8 CLEANING

A. Remove unused stockpiled materials; leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Asphalt materials.
2. Aggregate materials.
3. Aggregate subbase.
4. Asphalt paving base course, binder course, and wearing course.
5. Asphalt paving overlay for existing paving.

B. Related Requirement:
1. Section 312213 - Rough Grading: Preparation of site for paving and base.
2. Section 312323 - Fill: Compacted subbase for paving.
3. Section 321123 - Aggregate Base Courses: Compacted subbase for paving.
4. Section 321713 - Parking Bumpers: Concrete bumpers.
5. Section 321723 - Pavement Markings: Painted pavement markings, lines, and legends.

1.2 REFERENCE STANDARDS

A. Illinois Department of Transportation: Standard Specifications for Road and Bridge Construction (SSRB).

B. Municipal Subdivision and Development Control Regulations.

1.3 SUBMITTALS

A. Product Data:

1. Submit product information for asphalt and aggregate materials.
2. Submit mix design with laboratory test results supporting design.

1.4 QUALITY ASSURANCE

A. Mixing Plant: Certified by State.

B. Obtain materials from same source throughout.

C. Perform Work in accordance with State SSRB and Municipality.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 3 years' experience.

1.6 AMBIENT CONDITIONS

A. As specified in Section 406.06B SSRB.

PART 2 - PRODUCTS

2.1 ASPHALT PAVING

A. Performance / Design Criteria:

1. Paving: Design as specified on plans.

B. Asphalt Materials:

1. HMA: As specified in Section 1030 SSRB.
2. Primer: Per Section 406.02 SSRB.
3. Tack Coat: Per Section 406.02 SSRB.

C. Aggregate Materials:

1. Coarse Aggregate: Per Section 1004.03 SSRB.
2. Fine Aggregate: Per Section 1003.03 SRRB.

D. Aggregate Subbase: As specified in Geotechnical Report.

2.2 MIXES

A. Per Section 1030 SSRB.

2.3 ACCESSORIES

2.4 SOURCE QUALITY CONTROL

A. Submit proposed mix design for review prior to beginning of Work.

B. Test samples in accordance with independent testing and inspection professional services firm to be engaged by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.

B. Verify compacted subbase is dry and ready to support paving and imposed loads.

1. Proof roll subbase in conformance with recommendations from Geotechnical Engineer
2. Remove soft subbase and replace with compacted fill as specified in Section 312323.

C. Verify gradients and elevations of base are correct.

D. Verify manhole frames and lids are installed in correct position and elevation.

3.2 PREPARATION

A. Section 358 of SSRB.

3.3 DEMOLITION

A. As specified in Section 406.05 SSRB.

3.4 INSTALLATION

A. Subbase:

1. Aggregate Subbase: Install as specified in Section 358.04 SSRB.

B. Primer:

1. Apply primer in accordance with Section 406.05 SSRB.

C. Double Course Asphalt Paving: as specified in Section 406.05 SSRB.

3.5 TOLERANCES

A. Variation from Indicated Elevation: Within 1inch.

3.6 FIELD QUALITY CONTROL

A. Take samples and perform tests in conformance with recommendations from independent testing and inspection professional services firm.

3.7 PROTECTION

A. Immediately after placement, protect paving from mechanical injury until they have hardened to the satisfaction of independent testing and inspection professional services firm.

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete paving for:
      a. Concrete sidewalks.
      b. Concrete curbs and gutters.
      c. Concrete parking areas and roads.

B. Related Requirements:
   1. Section 312213 - Rough Grading: Preparation of site for paving.
   2. Section 312323 - Fill: Compacted sub-base for paving.
   3. Section 329119 - Landscape Grading: Preparation of subsoil at pavement perimeter.

1.2 REFERENCE STANDARDS

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

1.3 SUBMITTALS

A. Section 013000 – Administrative Requirements.

1.4 QUALITY ASSURANCE

A. Obtain cementitious materials from same source throughout.

B. Perform Work according to Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB) Sections 420, 421, 423, 424.

PART 2 - PRODUCTS

2.1 AGGREGATE SUBGRADE

A. As Specified on Plans.

2.2 CONCRETE PAVING

A. Form Materials:

1. Form Materials: as Specified in Sections 420.06 and 423.05 SSRB

B. Reinforcement:

1. Reinforcing Steel and Wire Fabric: as Specified on Plans.

C. Concrete Materials:

1. Concrete Materials: as Specified in Sections 420.02 and 424.02 SSRB

2.3 MIXES

A. Concrete Mix: As Specified in Section 1020 SSRB

1. Mix and deliver concrete according to Sections 420.02 and 424.02 SSRB

2.4 FINISHES

A. Finishes: As Specified in Section 420.09 and 424.06 SSRB

PART 3 - EXECUTION

3.1 PREPARATION

A. Preparation: As Specified in Sections 420.04 and 424.06 SSRB

3.2 INSTALLATION

A. Installation: As Specified in Sections 420.07 and 424.06 SSRB

B. Forms: As Specified in Sections 420.06 and 424.05 SSRB

C. Reinforcement: As Specified on Plans.

D. Placing Concrete: As Specified in Sections 420.07 and 424.06 SSRB

E. Joints: As Specified in Sections 420.05 and 424.07 SSRB

F. Finishing: As Specified in Sections 420.09 and 424.06 SSRB

G. Curing and Protection

1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
3. Cure concrete surfaces as specified in Section 1020.13 SSRB.

H. Backfilling for Sidewalks: As Specified in Section 424.10 SSRB

3.3 FIELD QUALITY CONTROL

A. Perform field testing as Specified in Section 1020.09 SSRB.

3.4 PROTECTION

A. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Curing as Specified in Section 1020.13 SSRB

END OF SECTION 321313

SECTION 321623 - SIDEWALKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete paving for sidewalks.

B. Related Requirements:
   1. Section 099000 - Painting and Coating: Pavement markings.
   2. Section 312213 – Rough Grading: Preparation of Site for paving and base subgrade.
   3. Section 312323 - Fill: Compacted subgrade for paving.

1.2 REFERENCE STANDARDS

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction. (SSRB)

1.3 SUBMITTALS

A. Section 013000 – Administrative Requirements for submittals.

1.4 QUALITY ASSURANCE

A. Obtain cementitious materials from same source throughout.

B. Perform Work according to Illinois Department of Transportation Standard Specifications for Road and Bridge Construction Section 424 (SSRB)

PART 2 - PRODUCTS

2.1 SUBGRADE

A. As specified on plans.

2.2 MATERIALS

A. Forms:

   1. Description: As specified in Section 423.05 SSRB
   2. Height: Equal to full depth of finished sidewalk.

B. Concrete:

1. Concrete Materials:

a. As specified in Section 424.02 SSRB

2.3 MIXES

A. Concrete: As specified in Section 1020 SSRB

B. Concrete Mix:

1. Mix and deliver concrete according to Section 424.02 and 1020 SSRB

2.4 FINISHES

A. Finishes as specified in Section 424.06 SSRB

PART 3 - EXECUTION

3.1 PREPARATION

A. Preparation as specified in Section 424.06 SSRB

3.2 INSTALLATION

A. Installation as Specified in Section 424.06 SSRB

B. Forms: As Specified ins Section 424.05 SSRB

C. Placing Concrete: As Specified in Section 424.06 SSRB

D. Joints: As Specified in Section 424.07 SSRB

E. Finishing: As Specified in Section 424.06 SSRB

F. Curing: As Specified in Section 1020.13 SSRB

G. Backfilling: As Specified in Section 424.10 SSRB

3.3 FIELD QUALITY CONTROL

A. Inspection and Testing: as Specified in Section 1020.09 SSRB

3.4 PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, rain and flowing water, and mechanical injury.

B. Curing: As Specified in Section 1020.13 SSRB

C. Damaged Concrete:

1. Remove and reconstruct concrete that has been damaged for entire length between scheduled joints.
2. Refinishing damaged portion is not acceptable.
3. Dispose of damaged portions.

END OF SECTION

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Traffic lines and markings.
2. Paint.

B. Related Requirements:

1. Section 321216 - Asphalt Paving: Asphalt paving for roads, parking areas, and sidewalks.
2. Section 321313 - Concrete Paving: Concrete paving for roads, parking areas, and sidewalks.

1.2 REFERENCE STANDARDS

A. MUTCD – Manual on Uniform Traffic Control Devices

B. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

1.3 QUALIFICATIONS

A. Applicator: Company specializing in performing Work of this Section with minimum three years' experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Storage:

1. According to manufacturer instructions.
2. Paint:

a. Invert containers several days prior to use if paint has been stored more than two months.
b. Minimize exposure to air when transferring paint.
c. Seal drums and tanks when not in use.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.5 AMBIENT CONDITIONS

A. Ambient Conditions as Specified in Section 780 SSRB.

PART 2 - PRODUCTS

2.1 PAINTED PAVEMENT MARKINGS

A. Paint: As Specified in Section 780.06 SSRB

B. Thermoplastic Compound: As Specified in Section 780.05 SSRB

C. Preformed Plastic and Thermoplastic: As Specified in Section 780.07 and 780.08 SSRB

2.2 APPLICATION EQUIPMENT

A. Equipment As Specified in Section 780.03, 1105.01 (a), 1105.01 (b)

PART 3 - EXECUTION

3.1 PREPARATION

A. Preparation as Specified in Section 780.04 SSRB

3.2 DEMOLITION

A. Demolition as Specified in Section 783 SSRB

B. Do not remove existing pavement markings by painting over with blank paint.

3.3 APPLICATION

A. Application Rate: As Specified in Section 780 SSRB, 780.05, 780.06, 780.07, 780.08

3.4 FIELD QUALITY CONTROL

A. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.

B. Acceptance:

1. Repair lines and markings which after application and curing do not meet following criteria:

a. Incorrect location.
b. Insufficient thickness, width, coverage, or retention.
c. Uncured or discolored material.
d. Insufficient bonding.

3.5 CLEANING

A. Collect and legally dispose of residues from painting operations.

3.6 PROTECTION

A. Protect painted pavement markings from vehicular and pedestrian traffic until paint is dry and track free.

B. If vehicle crosses a marking and tracks it, or if splattering or overspray occurs, eradicate affected marking and resultant tracking and apply new markings.

C. Barrier cones are satisfactory protection for materials being dried.

3.7 ATTACHMENTS

A. Pavement Markings: As Specified on Plans

END OF SECTION 321723

SECTION 32 31 13 - CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Concrete foundation for posts and center drop for gates.
4. Manual gates and related hardware.
5. Privacy slats.

B. Related Sections:
1. Section 03 30 00 Cast in place concrete.

1.2 REFERENCES

A. ASTM International:
1. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
4. ASTM F552 - Standard Terminology relating to Chain Link Fencing.
5. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
6. ASTM F626 - Standard Specification for Fence Fittings.
7. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
8. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
9. ASTM F1184 - Standard Specification for Industrial and Commercial Horizontal Slide Gates.

B. Chain Link Fence Manufacturers Institute:
1. CLFMI - Product Manual.

1.3 SYSTEM DESCRIPTION

A. Fence Height: 6 feet as indicated on Drawings.

B. Line Post Spacing: At intervals not exceeding 10 feet.

C. Fence Post and Rail Strength: Conform to ASTM F1043 Light Industrial Fence quality.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

C. Product Data: Submit data on fabric, posts, accessories, fittings and hardware.

D. Manufacturer's Installation Instructions: Submit installation requirements, post foundation anchor bolt templates.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines.

C. Operation and Maintenance Data: Procedures for submittals.

1.6 QUALITY ASSURANCE

A. Supply material in accordance with CLFMI - Product Manual.

B. Perform installation in accordance with ASTM F567.

C. Perform Work in accordance with Village of Oswego and CLFMI Standards.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 3 years documented experience approved by manufacturer.

1.8 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

C. Identify each package with manufacturer’s name.

D. Store fence fabric and accessories in secure and dry place.

PART 2 PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Materials and Components: Conform to CLFMI Product Manual.

B. Fabric Size: CLFMI Light Industrial service.

C. Intermediate Posts: Type I round.

D. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round.

E. Concrete: Type specified in Section 03 30 00.

2.2 COMPONENTS

A. Line Posts: 2.38 inch diameter.

B. Corner and Terminal Posts: 2.88 inch.

C. Gate Posts: 4.0 inch diameter.

D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.

E. Gate Frame: 1.66 inch diameter for fittings and truss rod fabrication.

F. Fabric: 2 inch diamond mesh interwoven wire, 6 gage thick, top salvage bottom selvage twisted tight.

G. Tension Wire: 6 gage thick steel, single strand, marcelled, spiraled or crimped, aluminum-coated tension wire conforming to ASTM A824.

H. Tension Band: 3/16 inch thick steel.

I. Tension Strap: 3/4 inch thick steel.

J. Tie Wire: Aluminum alloy steel wire.

2.3 ACCESSORIES

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; galvanized steel.

C. Hardware for Single Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; fork latch with gravity drop and padlock hasp; keeper to hold gate in fully open position.

D. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; drop bolt on inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.

E. Metal Enclosure Slats: (Transportation Facility only at Parts Storage Enclosure Fencing, Keynotes 32.310 and 32.311 as shown on Sheet A310); Fin/Slat 1000 manufactured by Master-Halco, inc. or approved equal. Provide bottom retainer for slats to prohibit slat movement.

2.4 GATES

A. General:
   1. Gate Types, Opening Widths and Directions of Operation: As indicated on Drawings.
   2. Factory assemble gates.
   3. Design gates for operation by one person.

B. Swing Gates:
   1. Fabricate gates to permit 180 degree swing.

C. Sliding Gates:
   1. Framing and Posts: ASTM F1184, Class 2 for internal rollers.
   2. Rollers for overhead and cantilever sliding gates: Bearing type. Furnish non-sealed bearings with grease fitting for periodic maintenance.
   3. Secure rollers to post or frame without welding.

D. Cantilever Sliding Gates:
   1. Fabricate gate leaf frames and tracks of aluminum conforming to ASTM B429/B429M alloy 6063-T6 or as required to meet performance requirements of ASTM F1184.
   2. Frame Members: Minimum 2 inches (50 mm) 0.91 lb/ft (1.4 g/mm) aluminum tubing welded assembly forming rigid, one piece unit.
   3. Install fabric securely stretched and held in center of tubing.
   4. Brace cantilever overhang frames with 3/8 inch (10 mm) brace rods. For gate leaf sizes greater than 23 feet (7 m), fabricate with additional lateral support rail welded adjacent to top and bottom horizontal rails.
   5. Provide minimum overhang for each leaf opening size as follows:

Opening	Overhang
Up to 10’-0” (3.0 m)	6’-6” (2.0 m)
10’-0” -14’-0” (3.0 m - 4.3 m)	7’-6” (2.3 m)
14’-1” -22’-0” (4.4 m - 6.7 m)	10’-0” (3.0 m)
22’-1” - 30’-0” (6.8 - 9.1 m)	12’-0” (3.7 m)

   6. Track: Combined, integral track and rail.
   7. Rail: Aluminum extrusion; minimum total weight of 3.72 lb/ft (5.5 g/mm); designed to withstand reaction load of 2,000 lbs (910 kg).
   8. Roller Track Assembly: Two swivel type, zinc, die cast trucks having four, sealed lubricant ball bearing wheels minimum 2 inches (50 mm) diameter by 9/16 inches (14 mm) width designed for same reaction load as rail. Provide two side-rolling wheels for each gate leaf to maintain alignment of truck in track.
   9. Fasten trucks to post brackets by minimum 7/8 inch (22 mm) diameter, 1/2 inch (13 mm) shank ball bolts.
   10. Provide galvanized steel guide wheel assemblies consisting of two rubber wheels of minimum 4 inch (100 mm) diameter with oil-impregnated bearings for each supporting post.
   11. Attach guide wheel assembly to post so bottom horizontal member rolls between wheels and permitting adjustment to maintain plumb gate frames and proper alignment.

2.5 FINISHES

A. Components and Fabric: Galvanized to ASTM A123/A123M for components; ASTM A153/A153M for hardware; ASTM A392 for fabric; 2.0 oz/sq ft coating.

B. Hardware: Galvanized to ASTM A153/A153M, 2.0 oz/sq ft coating.

C. Accessories: Same finish as framing.

PART 3 EXECUTION

3.1 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch.

C. Maximum Offset From Indicated Position: 1 inch.

D. Minimum distance from property line: 6 inches.

3.2 SCHEDULES

A. Property Perimeter: 6 feet high.

END OF SECTION

SECTION 32 91 19 - LANDSCAPE GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Final grade topsoil for finish landscaping.

B. Related Sections:
   1. Section 31 22 13 - Rough Grading: Site contouring.
   2. Section 31 23 17 - Trenching: Backfilling trenches.
   3. Section 32 05 13 - Soils for Exterior Improvements.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures

1.3 QUALITY ASSURANCE

A. Furnish each topsoil material from single source throughout the Work.

B. Perform Work in accordance with Illinois Department of Transportation Standard Specifications for Road and Bridge (SSRB) and Municipality.

PART 2 PRODUCTS

2.1 MATERIAL

A. In Conformance with Article 1081.05A Illinois Department of Transportation Standard Specifications for Road and Bridge Construction.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify building and trench backfilling have been inspected.

C. Verify substrate base has been contoured and compacted.

3.2 PREPARATION

A. Protect landscaping and other features remaining as final Work.

B. Protect fences, sidewalks, utilities, paving, and curbs.

3.3 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove contaminated subsoil.

C. Scarify surface to depth of 3 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.4 PLACING TOPSOIL

A. Place topsoil in areas where seeding, planting, is required to nominal depth of 6 inches. Place topsoil during dry weather.

B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.

C. Remove roots, weeds, rocks, and foreign material while spreading.

D. Manually spread topsoil close to fences, sidewalks, utilities, paving, and curbs to prevent damage.

E. Lightly compact placed topsoil.

F. Remove surplus subsoil and topsoil from site.

G. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.5 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Top of Topsoil: Plus or minus 1/2 inch.

3.6 PROTECTION OF INSTALLED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Prohibit construction traffic over topsoil.

END OF SECTION

SECTION 329219 - SEEDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fertilizing.
   2. Seeding.
   3. Mulching.
   4. Maintenance.

B. Related Sections:
   1. Section 312213 - Rough Grading: Rough grading of site.
   2. Section 312317 - Trenching: Rough grading over cut.
   3. Section 329119 - Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the Work of this section.

1.2 REFERENCES

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

1.3 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for seed mix, fertilizer, mulch, and other accessories.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

B. Perform Work according to Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

1.6 QUALIFICATIONS

A. Seed Supplier: Company specializing in manufacturing Products specified in this section with minimum three years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.8 MAINTENANCE SERVICE

A. Maintain seeded areas immediately after placement until grass is well established and exhibits vigorous growing condition.

PART 2 - PRODUCTS

2.1 SEED MIXTURE

A. Furnish materials according to Section 250.07 SSRB

B. Description:

1. Type 1: Lawn Mix
2. Type 1A: Salt Tolerant Mix
3. Type 3 Slope Mix

2.2 ACCESSORIES

A. Mulching Material: in conformance with Section 251 SSRB

B. Blanket as specified on plans and in conformance with Section 251.04 SSRB.

C. Fertilizer: Commercial grade; recommended for grass; of proportion as specified in Section 250.04 SSRB

D. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify prepared soil base is ready to receive the Work of this section.

3.2 FERTILIZING

A. Apply fertilizer at application rate recommended in Section 250.04 SSRB

B. Apply after smooth raking of topsoil.

C. Do not apply fertilizer at same time or with same machine used to apply seed.

D. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.3 SEEDING

A. Apply seed as specified in Section 250.06 SSRB

B. Do not seed areas in excess of that which can be mulched on same day.

C. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

3.4 SEED PROTECTION

A. Seed Protection as Specified in Section 251 SSRB

3.5 MAINTENANCE

A. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.

D. Water to prevent grass and soil from drying out.

E. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

F. Immediately reseed areas showing bare spots.

G. Repair washouts or gullies.

H. Protect seeded areas with warning signs during maintenance period.

END OF SECTION 329219

SECTION 33 01 31 - MANHOLE GRADE ADJUSTMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Raising manhole frames and covers.
   2. Replacing manhole frames and covers.

B. Related Sections:
   1. Section 03 41 00 - Precast Structural Concrete.
   2. Section 32 12 16 - Asphalt Paving.
   3. Section 32 91 19 - Landscape Grading.
   4. Section 32 92 19 - Seeding and Soil Supplements.
   5. Section 33 01 35 - Manhole Grout Sealing.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Repairing Manhole Frames and Covers:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes removal of old frame and cover, installing new frame and cover, and joint sealant.

1.3 REFERENCES

A. In Conformance with IDOT Standard Frame and Grate Specifications

B. Municipality Subdivision and Development Control Regulations

C. STM International:
   1. ASTM 478 - Standard Specification for Standard Specification for Precast Reinforced Concrete Manhole Sections.
   2. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
   3. ASTM A48 – Standard Specification for Gray Iron Casting.
   4. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
   5. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   6. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manhole covers and riser rings construction, features, configuration, dimensions.

C. Manufacturer's Certificate: Certify Products meet or exceed IDOT Standards.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual grade adjustment elevation of manhole.

1.6 QUALITY ASSURANCE

A. Perform Work in Conformance with SSRBC Section 603, IDOT, & Municipality Standards.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 3 years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in undamaged, unopened container, bearing manufacturer’s original labels. Inspect for damage.

C. Protect materials from damage by storage in secure location.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Provide schedule of manhole grade adjustment.

PART 2 PRODUCTS

2.1 MANHOLE FRAMES AND COVERS

A. In Conformance with SSRBC Section 604.03, IDOT and Municipality as called out on plans.

B. Furnish materials in accordance with IDOT and Municipality Standards.

2.2 RISER RINGS

A. In Conformance with SSRBC Section 1043, IDOT and Municipality Subdivision and Development Control Regulations.

B. Furnish materials in accordance with IDOT and Municipality Standards.

C. Precast Concrete: Section 03 41 00.

D. Accessories:
   1. Joint Sealant: ASTM C990.
   2. Bolts: Stainless steel ASTM F593; galvanized ASTM F1554.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify and locate manholes requiring grade adjustment.

3.2 EXISTING WORK

A. Saw cut existing paving.

B. Excavate.

C. Clean manholes.

D. Remove existing manhole frames and covers.

E. Repair waterproofing.

3.3 RAISING MANHOLE FRAMES AND COVERS

A. Locate and raise manholes to grade as indicated on Drawings.

B. Use flat or tapered rubber manhole rings to achieve elevation indicated for frame and cover.

C. Do not adjust elevation more than 6 inches (150 mm) with rubber manhole rings.

D. Seal joints between manhole top, rubber rings, and frame with sealant.

E. Reinstall removed manhole frame and cover.

3.4 REPLACING MANHOLE FRAMES AND COVERS

A. Remove existing manhole frames and covers to enable reuse.

B. Deliver removed manhole frames and covers to Owner as maintenance materials in accordance with Section 01 70 00 - Execution and Closeout Requirements.

C. Install new frames and covers for manholes as indicated on Drawings. Adjust to match finished grade as indicated on Drawings. Seal joints between manholes and manhole frames.

3.5 PAVING RESTORATION

A. Restore bituminous paving areas in accordance with Section 32 12 16.

3.6 LANDSCAPING RESTORATION

A. Restore grassed areas in accordance with Section 32 91 19 and Section 32 92 19.

END OF SECTION

SECTION 33 05 13 - MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Modular precast concrete manhole and structures with tongue-and-groove joints covers, anchorage, and accessories.
2. Bedding and cover materials.

B. Related Sections:
1. Section 04 05 14 - Masonry Mortaring and Grouting: Mortar and grout.
2. Section 31 05 13 - Soils for Earthwork: Soil for backfill in trenches.
3. Section 31 05 16 - Aggregates for Earthwork: Aggregate for backfill in trenches.
4. Section 31 23 16 - Excavation: Excavating for manholes and structures.
5. Section 31 23 23 - Fill: Backfilling after manhole and structure installation.
6. Section 33 05 16 - Utility Structures.
7. Section 33 71 19 - Electrical Underground Ducts.

1.2 REFERENCES

A. In Conformance with Article IDOT Standard Specifications, Adopted January 1, 2012

B. Municipality Subdivision and Development Control Regulations.

C. Standard Specifications for Water and Sewer main construction in Illinois Latest Edition (SSWSMC)

D. ASTM International:
1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
3. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes and Laterals.
4. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test

1.3 DESIGN REQUIREMENTS

A. SSRBC

B. SSWSMC

C. Municipality Subdivision and Development Regulations.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate manhole and structure locations, elevations, piping, sizes and elevations of penetrations.

C. Product Data: Submit cover and frame construction, features, configuration, dimensions.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with SSRBC, SSWSMC and Municipality Standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes and structures.

C. Store precast concrete manholes and structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.

D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

PART 2 PRODUCTS

2.1 MANHOLES AND STRUCTURES

A. SSRBC Section 1042 and 1043 and as called out on plan sheets.

B. Manhole and Structure Sections: Reinforced precast concrete in accordance with ASTM C478 with gaskets in accordance with ASTM C923.

C. Mortar and Grout: As specified in by IDOT and Municipality

2.2 FRAMES AND COVERS

A. Product Description: ASTM A48 Cast iron construction, machined flat bearing surface, removable lid as specified on plans.

2.3 COMPONENTS

A. Manhole and Structure Steps: Formed Plastic Coated Rebar MA Industries Model PS-1 rungs; 3/4 inch diameter. Formed integral with manhole and structure sections.

B. Base Pad: per IDOT and Municipality.

2.4 CONFIGURATION

A. Per IDOT and Municipality as called out on Plans.

B. Clear Inside Dimensions: As indicated on Drawings.

C. Design Depth: As indicated on Drawings.

D. Clear Cover Opening: As indicated on Drawings.

E. Pipe Entry: Furnish openings as indicated on Drawings.

F. Steps: per IDOT and Municipality and As indicated on Drawings.

2.5 BEDDING AND COVER MATERIALS

A. Bedding: Per Municipality and as indicated on Plans.

B. Cover: Per Municipality and as indicated on Plans.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify items provided by other sections of Work are properly sized and located.

C. Verify built-in items are in proper location, and ready for roughing into Work.

D. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.

C. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements, 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Vertical Adjustment of Existing Manholes and Structures:
   1. Where required, adjust top elevation of existing manholes and structures to finished grades shown on Drawings.
   2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.
   3. Remove concrete without damaging existing vertical reinforcing bars when removal of existing concrete wall is required. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement, as indicated Drawings.
   4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete in accordance with Section 03 30 00.

END OF SECTION

SECTION 331213 - WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe and fittings for domestic water service connections to buildings.
   2. Corporation stop assembly.
   3. Curb stop assembly.
   4. Bedding and cover materials.

B. Related Requirements:
   1. Section 31 23 16 - Excavation.
   2. Section 31 23 17 - Trenching.
   3. Section 33 13 00 - Disinfecting of Water Utility Distribution

1.2 REFERENCE STANDARDS

A. Title 77: Chapter I: Subchapter r: Part 89D Illinois Plumbing Code

B. Standard Specifications for Water and Sewer Construction in Illinois.

C. Town of Normal Manual of Practice for the Design of Public Improvements.

D. American Water Works Association:
   1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, and service saddles.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping mains, curb stops, connections, thrust restraints, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Municipality.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. During loading, transporting, and unloading of materials and products, exercise care to prevent any damage.

C. Store products and materials off ground and under protective coverings and custody, away from walls and in manner to keep these clean and in good condition until used.

PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS – SEE Plan Sheets

2.2 CORPORATION STOP ASSEMBLY – SEE Plan Sheets

2.3 CURB STOP ASSEMBLY – SEE Plan Sheets

2.4 BEDDING AND COVER MATERIALS – SEE Plan Sheets

2.5 ACCESSORIES – SEE Plan Sheets

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION - CORPORATION STOP ASSEMBLY

A. Make connection for each different kind of water main using suitable materials, equipment and methods approved by the Architect/Engineer.

B. Provide service clamps for mains other than of cast iron or ductile iron mains.

C. Screw corporation stops directly into tapped and threaded iron main at 10 and 2 o'clock position on main's circumference; locate corporation stops at least 12 inches (300 mm) apart longitudinally and staggered.

D. For plastic pipe water mains, provide full support for service clamp for full circumference of pipe, with minimum 2 inches (50 mm) width of bearing area; exercise care against crushing or causing other damage to water mains at time of tapping or installing service clamp or corporation stop.

E. Use proper seals or other devices so no leaks are left in water mains at points of tapping; do not backfill and cover service connection until approved by the Architect/Engineer.

3.4 BEDDING – SEE Plan Sheets

3.5 INSTALLATION - PIPE AND FITTINGS – SEE Plan Sheets

3.6 INSTALLATION - CURB STOP ASSEMBLY – SEE Plan Sheets

3.7 SERVICE CONNECTIONS

A. Install water service in accordance with ___(MUNICIPALITY)___ Requirements.

3.8 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00**.**

3.9 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting, testing.

B. Pressure test system in accordance with AWWA C600 and the Municipal Requirements:

1. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

END OF SECTION

SECTION 331416 - SITE WATER UTILITY DISTRIBUTION PIPING

1GENERAL

1.SUMMARY

a.Section Includes:

1)Pipe and fittings for Site water line, including domestic water line, fire water line.
2)Tapping sleeves and valves.
3)Valves and boxes.
4)Fire hydrants and yard hydrants.
5)Bedding and cover materials.

b.Related Requirements:

1)Section 033000 - Cast-in-Place Concrete: Concrete for thrust restraints.
2)Section 312316.13 - Trenching: Execution requirements for trenching.
3)Section 312323 - Fill: Requirements for backfill to be placed by this Section.

2.REFERENCE STANDARDS

a.Standard Specifications for Water and Sewer Construction in Illinois. Division IV Water Distribution.

b.IDOT Standard Specifications for road and Bridge Construction Sections:
1)1003 Fine Aggregate
2)1004 Coarse Aggregate
3)1001 Cement
4)1018 Mortar

c.American Water Works Association:

1)AWWA C600 – Installation of Ductile – Iron Mains and Their Appurtenances.

d.Municipal Standards as applicable

e.Illinois Environmental Protection Agency: Division of Public Water Supplies

3.SUBMITTALS

a.Product Data: Submit manufacturer information regarding pipe materials, pipe fittings, valves, hydrants.

4.CLOSEOUT SUBMITTALS

a.Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

5.QUALITY ASSURANCE

a.Perform Work according to Municipality& IEPA standards.

6.DELIVERY, STORAGE, AND HANDLING

a.Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

b.Storage:

1)Store materials according to manufacturer instructions.

c.Protection:

1)Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2)Provide additional protection according to manufacturer instructions.

7.EXISTING CONDITIONS

a.Field Measurements:

1)Verify field measurements prior to fabrication.

2PRODUCTS

1.PIPING

a.Pipe and Fittings: As Specified on Plans

b.Joints: As Specified on Plans

2.TAPPING SLEEVES AND VALVES

a.Tapping Sleeves: As Specified on Plans

3.VALVES AND HYDRANTS

a.Valves, Valve Boxes, and Fire Hydrants: As specified on Plans.

4.MATERIALS

a.Bedding and Cover: As Specified on Plans.

5.ACCESSORIES

a.Thrust Restraints: As specified on Plans.

3EXECUTION

1.EXAMINATION

a.Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

b.Verify that building service connections and municipal utility water main sizes, locations, and elevations are as indicated on Drawings.

2.PREPARATION

a.Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

b.As Specified on Plans.

c.Remove scale and dirt on inside and outside before assembly.

d.Prepare pipe connections to equipment with flanges or unions.

e.Protect and support existing distribution piping and appurtenances as Work progresses.

3.INSTALLATION

a.Bedding: As Specified on Plans.

b.Pipe and Fittings: As Specified on Plans

c.Meters and Boxes: As specified on plans.

d.Disinfection: As specified on Plans.

4.FIELD QUALITY CONTROL

a.Testing: As Specified on Plans.

END OF SECTION 331416

SECTION 33 31 00 - SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1. SUMMARY

a. Section Includes:

1) Sanitary sewerage piping.
2) Bedding and cover materials.

b. Related Requirements:

1) Section 221300 - Facility Sanitary Sewerage: Product and execution requirements for sanitary waste and vent piping at building.
2) Section 310513 - Soils for Earthwork: Soil for backfill in trenches.
3) Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.
4) Section 312316 - Excavation: Requirements for excavation and backfill as required by this Section.
5) Section 312316.13 - Trenching: Requirements for trenching as required by this Section.
6) Section 312323 - Fill: Requirements for backfilling as required by this Section.

2. DEFINITIONS

a. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

3. REFERENCE STANDARDS

a. Standard Specifications for Water and Sewer Construction in Illinois.

b. Illinois Environmental Protection Agency – Division of Water Pollution Control.

c. Village of Oswego Subdivision and Development Control Regulations.

4. COORDINATION

a. Section 013000 - Administrative Requirements: Requirements for coordination.

5. PREINSTALLATION MEETINGS

a. As required by Village of Oswego Department of Public Works and Building Department.

6. SUBMITTALS

a. Section 013300 - Submittal Procedures: Requirements for submittals.

b. Product Data: Submit manufacturer information indicating pipe material to be used, pipe accessories.

7. CLOSEOUT SUBMITTALS

a. Identify and describe discovery of uncharted utilities.

8. QUALITY ASSURANCE

a. Perform Work according to Standard Specifications for Water and Sewer Construction in Illinois.

9. DELIVERY, STORAGE, AND HANDLING

a. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

b. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

10. EXISTING CONDITIONS

a. Field Measurements:

1) Verify field measurements prior to fabrication.
2) Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

1. SANITARY SEWERAGE PIPING

a. Plastic Pipe:

1) Material: PVC.
2) Comply with ASTM D3034, SDR-26
3) End Connections: Bell and spigot with rubber-ring-sealed gasket joint.
4) Fittings: PVC.
5) Joints:

a) Elastomeric gaskets.
b) Comply with ASTM F477.

2. MANHOLES

a. As specified on Plan Sheets.

3. FLEXIBLE COUPLINGS

a. Fernco:

1) Substitutions: Upon approval of Engineer.

b. Description:

1) Material: Resilient, chemical-resistant, elastomeric PVC.
2) Attachment: Two [**Series-300**] stainless-steel clamps, screws, and housings.

4. FLEXIBLE PIPE BOOTS FOR MANHOLE PIPE ENTRANCES

a. Furnish materials according to Municipal standards and as shown on plans.

5. MATERIALS

a. Bedding and Cover:

1) Bedding: Fill Type per Municipal standards and as specified on plans.
2) Cover: Fill Type per Municipal standards and as specified on plans.
3) Soil Backfill from Above Pipe to Finish Grade: per Municipal standards and as specified on plans.

6. MIXES

a. Grout: As specified per Municipal standards and as specified on plans.

PART 3 EXECUTION

1. EXAMINATION

a. Verify that trench cut is ready to receive Work of this Section.

b. Verify that excavations, dimensions, and elevations are as indicated on drawings.

2. PREPARATION

a. Correct over-excavation as specified on plans.

b. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.

c. Protect and support existing sewer lines, utilities, and appurtenances.

d. Utilities:

1) Maintain profiles of utilities.
2) Coordinate with other utilities to eliminate interference.
3) Notify Architect/Engineer if crossing conflicts occur.

3. INSTALLATION

a. Bedding: As specified on plans and per Municipality.

b. Piping: As specified on plans and per Municipality.

c. Manholes: As specified on plans and per Municipality.

d. Backfilling: As specified on plans and per Municipality.

4. TOLERANCES

a. Per Municipal standards.

5. FIELD QUALITY CONTROL

a. Testing:

1) If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
2) Perform testing on Site sanitary sewage system according to plans and State and Municipality standards.

6. PROTECTION

a. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

b. Cap open ends of piping during periods of Work stoppage.

PART 4 END OF SECTION 333100

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Storm drainage piping.
2. Accessories.
3. Underground pipe markers.
4. Catch basins and yard drains.
5. Bedding and cover materials.

B. Related Sections:
1. Section 03 60 00 - Grouting: Mortar and grout.
2. Section 31 23 16 - Excavation: Product and execution requirements for excavation and backfill required by this section.
3. Section 31 23 16.13 - Trenching: Execution requirements for trenching required by this section.
4. Section 31 23 23 - Fill: Requirements for backfill to be placed by this section.
5. Section 33 05 13 - Manholes and Structures.

1.2 REFERENCES

A. (SSRBC) IDOT Standard Specifications for Road and Bridge Construction

B. (SSWSC) Standard Specifications for Water and Sewer Construction in Illinois.

C. ASTM International:
1. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
2. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data indicating pipe, pipe accessories.

C. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents:
   1. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
   2. Identify and describe discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Municipality.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPING

A. As Called for on plans and per Municipality.

2.2 ACCESSORIES

A. Grout: Specified in Section 03 60 00.

2.3 CATCH BASINS AND YARD DRAINS

A. As specified on plans and per Municipality.

2.4 BEDDING AND COVER MATERIALS

A. As outlined on plans and per the Municipality.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with pipe adding material as specified on plans.

B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench in accordance with plans. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level materials in continuous layer and compacted depth as specified on plans.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with plans and Municipality.

B. Place pipe on bedding as specified on plans and Municipality.

C. Lay pipe to slope gradients noted on drawings.

D. Install aggregate at sides and over top of pipe.

E. Refer to plans and Municipality for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

F. Refer to Section 33 05 13 and plans for manhole requirements.

G. Install Work in accordance with Municipality.

3.5 INSTALLATION - CATCH BASINS AND CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.6 FIELD QUALITY CONTROL

A. Section [01 40 00 - Quality Requirements] [01 70 00 - Execution and Closeout Requirements]: Field inspecting, testing, adjusting, and balancing.

B. Compaction Testing: In accordance with AASHTO T180 and ASTM D2922.

C. When tests indicate work does not meet specified requirements, remove work, replace and retest.

3.7 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
   1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
   2. Repair or replace pipe that is damaged or displaced from construction operations.

END OF SECTION

SECTION 334200 - STORMWATER CONVEYANCE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stormwater drainage piping.
2. Manholes.
3. Catch basins.
4. Bedding and cover materials.

B. Related Requirements:

1. Section 036000 - Grouting: Cementitious grout.
2. Section 312316.13 - Trenching: Execution requirements for trenching as required by this Section.
3. Section 312323 - Fill: Requirements for backfill to be placed under this Section.
4. Section 330573 - Polyethylene Manholes: Manholes and accessories as required by this Section.
5. Section 334113 - Foundation Drainage: Termination of subdrainage tile system for connection to Work of this Section.

1.2 DEFINITIONS

A. HDPE – High Density Polyethylene

1.3 REFERENCE STANDARDS

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

B. Municipal Subdivision and Development Control Regulations

C. ASTM International:

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.
3. ASTM C14 - Standard Specification for Non-reinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
4. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
5. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
6. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

7. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
8. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
9. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.
10. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
11. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
12. ASTM F405 - Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings.
13. ASTM F667/F667M - Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer information describing pipe, pipe accessories, and joints.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.

1.6 QUALITY ASSURANCE

A. Perform Work according to Section 551 SSRB and Per Municipal Subdivision and Development standards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.8 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 STORM DRAINAGE PIPING

A. Storm Drainage Pipe as Specified on Plans, Notes and Details.

2.2 MANHOLES

A. As specified on Plans and Details

2.3 CATCH BASINS

A. Catch Basins as Specified on Plans, Notes and Details.

B. Lids and Frames: As Specified on Plans, Notes and Details.

2.4 MATERIALS

A. Bedding and Cover: as Specified on Plans, Notes and Details.

2.5 MIXES

A. Grout: As specified in Section 036000 - Grouting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut excavation base is ready to receive Work of this Section.

B. Verify that excavations, dimensions, and elevations are as indicated on layout drawings.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Correct over-excavation with material as specified on plans, notes and details.

C. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

A. Excavation and Bedding: As Specified on Plans, Notes and Details.

B. Piping:

1. Pipe, Fittings, and Accessories: As Specified on Plans, Notes and Details.
2. Seal joints watertight.
3. Install aggregate at sides and over top of pipe as Specified on Plans, Notes and Details.
4. Backfilling and Compaction:

    a. As specified on Plans, Notes and Details.
    b. Do not displace or damage pipe while compacting.

5. Manholes: As specified on Plans, Notes and Details.

C. Catch Basins:

1. Catch Basins and Accessories as Specified on Plans, Notes and Details.
2. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.
3. Mount lid and frame level in grout, secured to top section to indicated elevation.

3.4 PROTECTION

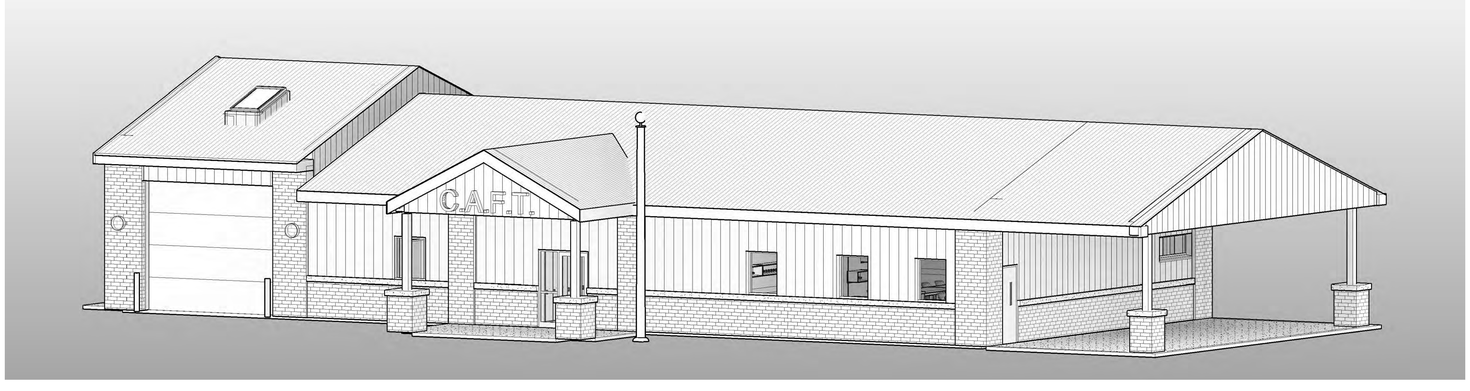
A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

Combined Area Fire Training Facility

Village of Buffalo Grove

Buffalo Grove, IL



CIVIL

C1.0	EXISTING CONDITION PLANS
C2.0	DEMOLITION AND GEOMETRIC PLAN
C3.0	GRADING AND UTILITY PLAN
C4.0	STANDARD CONSTRUCTION NOTES
C5.0	STANDARD CONSTRUCTION DETAILS

ARCHITECTURAL

A0.01	SITE PLAN AND CODE PLAN
A1.10	FLOOR, REFLECTED CEILING AND ROOF PLANS
A2.10	EXTERIOR ELEVATIONS
A2.11	ENLARGED PLANS
A3.10	WALL SECTIONS
A4.11	SCHEDULES AND DETAILS
A4.12	DETAILS
A4.13	DETAILS

STRUCTURAL

S0.10	STRUCTURAL GENERAL NOTES
S1.10	FOUNDATION PLAN AND DETAILS

MECHANICAL

F001	FIRE PROTECTION GENERAL NOTES AND SYMBOLS
F100	FIRE PROTECTION PLAN
M001	MECHANICAL GENERAL NOTES AND SYMBOLS
M100	MAIN LEVEL HVAC PLAN
M200	MECHANICAL SCHEDULES
M300	MECHANICAL DETAILS
P100	MAIN LEVEL PLUMBING PLANS
P200	PLUMBING RISER DIAGRAMS

ELECTRICAL

E101	ELECTRICAL PLANS
E201	ELECTRICAL SCHEDULES

BIDDING DOCUMENTS

Set No: _____
Comm No: 173013

Combined Area Fire Training Facility

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

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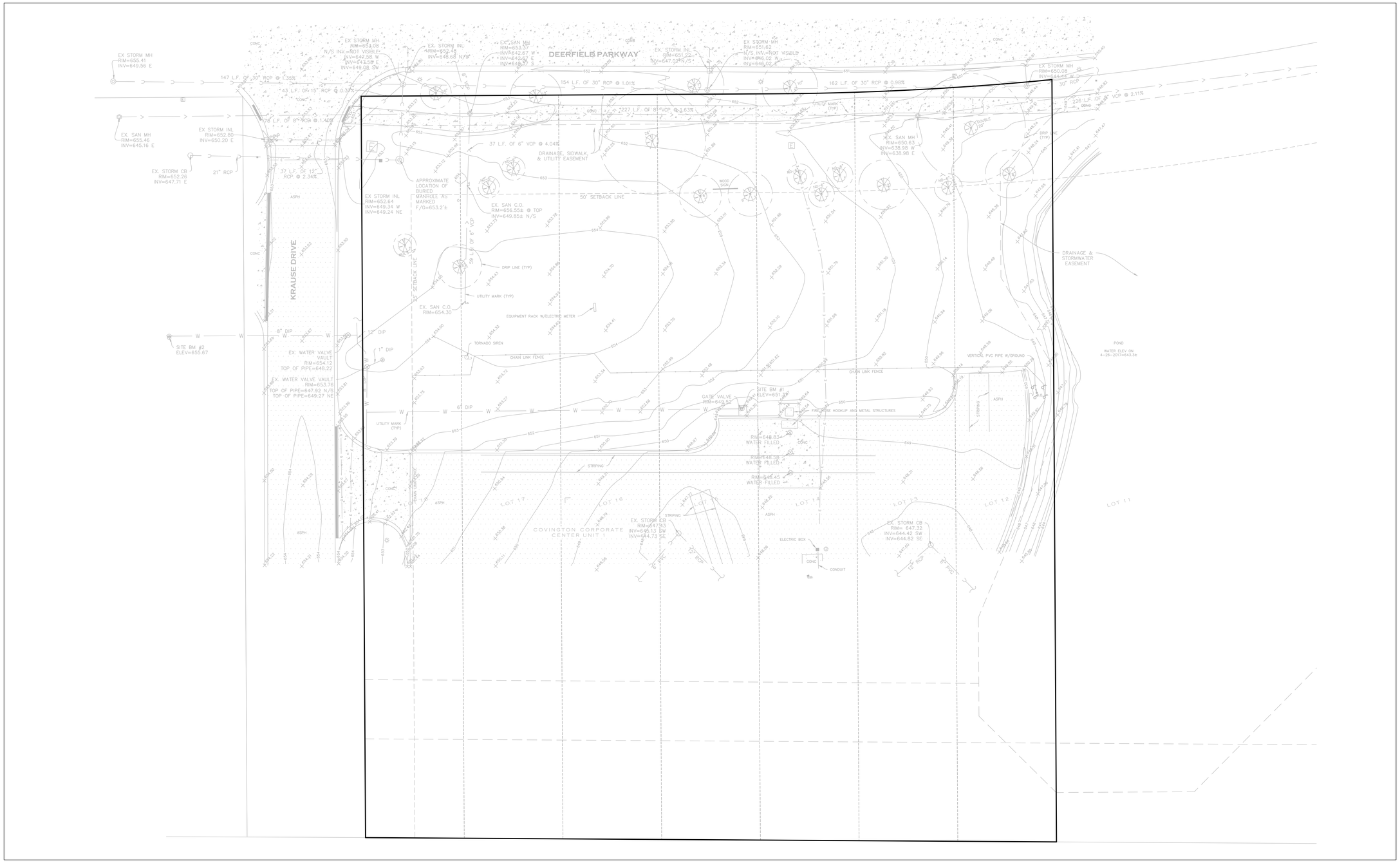
110 North Brockway, Suite 220
Palatine, Illinois 60067

woldac.com | 847 241 6100



1 **EXISTING CONDITION PLAN**
SCALE: 1" = 20'

NOTES

1. FIELD WORK WAS COMPLETED APRIL 26, 2017.
2. ONLY THOSE TREES BEING 6" DIAMETER AND LARGER ARE SHOWN HEREON.
3. PROPERTY LINES, SETBACKS, AND EASEMENTS SHOWN HEREON ARE APPROXIMATE AND FOR INFORMATIONAL PURPOSES ONLY. PLEASE REFER TO A CURRENT PLAT OF SURVEY FOR ALL BOUNDARY INFORMATION AND DATA.
4. SURVEYOR WAS NOT PROVIDED TITLE WORK OR DEED FOR THE PREMISES SHOWN HEREON.
5. THE IMPROVEMENTS/UTILITIES SHOWN HEREON WERE LOCATED AT THE TIME OF THE SURVEY AND ARE NOT A REPRESENTATION OF ANY PHYSICAL STRUCTURES OR FEATURES THAT MAY HAVE BEEN OBSTRUCTED BY SNOW, ICE, LANDSCAPING, OR BRUSH.
6. SURFACE INDICATIONS OF UTILITIES ON THE SURVEYED AREA HAVE BEEN SHOWN, INCLUDING UTILITIES FLAGGED OR PAINTED ON SITE. PUBLIC AND/OR PRIVATE RECORDS HAVE NOT BEEN SEARCHED TO PROVIDE ADDITIONAL INFORMATION. OVERHEAD WIRES AND POLES (IF ANY) HAVE BEEN SHOWN, HOWEVER THEIR FUNCTION AND DIMENSIONS HAVE NOT BEEN SHOWN.
7. OTHER THAN VISIBLE OBSERVATIONS NOTED HEREON, THIS SURVEY MAKES NO STATEMENT REGARDING THE ACTUAL PRESENCE OR ABSENCE OF ANY SERVICE OR UTILITY LINE.
8. SURVEY COMPLETED FOR:
   VILLAGE OF BUFFALO GROVE
   51 RAUPP BLVD
   BUFFALO GROVE, IL 60023

BENCHMARKS

ELEVATIONS SHOWN ARE RELATIVE TO NAVD 88.

SOURCE BENCHMARK:
LAKE COUNTY BENCHMARK ID # SMC 28. PLEASE REFER TO LAKE COUNTY BENCHMARK RECOVERY SHEET FOR LOCATION AND DESCRIPTION.
ELEVATION= 643.28'

SITE BENCHMARK #1:
NORTHWESTERLY UPPER FLANGE BOLT ON FIRE HYDRANT SHOWN HEREON.
ELEVATION= 651.37'

SITE BENCHMARK #2:
NORTHEASTERLY UPPER FLANGE BOLT ON FIRE HYDRANT SHOWN HEREON.
ELEVATION= 655.67'

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I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed under the laws of the State of Illinois.

DATE: 7-7-2017
JAMES P. MEIER — LICENSED PROFESSIONAL ENGINEER
Registration Number: 062-051277 — EXP. DATE: NOVEMBER 30, 2017

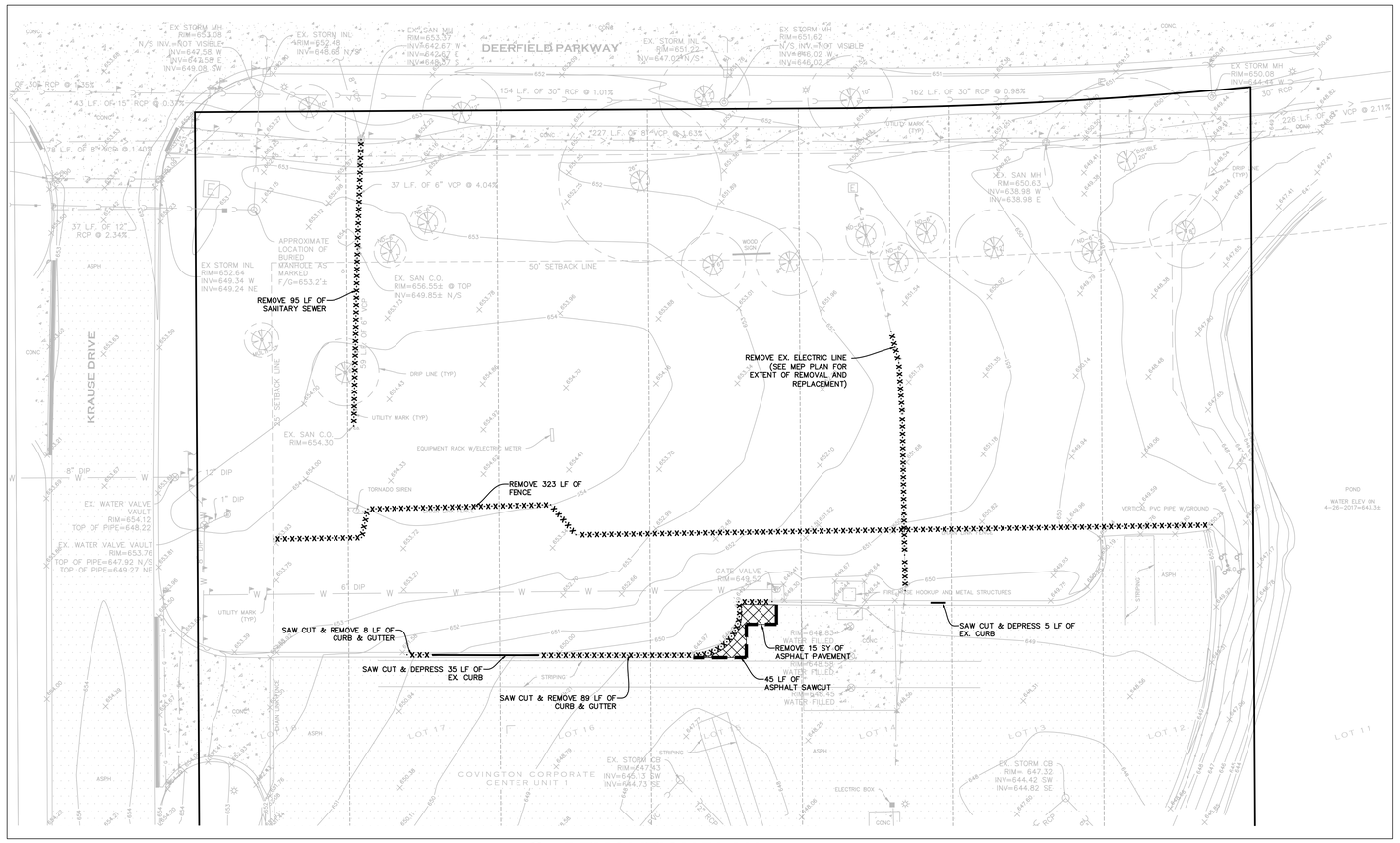
Revisions		
Description	Date	Num

Comm: 173013
Date: 7-7-2017
Drawn: CLS
Check: JPM
North

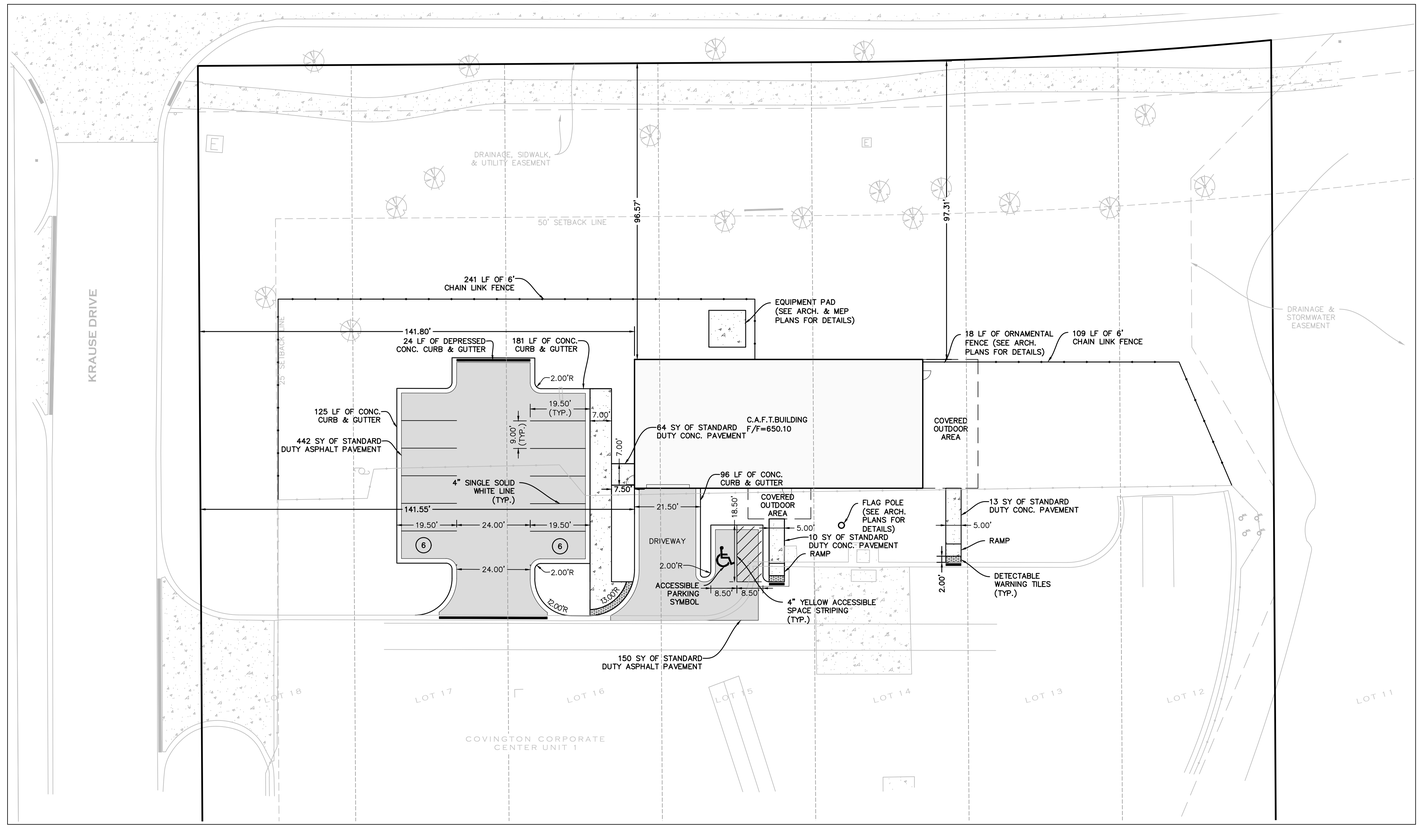
EXISTING CONDITION PLAN

Scale:

C1.0



2 **DEMOLITION PLAN**
SCALE: 1" = 20'



3 **GEOMETRIC PLAN**
SCALE: 1" = 20'

DEMOLITION LEGEND

- REMOVE ITEM
- SAWCUT BACK OF CURB
- FULL DEPTH SAWCUT PAVEMENT
- REMOVE ASPHALT PAVEMENT

LEGEND

- DEPRESSED CURB AND GUTTER (SEE DETAILS ON SHEET 5)
- STANDARD DUTY ASPHALT PAVEMENT (SEE DETAILS ON SHEET 5)
- CONCRETE PAVEMENT (SEE DETAILS ON SHEET 5)
- PL — PROPERTY LINE
- ES — EDGE OF STRIPE
- CS — CENTER OF STRIPE
- B — BUILDING
- BC — BACK OF CURB
- EW — EDGE OF WALK
- R — RADIUS

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Date: 7-7-2017
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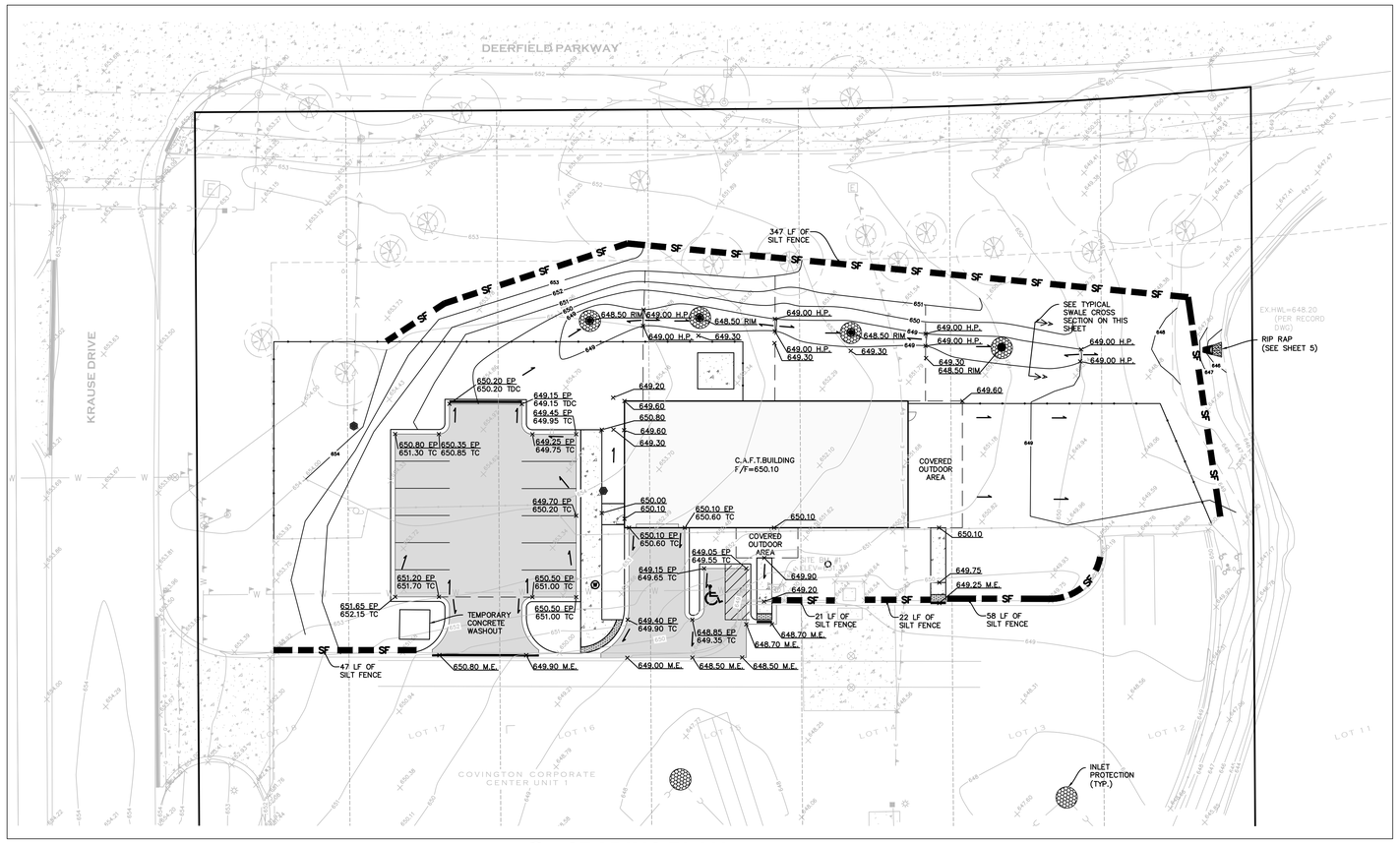
North

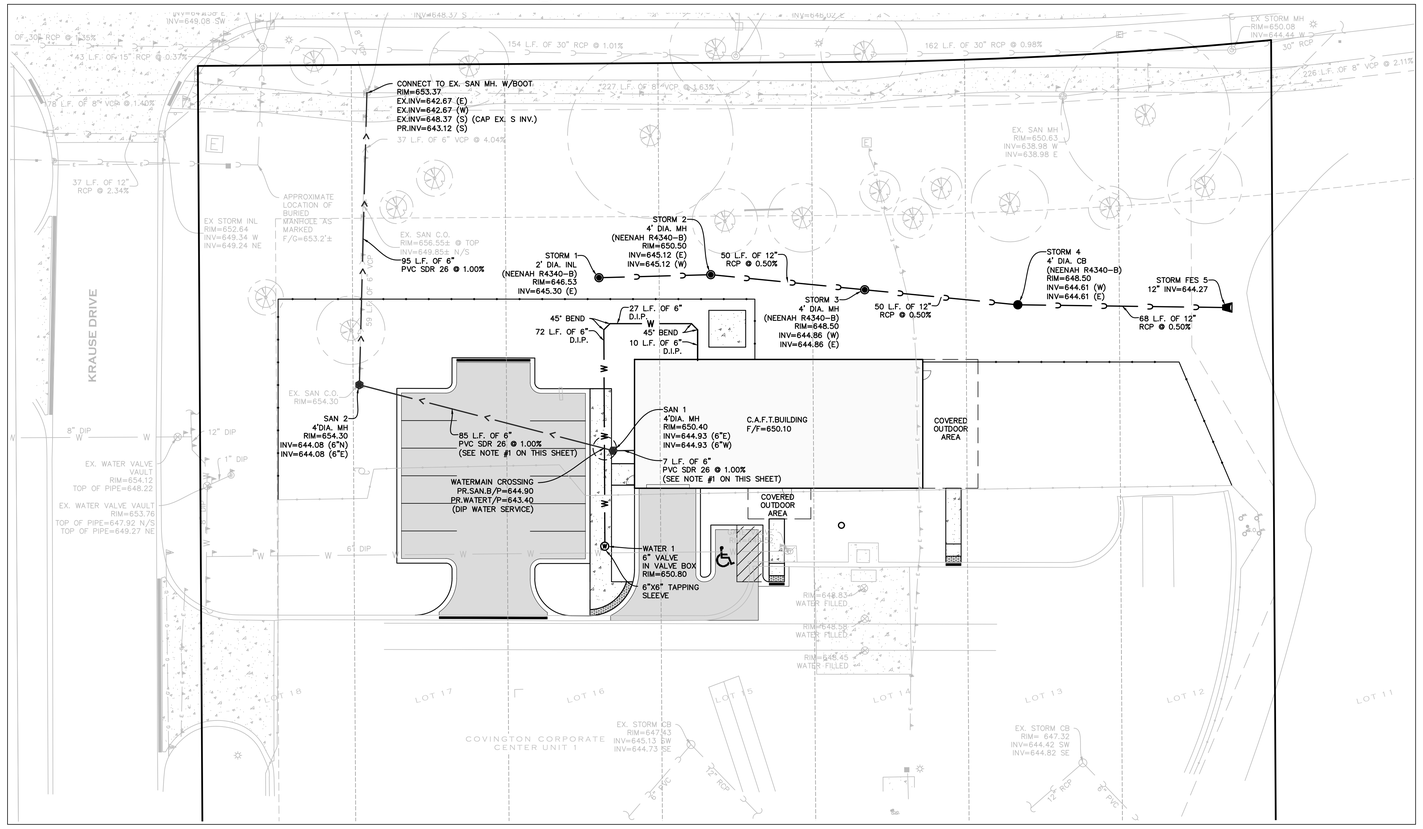
DEMOLITION PLAN GEOMETRIC PLAN

Scale:

C2.0



4 **GRADING PLAN**
SCALE: 1" = 20'

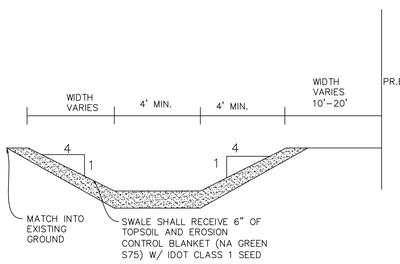


5 **UTILITY PLAN**
SCALE: 1" = 20'

GRADING LEGEND

720	GRADING CONTOUR
	EMERGENCY OVERLAND FLOOD ROUTE
	DRAINAGE FLOW ARROW
T/F	TOP OF FOUNDATION
G/F	GARAGE FLOOR
EP	EDGE OF PAVEMENT
TC	TOP OF CURB
TDC	TOP OF DEPRESSED CURB
M.E.	MATCH EXISTING
	DEPRESSED CURB AND GUTTER
	INLET PROTECTION (SEE SHEET #)
	END SECTION RIP RAP
SF	SILT FENCE

GRADING PLAN NOTE:
1. ALL PERVIOUS DISTURBED AREAS SHALL RECEIVE A MINIMUM 6" OF TOPSOIL AND IDOT CLASS 1 SEED.



TYPICAL SWALE CROSS SECTION A-A

UTILITY & STORM LEGEND

T	TELEPHONE LINE
E	ELECTRIC LINE
G	GAS LINE
<	SANITARY LINE
W	WATER LINE
	SANITARY MANHOLE
	VALVE VAULT
	FIRE HYDRANT
	BUFFALO BOX
	GAS VALVE
C.O.	CLEAN OUT
C	STORM SEWER
	STORM MANHOLE/INLET
	STORM CATCH BASIN
	STORM FLARED END SECTION

UTILITY PLAN NOTE:
1. SANITARY PIPE SHALL BE WATERMAIN WHERE SPECIFIED, QUALITY MEETING ASTM D-2241 W/ ASTM D-3130 JOINTS.

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North

GRADING PLAN
UTILITY PLAN

Scale:

C3.0

GENERAL SITE IMPROVEMENTS

1. COPIES OF THE REFERENCED STANDARD SPECIFICATIONS, CONSTRUCTION PLANS AND DETAILS ARE ALL TO BE CONSIDERED AS PART OF THE CONTRACT. INCIDENTAL ITEMS OR ACCESSORIES NECESSARY TO COMPLETE THIS WORK MAY NOT BE SPECIFICALLY NOTED BUT ARE CONSIDERED A PART OF THIS CONTRACT.

2. THE GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND GENERAL REQUIREMENTS (IF ANY) APPLY TO THE WORK SPECIFIED IN THE PLANS.

3. EASEMENTS FOR EXISTING UTILITIES, BOTH PUBLIC AND PRIVATE, AND UTILITIES WITHIN PUBLIC RIGHTS-OF-WAY ARE SHOWN ON THE PLANS ACCORDING TO INFORMATION AVAILABLE IN THE RECORDS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING THE EXACT LOCATION OF THESE UTILITY LINES IN THE FIELD AND FOR THEIR PROTECTION FROM DAMAGE DUE TO CONSTRUCTION OPERATIONS. IF EXISTING UTILITY LINES OF ANY NATURE ARE ENCOUNTERED WHICH CONFLICT IN LOCATION WITH NEW CONSTRUCTION, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE DEVELOPER'S REPRESENTATIVE SO THE CONFLICT MAY BE RESOLVED. THE CONTRACTOR SHALL CALL 811 OR J.U.L.I.E. (800-892-0123) PRIOR TO CONSTRUCTION.

4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL PRIVATE AND PUBLIC UTILITIES EVEN THOUGH THEY MAY NOT BE SHOWN IN THE PLANS. ANY UTILITY THAT IS DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR AT HIS OWN EXPENSE, TO THE SATISFACTION OF THE UTILITY OWNER.

5. RELOCATING UTILITIES SHALL BE THE RESPONSIBILITY OF THE OWNERS EXCEPT WHEN NOTED IN THE PLANS. THE CONTRACTOR SHALL COORDINATE WITH THESE OWNERS WHEN MOVING IS NECESSARY.

6. EXPENSE IN CONNECTING PROPOSED UTILITIES TO EXISTING UTILITIES SHALL BE INCIDENTAL TO THE CONTRACT.

7. THE CONTRACTOR SHALL COORDINATE WITH ALL UTILITY OWNERS. THE CONTRACTOR SHALL NOTIFY ALL UTILITY OWNERS PRIOR TO CONSTRUCTION.

8. ALL FIELD TILE ENCOUNTERED DURING CONSTRUCTION OPERATIONS SHALL BE CONNECTED TO THE PROPOSED STORM SEWER SYSTEM OR EXTENDED TO OUTLET INTO A PROPOSED DRAINAGE SWALE. IF THIS CANNOT BE ACCOMPLISHED, THEN IT SHALL BE REPAIRED WITH NEW PIPE OF SIMILAR SIZE AND MATERIAL TO THE ORIGINAL LINE AND PUT IN ACCEPTABLE OPERATING CONDITION. A RECORD OF THE LOCATION OF ALL FIELD TILE OR DRAIN PIPE ENCOUNTERED SHALL BE KEPT BY THE CONTRACTOR AND SUBMITTED TO THE MUNICIPALITY UPON COMPLETION OF THE PROJECT.

9. WHENEVER ANY LOOSE MATERIAL IS DISPOSED IN THE FLOW LINE OF GUTTERS, DRAINAGE STRUCTURES OR DITCHES SUCH THAT THE NATURAL FLOW LINE OF WATER IS OBSTRUCTED, THE LOOSE MATERIAL SHALL BE REMOVED AT THE CLOSE OF EACH WORKING DAY. AT THE CONCLUSION OF CONSTRUCTION OPERATIONS, ALL DRAINAGE STRUCTURES AND FLOW LINES SHALL BE FREE FROM DIRT AND DEBRIS. THIS WORK SHALL BE CONSIDERED INCIDENTAL TO THE CONTRACT.

10. REMOVED DRIVEWAY PAVEMENT, SIDEWALK AND CURBS AND CURB AND GUTTER SHALL BE DISPOSED OF OFF-SITE AT LOCATIONS PROVIDED BY THE CONTRACTOR AT HIS OWN EXPENSE.

11. BEFORE APPROPRIATE ACCEPTANCE BY THE OWNER AND/OR THE MUNICIPALITIES AND FINAL PAYMENT, ALL WORK SHALL BE INSPECTED AND APPROVED BY THE MUNICIPALITIES AND THE OWNER OR HIS REPRESENTATIVES. FINAL PAYMENT WILL BE MADE AFTER ALL OF THE CONTRACTOR'S WORK HAS BEEN APPROVED AND ACCEPTED. THE CONTRACTOR SHALL GUARANTEE HIS WORK FOR A PERIOD OF ONE YEAR FROM THE DATE OF ACCEPTANCE AND SHALL BE HELD RESPONSIBLE FOR ANY DEFECTS IN MATERIAL OR WORKMANSHIP OF THIS WORK DURING THAT PERIOD.

12. TRAFFIC CONTROL DEVICES IN CONFORMANCE WITH I.D.O.T. STANDARDS SHALL BE INSTALLED AND PROVIDED WHENEVER CONSTRUCTION FOR UTILITIES IS WITHIN A PUBLIC RIGHT OF WAY AREA. ORDINANCES OF THE MUNICIPALITY MAY ALSO GOVERN TRAFFIC CONTROL. THE COST OF PROVIDING, INSTALLING AND MAINTAINING NECESSARY TRAFFIC CONTROL DEVICES SHALL BE INCIDENTAL TO THE CONTRACT.

13. ALL PROPOSED ELEVATIONS SHOWN ON PLANS ARE FINISHED SURFACE ELEVATIONS UNLESS OTHERWISE SPECIFIED.

14. UPON AWARDING OF THE CONTRACT AND WHEN REQUIRED BY THE MUNICIPALITY, THE CONTRACTOR SHALL FURNISH ALL LABOR, MATERIAL AND PERFORMANCE BOND IN THE AMOUNT REQUIRED BY THE MUNICIPALITY TO GUARANTEE COMPLETION OF THE WORK. THE UNDERWRITER SHALL BE ACCEPTABLE TO THE MUNICIPALITY. THE CONTRACTOR SHALL NOT COMMENCE WORK UNTIL ALL REQUIRED INSURANCE IS OBTAINED AND ACCEPTED.

15. ALL PERMITS, BONDS AND EVIDENCE OF INSURANCE AS REQUIRED BY UTILITY COMPANIES AND THE MUNICIPALITY SHALL BE OBTAINED BY THE CONTRACTOR AND THE COST OF THESE PERMITS AND BONDS SHALL BE BORNE BY THE CONTRACTOR AND SHALL BE INCIDENTAL TO THE CONTRACT.

16. THE CONTRACTOR SHALL COLLECT AND REMOVE ALL CONSTRUCTION DEBRIS, EXCESS MATERIALS, TRASH, OIL AND GREASE RESIDUE, MACHINERY, TOOLS AND OTHER MISCELLANEOUS ITEMS WHICH ARE PRESENT UPON COMPLETION OF CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ACQUIRING ANY AND ALL PERMITS NECESSARY FOR THE HAULING AND DISPOSAL REQUIRED FOR CLEAN-UP AS DIRECTED BY THE MUNICIPALITY OR OWNER. BURNING ON THE SITE IS NOT PERMITTED.

17. NO CONSTRUCTION PLAN SHALL BE USED FOR CONSTRUCTION UNLESS SPECIFICALLY MARKED FOR CONSTRUCTION. PRIOR TO COMMENCEMENT OF CONSTRUCTION, THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS AFFECTING THE WORK WITH THE ACTUAL CONDITIONS AT THE JOB SITE. IN ADDITION, THE CONTRACTOR MUST VERIFY ALL LINE AND GRADE STAKES PROVIDED BY THE OWNER. IF THERE ARE ANY DISCREPANCIES WITH WHAT IS SHOWN ON THE CONSTRUCTION PLANS, HE MUST IMMEDIATELY REPORT TO THE OWNER BEFORE DOING ANY WORK OR ASSUME FULL RESPONSIBILITY. IN THE EVENT OF DISAGREEMENT BETWEEN THE CONSTRUCTION PLANS, SPECIFICATIONS AND/OR SPECIAL DETAILS, THE CONTRACTOR SHALL SECURE WRITTEN INSTRUCTION FROM THE OWNER PRIOR TO PROCEEDING WITH ANY PART OF THE WORK AFFECTED BY OMISSIONS OR DISCREPANCIES. FAILING TO SECURE SUCH INSTRUCTION, THE CONTRACTOR WILL BE CONSIDERED TO HAVE PROCEEDED AT HIS OWN RISK AND EXPENSE. IN THE EVENT OF ANY DOUBT OR QUESTIONS ARISING WITH RESPECT TO THE TRUE MEANING OF THE CONSTRUCTION PLANS OR SPECIFICATIONS, THE DECISION OF THE OWNER SHALL BE FINAL.

18. NOTIFICATION OF COMMENCING CONSTRUCTION: A. THE CONTRACTOR SHALL NOTIFY THE OWNER AND/OR HIS REPRESENTATIVE AND THE AFFECTED GOVERNMENTAL AGENCIES IN WRITING AT LEAST THREE FULL WORKING DAYS PRIOR TO COMMENCEMENT OF CONSTRUCTION. IN ADDITION, THE CONTRACTOR SHALL NOTIFY, AS NECESSARY, ALL TESTING AGENCIES. B. FAILURE OF CONTRACTOR TO ALLOW PROPER NOTIFICATION TIME WHICH RESULTS IN TESTING COMPANIES TO BE UNABLE TO VISIT SITE AND PERFORM TESTING WILL CAUSE CONTRACTOR TO SUSPEND OPERATION (PERTAINING TO TESTING) UNTIL TESTING AGENCY CAN SCHEDULE TESTING OPERATIONS. THE COST OF SUSPENSION OF WORK SHALL BE BORNE BY THE CONTRACTOR.

19. ALL CONTRACTORS SHALL KEEP ACCESS AVAILABLE AT ALL TIMES FOR EMPLOYEES AND EMERGENCY VEHICLES. AT NO TIME SHALL ACCESS BE DENIED TO EMPLOYEES OF THE SITE.

20. THE CONTRACTOR SHALL PROVIDE ELECTRONIC COPIES AND 2 SETS OF COPIES OF "RECORD" DRAWINGS TO THE MUNICIPALITIES AND OWNER PRIOR TO ANY REQUEST FOR FINAL INSPECTION. SAID PLANS SHALL INDICATE THE FINAL LOCATIONS AND LAYOUT OF ALL IMPROVEMENTS AND SHALL INCLUDE VERIFICATION OF ALL BUILDING PADS, INVERTS, RIMS AND SPOT GRADE ELEVATIONS AND INCORPORATE ALL FIELD DESIGN CHANGES APPROVED BY THE MUNICIPALITY. MYLAR DRAWINGS SHALL BE PROVIDED WHEN THE COPIES ARE APPROVED BY THE MUNICIPALITY.

21. THE CONTRACTOR SHALL VIDEO RECORD THE WORK AREA PRIOR TO CONSTRUCTION FOR THE PURPOSE OF DOCUMENTING EXISTING CONDITIONS.

EARTHWORK

1. ALL SITE WORK, GRADING AND EMBANKMENT CONSTRUCTION WITHIN THE LIMITS OF THIS PROJECT SHALL BE DONE IN ACCORDANCE WITH THE “STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION IN ILLINOIS” (STANDARD SPECIFICATIONS), THE MOST RECENT EDITION.

2. EARTH EXCAVATION SHALL INCLUDE CLEARING, STRIPPING AND STOCKPILING TOPSOIL, REMOVING UNSUITABLE MATERIALS, THE CONSTRUCTION OF EMBANKMENTS, NON-STRUCTURAL FILLS, FINAL SHAPING AND TRIMMING TO THE LINES, GRADES AND CROSS-SECTIONS SHOWN ON THE PLANS. THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH APPLICABLE PROVISIONS OF SECTION 200 OF THE STANDARD SPECIFICATIONS. ALL UNSUITABLE OR EXCESS MATERIAL SHALL BE DISPOSED OF BY THE CONTRACTOR.

3. TOPSOIL EXCAVATED SHALL BE STOCKPILED ON THE SITE OR IN AREAS DESIGNATED BY THE OWNER UNTIL SUCH TIME THAT THIS TOPSOIL CAN BE USED FOR FINAL GRADING.

4. THE CONTRACTOR IS REFERRED TO SOILS INVESTIGATION FOR THE SITE AND ALL ADDENDA THERETO, SHOWING THE RESULTS OF SUBSURFACE INVESTIGATION MADE ON THIS SITE. COPIES OF SAID SOILS REPORTS ARE ON FILE WITH THE OWNER AND ARE AVAILABLE FOR INSPECTION. THE RECOMMENDATIONS OF SOIL INVESTIGATIONS AS STATED IN SAID REPORT ARE HEREBY INCORPORATED INTO THESE CONSTRUCTION NOTES BY REFERENCE AND SHALL BE FOLLOWED BY THE CONTRACTORS. THE GRADING OPERATIONS ARE TO BE CLOSELY SUPERVISED AND INSPECTED, PARTICULARLY DURING THE REMOVAL OF UNSUITABLE MATERIAL AND THE CONSTRUCTION OF EMBANKMENTS, BY THE SOILS ENGINEER OR HIS REPRESENTATIVE.

5. THE GRADING AND CONSTRUCTION OF THE IMPROVEMENTS SHALL NOT CAUSE PONDING OF STORM WATER. ALL AREAS ADJACENT TO THESE IMPROVEMENTS SHALL BE GRADED TO ALLOW POSITIVE DRAINAGE.

6. ALL TESTING, INSPECTION AND SUPERVISION OF SOILS QUALITY, UNSUITABLE REMOVAL AND ITS REPLACEMENT AND OTHER SOILS RELATED OPERATIONS SHALL BE ENTIRELY THE RESPONSIBILITY OF THE SOILS ENGINEER AND THE OWNER.

7. THE PROPOSED GRADING ELEVATIONS SHOWN ON THE PLANS ARE FINISH GRADE. A MINIMUM OF SIX (6) INCHES OF TOPSOIL IS TO BE PLACED IN OPEN AREAS BEFORE FINISH GRADE ELEVATIONS ARE ACHIEVED.

8. THE CONTRACTOR WILL USE CARE WHEN GRADING NEAR TREES, SHRUBS AND BUSHES WHICH ARE NOT TO BE REMOVED SO AS NOT TO CAUSE INJURY TO ROOTS OR TRUNKS. SHOULD THE EXISTING BECOME DAMAGE OR DIE, CONTRACTOR SHALL REPLACE IN KIND AT THE CONTRACTOR'S OWN EXPENSE AND SHALL BE INCIDENTAL TO THE CONTRACT. SEE LANDSCAPE PLANS FOR TREES THAT ARE NOT TO BE REMOVED.

9. THE CONTRACTOR SHALL USE CARE IN GRADING OR EXCAVATING NEAR ANY AND ALL EXISTING ITEMS WHICH ARE NOT INDICATED TO BE REMOVED. ANY DAMAGE DONE TO THESE EXISTING ITEMS BY CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY HIM AT HIS OWN EXPENSE.

10. UNSUITABLE MATERIAL ENCOUNTERED IN EXCAVATING FOR PAVEMENT SUBGRADES SHALL BE REMOVED AND REPLACED WITH SUITABLE MATERIAL TO THE LIMITS APPROVED BY THE OWNER. UNSUITABLE MATERIAL THAT IS EXCAVATED, AS DIRECTED BY THE SOILS ENGINEER AND OWNER, SHALL BE DISPOSED OF AT THE CONTRACTOR'S OWN EXPENSE AND SHALL BE INCIDENTAL TO THE CONTRACT.

11. THE EARTHWORK CONTRACTOR SHALL BE RESPONSIBLE FOR BACKFILLING OF ALL CURBS, AS SOON AS THE CONCRETE HAS SET SUFFICIENTLY, TO THE REQUIRED ELEVATION WITH SUITABLE MATERIAL WHICH SHALL BE COMPACTED UNTIL FIRM AND SOLID, AND NEATLY GRADED.

12. THE PAVEMENT SUBGRADE SHALL BE GRADED WITHIN +/- 0.10' (AVERAGING ZERO) OF PROPOSED SUBGRADE AS SHOWN ON THE PLANS AND SET BY THE ENGINEER IN THE FIELD. ALL FILL DEPOSITED IN THE AREAS SHALL BE CLEAN CLAY COMPACTED TO 95% OF THE MAXIMUM DENSITY SHOWN ON THE DRY WEIGHT CURVES DETERMINED BY THE MODIFIED PROCTOR ANALYSIS.

13. WASTE EXCAVATION SHALL BE DISPOSED OF BY THE CONTRACTOR AT HIS OWN EXPENSE AND AT A LOCATION PROVIDED BY THE CONTRACTOR WHICH LOCATION BE APPROVED BY OWNER.

14. SUITABLE EXCAVATION IS CLASSIFIED AS EXCAVATION CAPABLE OF 3,000 PSF BEARING WHEN COMPACTED TO 95% MODIFIED PROCTOR.

15. SUITABLE EMBANKMENT IS CLASSIFIED AS EMBANKMENT CAPABLE OF 3,000 PSF BEARING WHEN COMPACTED TO 95% MODIFIED PROCTOR, TO BE USED WITHIN PAVEMENT AREAS. SUITABLE EMBANKMENT CONTAINS 15% COMPACTION FACTOR.

16. UNCLASSIFIED EXCAVATION IS CLASSIFIED AS EXCAVATION NOT NECESSARILY CAPABLE OF A 3,000 PSF BEARING WHEN COMPACTED.

17. UNCLASSIFIED EMBANKMENT IS CLASSIFIED AS EMBANKMENT NOT REQUIRING 3,000 PSF BEARING WHEN COMPACTED. THIS FILL IS TO BE USED IN AREAS OUTSIDE ROADWAY LIMITS AND PAD AREAS.

18. UNCLASSIFIED EMBANKMENT SHALL BE COMPACTED TO NATURAL COMPACTION. SUITABLE EMBANKMENT SHALL BE COMPACTED TO 95% MODIFIED PROCTOR.

19. EARTHWORK QUANTITIES SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO BIDDING. ANY DISCREPANCIES IN QUANTITIES SHALL BE REPORTED TO OWNER.

20. ALL UNDERCUTTING SHALL BE DONE AT THE DIRECTION OF THE OWNER OR HIS REPRESENTATIVE. THE UNDERCUT SHALL BE CROSS-SECTIONED BY THE OWNER'S REPRESENTATIVE AFTER THE UNDERCUTTING HAS BEEN DONE TO DETERMINE QUANTITY.

21. ALL UTILITY SPOIL PILES SHALL BE CLEANED UP BY THE UTILITY CONTRACTOR. MATERIAL SHALL NOT BE REMOVED FROM THE SITE WITHOUT THE APPROVAL OF THE OWNER AND LOCATION OF DISPOSAL ON THE SITE SHALL BE APPROVED BY OWNER.

22. EXCAVATION BELOW TOPSOIL FOR PAVEMENT SHALL BE TO 2' BEHIND CURB OR PAVEMENT EDGE IN CUT AREA. EXCAVATION BELOW TOPSOIL FOR PADS SHALL BE 5' BEYOND BUILDING LIMITS.

23. TOPSOIL PRESENT IN CUT AREAS SHALL BE STOCKPILED OR USED AS UNCLASSIFIED EMBANKMENT ON SITE OR DISPOSED OF AT THE DIRECTION OF THE OWNER. STOCKPILE LOCATIONS SHALL BE APPROVED BY OWNER OR AS SHOWN ON THE PLANS.

24. IF REQUIRED, BORROW EXCAVATION SHALL BE OBTAINED OFF-SITE. ON-SITE BORROW AREAS SHALL BE DETERMINED BY THE OWNER. PRIOR TO BORROW EXCAVATION, THE CONTRACTOR SHALL HAVE THE AREA CROSS-SECTIONED BY AN AUTHORIZED AGENT OF THE OWNER AND SHALL HAVE THE AREA CROSS-SECTIONED BY THE SAME AFTER THE BORROW AREA HAS BEEN EXCAVATED. IF BORROW MATERIAL IS REQUIRED, THE COST OF OBTAINING, TRANSPORTING, AND PLACEMENT OF THE BORROW MATERIAL ALONG WITH ANY FILLING OF BORROW PITS, IF REQUIRED, SHALL BE AGREED UPON BETWEEN OWNER AND CONTRACTOR PRIOR TO COMMENCEMENT OF BORROW WORK.

25. BERMING FOR LANDSCAPING SHALL BE ROUGH GRADED TO WITHIN 8" OF FINISHED GRADES AS SHOWN ON LANDSCAPE PLANS.

GENERAL PAVING AND SURFACING

1. ALL PAVING OPERATIONS SHALL BE CONSTRUCTED IN CONFORMANCE WITH THE “STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION IN ILLINOIS” (STANDARD SPECIFICATIONS), LATEST EDITION AND WITH THE REQUIREMENTS OF THE MUNICIPALITY.

2. FINE GRADING: A. PRIOR TO THE CONSTRUCTION OF THE CURB AND GUTTER AND THE PLACEMENT OF THE BASE MATERIAL, THE STREETS SHALL BE FINE GRADED TO WITHIN 0.1 FOOT OF FINAL SUBGRADE ELEVATION, TO A LIMIT OF TWO (2) FEET BEYOND THE BACK OF CURB.

3. THE CONTRACTOR SHALL PROOF ROLL THE SUBGRADE AND BASE BEFORE PAVEMENT CONSTRUCTION PROCEEDS. THE SUBGRADE AND BASE WILL NOT BE APPROVED AND ACCEPTED BY THE MUNICIPALITY OR APPROVED FOR PAYMENT WITHOUT PROOF ROLLING. PROOF ROLLING SHALL BE DONE WITH A RUBBER TIRED VEHICLE HAVING A GROSS WEIGHT OF NOT LESS THAN 30,000 POUNDS (15 TONS). IF THE SUBGRADE OR BASE HAS FAILURES OR PUMPING AS INDICATED BY PROOF ROLLING, THE SUBGRADE OR BASE SHALL EITHER REMOVED AND REPLACED WITH GRANULAR MATERIAL TO A DEPTH AS DIRECTED BY THE OWNER OR OTHER CORRECTIVE MEASURES AS DIRECTED BY THE OWNER.

4. THE FOLLOWING APPLICATION RATES ARE TO BE USED DURING PAVING: A. BITUMINOUS MATERIAL (TACK COAT) ON EXISTING BITUMINOUS CONCRETE SURFACES (PRIME TO BE RC-70) = 0.10 GAL./SQ.YD. B. BITUMINOUS MATERIAL (PRIME COAT) ON AGGREGATE BASE (PRIME TO BE MC-30) = 0.50 GAL./SQ.YD. C. BITUMINOUS CONCRETE SURFACE AND BINDER COURSES. (BINDER COURSE SHALL BE B MIXTURE). (SURFACE COURSE SHALL BE C MIXTURE) = 115 LBS./SQ.YD. ALL MATERIAL SHALL BE CLASS I BITUMINOUS AND SHALL BE VIRGIN MATERIAL. RECYCLED MATERIALS FOR BINDER MAY BE PERMITTED OUTSIDE PUBLIC RIGHT OF WAY UPON APPROVAL OF THE OWNER.

5. PAVEMENT: THE PAVEMENT MATERIALS SHALL BE DETAILED ON THE ENGINEERING PLANS. THICKNESSES SPECIFIED SHALL BE CONSIDERED TO BE THE MINIMUM COMPACTED THICKNESS.

6. GENERAL: THE PAVING CONTRACTOR SHALL: A. REPAIR ANY BASE COURSE AND BINDER COURSE FAILURES PRIOR TO THE INSTALLATION OF THE FINAL BITUMINOUS CONCRETE SURFACE COURSE. B. SWEEP THE BINDER COURSE PRIOR TO THE INSTALLATION OF THE FINAL BITUMINOUS CONCRETE SURFACE COURSE.

7. ACCEPTANCE: A. PRIOR TO THE PLACEMENT OF THE BASE COURSE, THE SUBGRADE MUST BE APPROVED BY THE OWNER. B. PRIOR TO PLACEMENT OF THE SURFACE COURSE, THE CONTRACTOR, WHEN REQUIRED, SHALL OBTAIN SPECIMENS OF THE BINDER COURSE WITH A CORE DRILL WHERE DIRECTED, FOR THE PURPOSE OF THICKNESS VERIFICATION.

8. WHEN REQUESTED BY THE OWNER, DOCUMENTATION FOR THICKNESS AND AREAS OF PLACEMENT FOR THE BASE COURSE AND BITUMINOUS CONCRETE SHALL BE SUBMITTED FOR VERIFICATION.

9. ALL NOTES AND CONDITIONS SHOWN ON THE PLANS SHALL APPLY.

STORMWATER DISTRIBUTION SYSTEM

1. ALL STORM DRAIN CONSTRUCTION SHALL BE PERFORMED IN ACCORDANCE WITH THE “STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION IN ILLINOIS” (STANDARD SPECIFICATIONS), LATEST EDITION AND TO THE REQUIREMENTS OF I.E.P.A., O.S.H.A. AND THE MUNICIPALITY.

2. STORM SEWER WITH LESS THAN 3' OF COVER SHALL BE CLASS V RCP CONFORMING TO ASTM C-76. STORM SEWER WITH MORE THAN 3' OF COVER SHALL BE CLASS III RCP CONFORMING TO ASTM C-76. “O” RING JOINTS CONFORMING TO ASTM C443 SHALL BE USED FOR ALL R.C.P. STORM SEWER PIPE. STORM SEWER DENOTED AS DUCTILE IRON PIPE (DIP) SHALL CONFORM TO ANSI A21.51 WITH JOINTS CONFORMING TO ANSI 21.11.

3. ALL STORM DRAINS WHICH FALL WITHIN PAVED AREAS SHALL BE BACKFILLED WITH GRANULAR TRENCH BACKFILL ACCORDING TO THE STANDARD SPECIFICATIONS AND THE DETAILS HEREIN.

4. ALL DOWNSPOUTS, FOOTING DRAINS AND SUMP PUMPS SHALL BE DISCHARGED AS SHOWN ON THE PLANS.

5. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DEWATERING TO CONSTRUCT TRENCHES AND TO INSTALL THE STORM DRAINS. ANY DEWATERING SHALL BE INCIDENTAL TO THE CONTRACT.

6. WATER PUMPED OR OTHERWISE DISCHARGED FROM THE SITE DURING ANY CONSTRUCTION DEWATERING SHALL BE FILTERED.

7. ALL STORM PIPE, JOINTS AND FITTINGS SHALL BE INSTALLED AND BACKFILLED PER THE CORRESPONDING MANUFACTURER SPECIFICATIONS. SHOULD THERE BE ANY DISCREPANCIES BETWEEN MANUFACTURERS SPECIFICATIONS AND FEDERAL, STATE, OR LOCAL CODES, CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO BIDDING AND ORDERING THE MATERIAL.

8. ALL NOTES AND CONDITIONS SHOWN ON THE PLANS SHALL APPLY.

SANITARY DISTRIBUTION SYSTEM NOTES

1. ALL SANITARY SEWER CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE “STANDARD SPECIFICATIONS FOR WATER AND SEWER MAIN CONSTRUCTION IN ILLINOIS” (STANDARD SPECIFICATIONS), 1996, AND THE REQUIREMENTS OF THE I.E.P.A., O.S.H.A. AND THE MUNICIPALITY.

2. THE CONTRACTOR SHALL NOTIFY PUBLIC WORKS A MINIMUM OF TWO (2) WORKING DAYS PRIOR TO THE CONSTRUCTION OF THE SEWER.

3. ALL SANITARY SEWERS SHALL BE DEFLECTION TESTED AND LOW-PRESSURE AIR TESTED IN ACCORDANCE WITH SECTION 31-1.11 OF THE STANDARD SPECIFICATIONS. ALL MANHOLES SHALL BE VACUUM TESTED AS PER ASTM C-1244-02.

4. TELEVISION TESTING ALL SANITARY SEWERS SHALL BE TELEVISED WITH DVD EQUIPMENT AND A WRITTEN REPORT SUBMITTED BEFORE ACCEPTANCE. TESTING SHALL BE WITNESSED AND APPROVED BY THE MUNICIPALITY.

5. IF THE SANITARY SEWER INSTALLATION FAILS TO MEET THE TEST REQUIREMENTS SPECIFIED, THE CONTRACTOR SHALL DETERMINE THE CAUSE OR CAUSES OF THE DEFECT AND SHALL, AT HIS OWN EXPENSE, REPAIR OR REPLACE ALL MATERIALS AND WORKMANSHIP AS MAY BE NECESSARY TO COMPLY WITH THE REQUIREMENTS.

6. CLASS 1-A BEDDING AND BACKFILL SHALL BE INSTALLED IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS AND IN ACCORDANCE WITH ASTM D2321. IT SHALL CONSIST OF A MINIMUM OF 4” OF COMPACTED CA-11 CRUSHED GRAVEL OR STONE BELOW THE PIPE AND SHALL HAVE TAMPED CA-6 CRUSHED GRAVEL TO A MINIMUM 12” ABOVE THE TOP OF THE PIPE. BACKFILL UNDER PAVEMENT SHALL EXTEND THE FULL TRENCH DEPTH ABOVE THE TOP OF PIPE.

7. SANITARY SEWER MANHOLES SHALL BE 4'-0” INSIDE DIAMETER. REINFORCED CONCRETE SECTIONS MEETING ASTM C-478 AND HAVE AN ECCENTRIC CONE INSTALLED TO LINE UP WITH THE MANHOLE STEPS. ALL MANHOLE STEPS SHALL BE IN CONFORMANCE WITH MUNICIPAL STANDARDS.

8. ALL MANHOLE JOINTS SHALL BE SEALED WITH BITUMINOUS MASTIC.

9. NOT MORE THAN 2 RINGS OF 2 INCH MINIMUM SIZE UP TO A MAXIMUM OF 12 INCHES OF PRECAST ADJUSTING RINGS SHALL BE USED TO ADJUST FRAME ELEVATIONS.

10. ALL MANHOLE LIDS MUST BE STAMPED “SANITARY” AND BE SET WITH PREFORMED BUTYL MASTIC.

11. ALL MANHOLES SHALL BE THOROUGHLY CLEANED OF DIRT AND DEBRIS AND ALL VISIBLE LEAKAGE ELIMINATED BEFORE FINAL INSPECTION AND ACCEPTANCE.

12. “NO-SHEAR” TYPE MISSION COUPLINGS SHALL BE USED WHEN CONNECTING SEWER PIPES OF DISSIMILAR MATERIALS.

13. ALL FLOOR DRAINS SHALL CONNECT TO THE SANITARY SEWER.

14. ANY UNSUITABLE MATERIAL ENCOUNTERED SHALL BE REMOVED AND REPLACED WITH COMPACTED CA-6 CRUSHED GRAVEL OR STONE.

15. WATERMAINS SHALL BE SEPARATED FROM SANITARY SEWERS AND STORM SEWERS IN ACCORDANCE WITH I.E.P.A. REQUIREMENTS AS SPECIFIED IN "WATER DISTRIBUTION SYSTEM" SECTION.

16. THE CONTRACTOR SHALL FURNISH "AS-BUILT" DRAWINGS OF SANITARY SEWERS AND SERVICES AT THE COMPLETION OF THE CONSTRUCTION.

17. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DEWATERING NECESSARY TO CONSTRUCT TRENCHES AND TO INSTALL THE SANITARY SEWER. ANY DEWATERING SHALL BE CONSIDERED INCIDENTAL TO THE CONTRACT.

18. WATER PUMPED OR OTHERWISE DISCHARGED FROM THE SITE DURING ANY CONSTRUCTION DEWATERING SHALL BE FILTERED AND DIRECTED TO THE STORM SEWER IF POSSIBLE.

19. CERTIFICATION: IT SHALL BE THE RESPONSIBILITY OF THE PIPE MANUFACTURERS TO CERTIFY THAT PIPE AND JOINT MATERIALS FURNISHED ARE CAPABLE OF MEETING THE LOWER PRESSURE AIR TEST, INFILTRATION TEST, AND EXFILTRATION TEST, ARE MANUFACTURED IN CONFORMANCE WITH THE A.S.T.M., A.N.S.I., A.W.W.A., OR A.A.S.H.O. TEST(S) SPECIFIED.

20. ALL SANITARY PIPE, JOINTS AND FITTINGS SHALL BE INSTALLED AND BACKFILLED PER THE CORRESPONDING MANUFACTURER SPECIFICATIONS. SHOULD THERE BE ANY DISCREPANCIES BETWEEN MANUFACTURERS SPECIFICATIONS AND FEDERAL, STATE, OR LOCAL CODES, CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO BIDDING AND ORDERING THE MATERIAL.

21. ALL NOTES AND CONDITIONS SHOWN ON THE PLANS SHALL APPLY.

WATER DISTRIBUTION SYSTEM

1. ALL WATER MAIN CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE "STANDARD SPECIFICATIONS FOR WATER AND SEWER MAIN CONSTRUCTION IN ILLINOIS" (STANDARD SPECIFICATIONS), 1996, AND THE REQUIREMENTS OF THE I.E.P.A., O.S.H.A. AND THE MUNICIPALITY.

2. ALL WATER MAIN SHALL BE DUCTILE IRON CLASS 52, WITH MECHANICAL JOINTS AS SHOWN ON THE PLANS. ALL WATER SERVICES LEADS SHALL BE TYPE "K" COPPER UNLESS OTHERWISE SPECIFIED ON THE PLANS.

3. ALL TEES, BENDS, VALVES, AND FIRE HYDRANTS SHALL BE ADEQUATELY SUPPORTED WITH A CONCRETE BASE, AND SUPPORTED LATERALLY WITH POURED IN PLACE THRUST BLOCKING AGAINST UNDISTURBED EARTH.

4. DISINFECTION OF THE WATER MAINS - UPON COMPLETION OF THE NEWLY LAID WATER MAINS, THE WATER MAINS SHALL BE DISINFECTED IN ACCORDANCE WITH THE AMERICAN WATER WORKS ASSOCIATION PROCEDURE DESIGNATION AWWA C-651-99, LATEST EDITION. THE CONTRACTOR IS RESPONSIBLE FOR COLLECTING SAMPLES AND HAVING BACTERIOLOGICAL TESTING PERFORMED AS REQUIRED BY THE I.E.P.A.. THE CONTRACTOR SHALL FURNISH TO THE MUNICIPALITY THE REQUIRED DOCUMENTATION, TEST RESULTS, ETC., REQUIRED BY THE I.E.P.A. FOR PLACING THE WATER MAINS OR SERVICE LINES IN SERVICE AND/OR SECURING AN OPERATING PERMIT.

5. WATER MAINS AND WATER SERVICE LINES SHALL BE PROTECTED FROM SANITARY SEWERS, STORM SEWERS, COMBINED SEWERS, HOUSE SEWER SERVICE CONNECTIONS AND DRAINS IN ACCORDANCE WITH “TITLE 35: ENVIRONMENTAL PROTECTION AGENCY SUBTITLE F: PUBLIC WATER SUPPLIES, CHAPTER II: ENVIRONMENTAL PROTECTION AGENCY, PARTS 651-654 TECHNICAL POLICY STATEMENTS, SECTION 653.119.”

6. WHENEVER POSSIBLE, A WATER MAIN MUST BE LAID AT LEAST TEN FEET HORIZONTALLY FROM ANY EXISTING OR PROPOSED DRAIN OR SEWER LINE. SHOULD LOCAL CONDITIONS EXIST WHICH WOULD PREVENT A LATERAL SEPARATION OF TEN FEET, A WATER MAIN MAY BE LAID CLOSER THAN TEN FEET TO A STORM OR SANITARY SEWER PROVIDED THAT THE WATER MAIN INVERT IS AT LEAST EIGHTEEN INCHES ABOVE THE CROWN OF THE SEWER, AND IS EITHER IN A SEPARATE TRENCH OR IN THE SAME TRENCH ON AN UNDISTURBED EARTH SHELF LOCATED TO ONE SIDE OF THE SEWER. IF IT IS IMPOSSIBLE TO OBTAIN PROPER HORIZONTAL OR VERTICAL SEPARATION AS DESCRIBED ABOVE, THEN THE SEWER MUST ALSO BE CONSTRUCTED OF WATER MAIN TYPE MATERIAL (DUCTILE IRON PIPE WITH SLIP-ON OR MECHANICAL JOINTS, ETC.) AND PRESSURE TESTED TO THE MAXIMUM EXPECTED SURCHARGE HEAD TO ASSURE WATER TIGHTNESS BEFORE BACKFILLING.

7. WATER VALVES AND FIRE HYDRANTS SHALL BE OPERATED BY MUNICIPAL PERSONNEL, ONLY.

8. ALL WATERMAIN PIPE, JOINTS AND FITTINGS SHALL BE INSTALLED AND BACKFILLED PER THE CORRESPONDING MANUFACTURER SPECIFICATIONS. SHOULD THERE BE ANY DISCREPANCIES BETWEEN MANUFACTURERS SPECIFICATIONS AND FEDERAL, STATE, OR LOCAL CODES, CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO BIDDING AND ORDERING THE MATERIAL.

9. ALL NOTES AND CONDITIONS SHOWN ON THE PLANS SHALL APPLY.

ISSUED FOR BID
07-07-2017

C.A.F.T. Building

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

Wold
RUCK PATE
WOLD | RUCK PATE
110 North Brockway, Suite 220
Palatine, Illinois 60067
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MeritCorp
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Engineering - Planning - Surveying - Environmental
50 North Brockway, Suite 3-9 | 3697 Darlene Ct.
Palatine, IL 60067 | Aurora, IL 60504
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Lic. No. 184-005860 | Fax 630.554.7788
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I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed under the laws of the State of Illinois.

DATE: 7-7-2017
JAMES P. MEIER LICENSED PROFESSIONAL ENGINEER

Registration Number: 062-051277
EXP. DATE: NOVEMBER 30, 2017

Revisions		
Description	Date	Num

Comm: 173013
Date: 7-7-2017
Drawn: CLS
Check: JPM

North

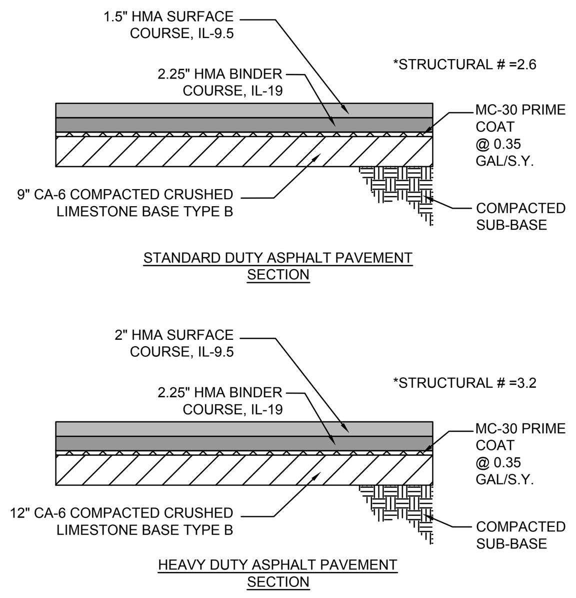
STANDARD CONSTRUCTION NOTES

Scale:

C4.0

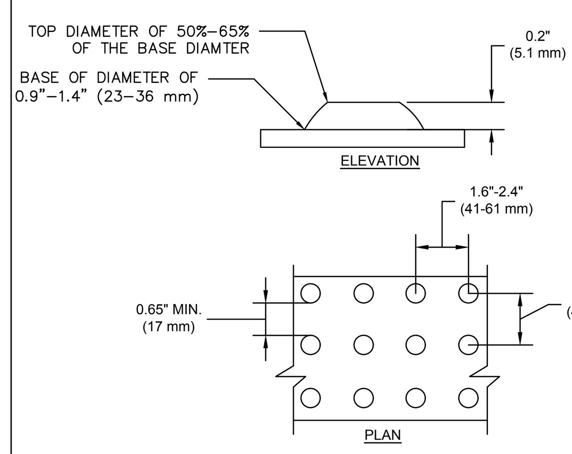
IL

ASPHALT PAVEMENT SECTIONS



MC - SITE5
REVISED: 10/2016

DETECTABLE WARNINGS

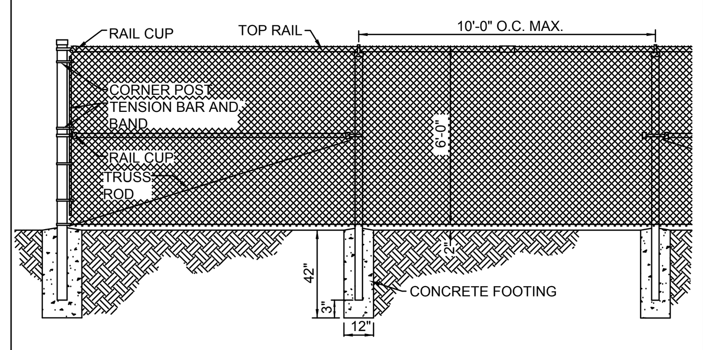


NOTES:

1. ALL DETECTABLE WARNINGS SHALL COMPLY WITH ADA STANDARDS FOR ACCESSIBLE DESIGN AND THE ILLINOIS ACCESSIBILITY CODE.
2. DETECTABLE WARNING SURFACES SHALL CONTRAST VISUALLY WITH ADJACENT WALKING SURFACES EITHER LIGHT–ON–DARK, OR DARK–ON–LIGHT.
3. DETECTABLE WARNING SURFACES SHALL HAVE A MINIMUM DEPTH OF 2'.

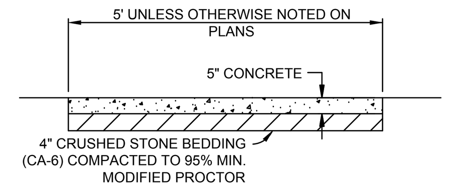
MC - SITE12
REVISED: 6/2013

CHAIN LINK FENCE SECTION DETAIL



MC - SITE10
REVISED: 7/2012

PCC SIDEWALK

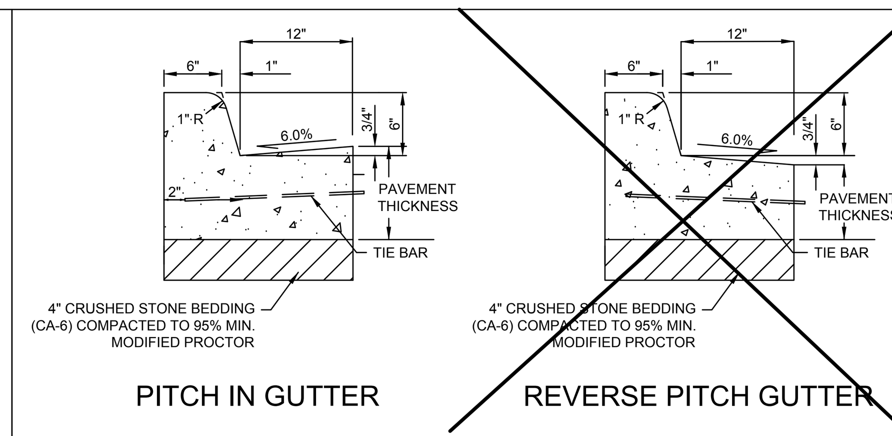


NOTES:

1. INSTALL CONTRACTION JOINTS EVERY 5'-0" O.C.
2. INSTALL EXPANSION JOINTS EVERY 45'-0" O.C.
3. INSTALL (3) #5 REBARS, 20' LONG ACROSS TRENCH CROSSINGS (TYP).
4. CONCRETE THICKNESS SHALL BE INCREASED TO 6" AT ALL DRIVEWAYS.
5. P.C.C. SHALL BE CLASS SI, 3500 PSI @ 14 DAYS, SIX BAG MIX.
6. SIDEWALK SHALL HAVE A BROOM FINISH.

MC - SITE3
REVISED: 7/2012

B-6.12 CURB AND GUTTER DETAIL



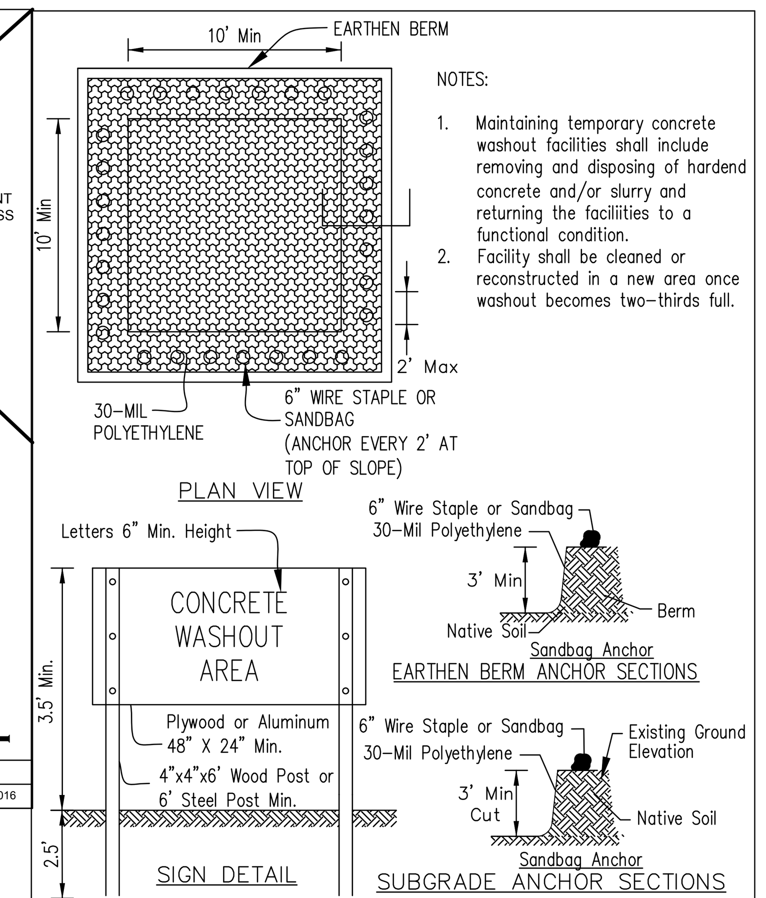
NOTES:

1. LONGITUDINAL JOINT TIE BARS SHALL BE NO. 6 AT 24" CENTERS IN ACCORDANCE WITH DETAILS FOR LONGITUDINAL CONSTRUCTION JOINT.
2. BOTTOM SLOPE OF COMBINATION CURB AND GUTTER CONSTRUCTED ADJACENT TO PCC PAVEMENT SHALL BE THE SAME SLOPE AS THE SUBBASE OR 6% WHEN SUBBASE IS OMITTED.
3. A MINIMUM CLEARANCE OF 2" BETWEEN THE END OF THE TIE BAR AND THE BACK OF THE CURB SHALL BE MAINTAINED.
4. INSTALL CONTRACTION JOINTS NAD EXPANSION JOINTS PER IDOT STANDARD 606001-02.
5. ALL CONCRETE CURB CONSTRUCTION SHALL BE PER THE IDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, TALTEST REVISIONS.

NOT TO SCALE

MC - SITE16
REVISED: 4/2016

TEMPORARY CONCRETE WASHOUT FACILITY – EARTHEN TYPE

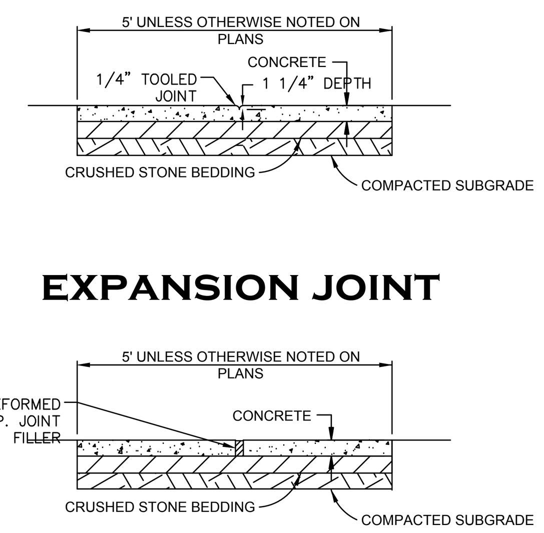


NOTES:

1. Maintaining temporary concrete washout facilities shall include removing and disposing of hardend concrete and/or slurry and returning the facilities to a functional condition.
2. Facility shall be cleaned or reconstructed in a new area once washout becomes two–thirds full.

Sheet 1 of 1	Drawing No. IUM-65ET
Designed	
Drawn	B. JOHNSON 6/08
Checked	
Approved	

CONTRACTION JOINT

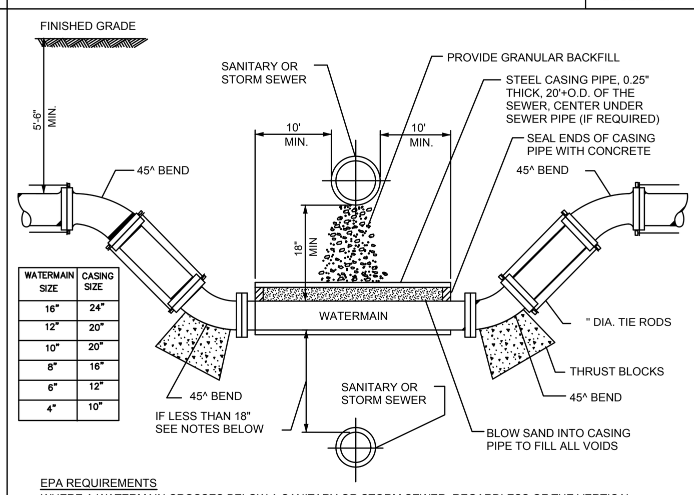


NOTES:

1. REFER TO IDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 2012, SECTION 423.06.

CONCRETE JOINT

MC - SITE15
REVISED: 12/2016

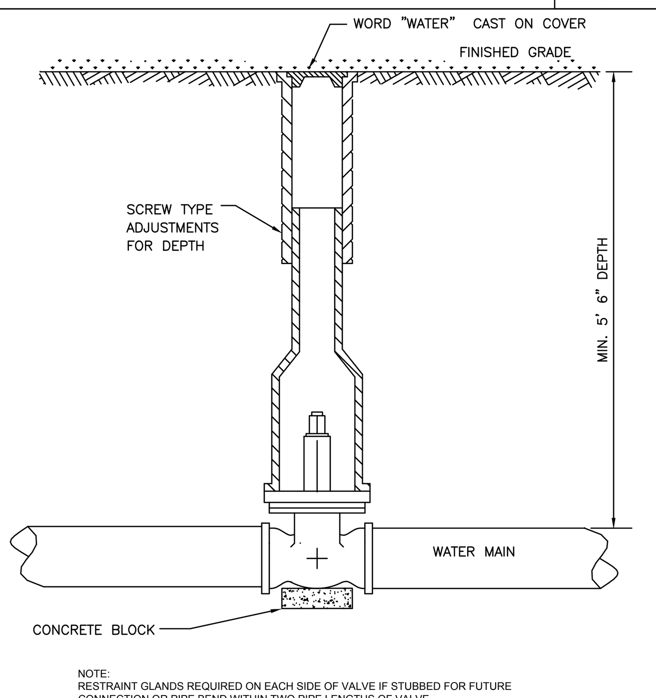


EPA REQUIREMENTS

WHERE A WATERMAIN CROSSES BELOW A SANITARY OR STORM SEWER, REGARDLESS OF THE VERTICAL SEPARATION, BOTH THE WATERMAIN AND THIS SEWER MUST BE CONSTRUCTED OF WATERMAIN TYPE MATERIALS, AND CONSTRUCTION MUST EXTEND ON EACH SIDE OF THE CROSSING UNTIL THE NORMAL DISTANCE FROM THE WATERMAIN TO THE SEWER IS AT LEAST 10 FEET. THE SEWER MUST BE CONSTRUCTED OF SLIP-ON OR MECHANICAL JOINT CAST IRON OR DUCTILE IRON PIPE, ASBESTOS CEMENT PRESSURE PIPE, PRE-STRESSED CONCRETE PIPE OR PVC PIPE MEETING WATERMAIN STANDARDS. AS AN ALTERNATE, EITHER THE WATERMAIN OR THE SEWER CAN BE ENCASED IN A CASING PIPE WHICH EXTENDS AT LEAST 10 FEET ON EACH SIDE OF THE CROSSING. THE PRECEDING REQUIREMENT ALSO APPLIES WHERE THE BOTTOM OF THE WATERMAIN IS LESS THAN 18" ABOVE THE TOP OF THE SANITARY OR STORM SEWER AND WHERE THE HORIZONTAL DISTANCE BETWEEN THE WATERMAIN AND THE SANITARY OR STORM SEWER IS LESS THAN 10'.
**ALSO SEE "IEPA WATER AND SEWER SEPARATION REQUIREMENTS" FOR ADDITIONAL REQUIREMENTS

WATERMAIN CASING PIPE AND SEWER SEPARATION

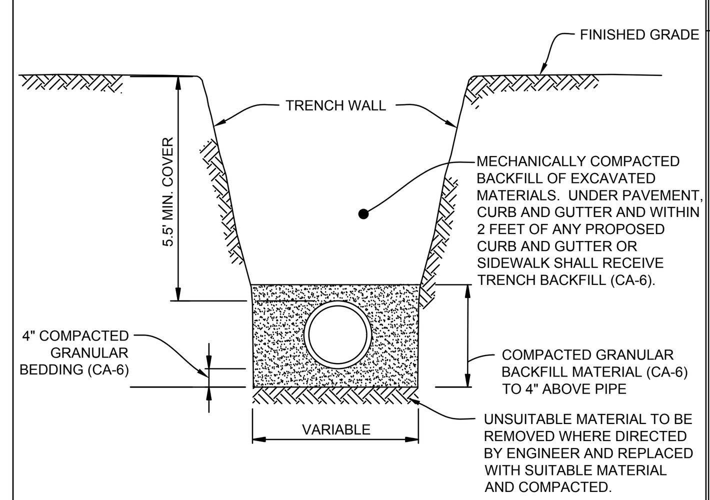
MC - W1
REVISED: 7/2012



NOTE:
RESTRAINT GLANDS REQUIRED ON EACH SIDE OF VALVE IF STUBBED FOR FUTURE CONNECTION OR PIPE BEND WITHIN TWO PIPE LENGTHS OF VALVE

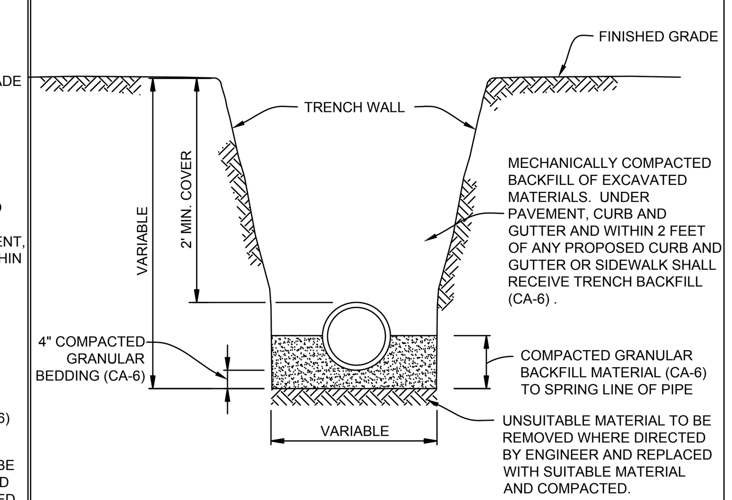
VALVE BOX INSTALLATION

MC - W8
REVISED: 7/2012



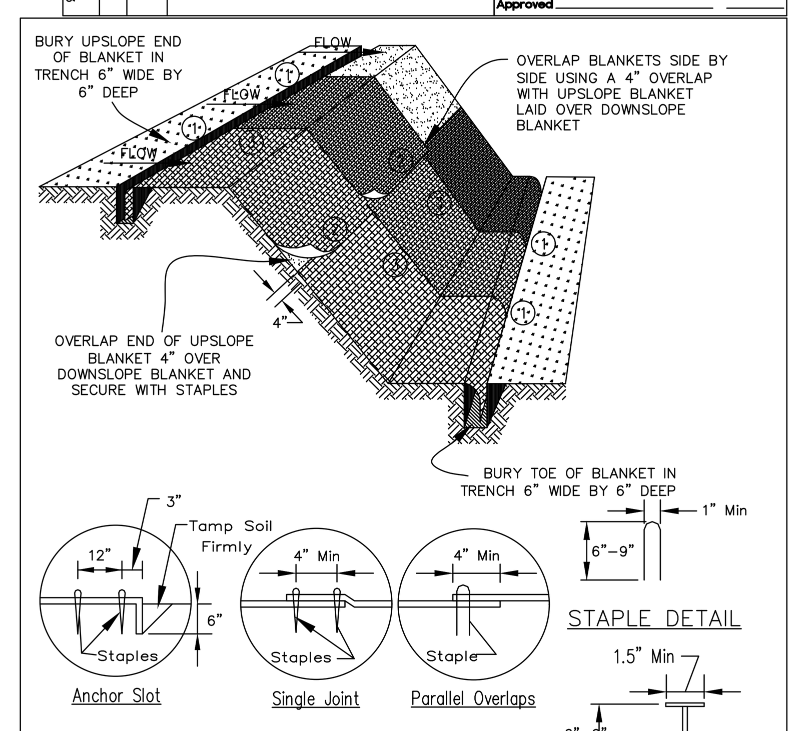
WATER MAIN/SERVICE TRENCE DETAIL

MC - W9
REVISED: 7/2013



STORM SEWER TRENCH DETAIL

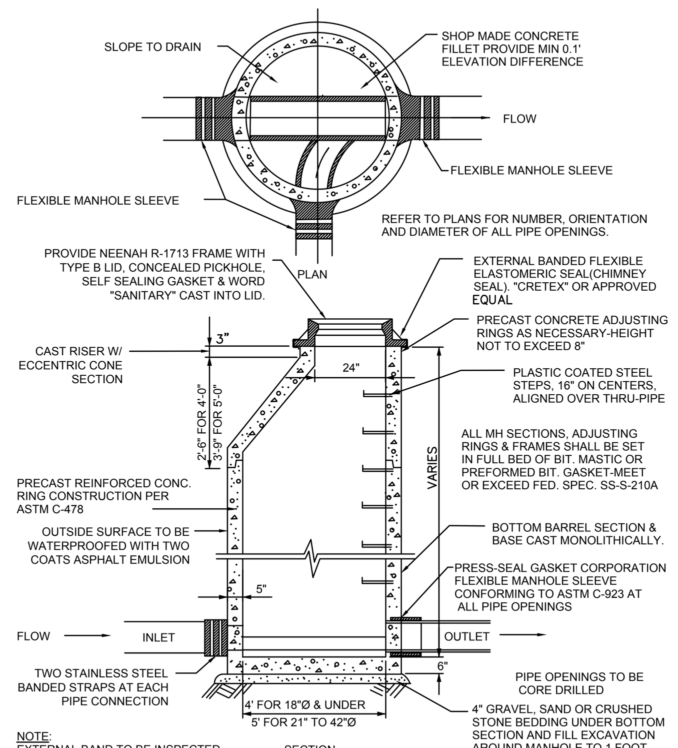
MC - STM17
REVISED: 9/2013



NOTES:

1. Staples shall be placed in a diamond pattern at 2 per s.y. for stiched blankets. Non–stiched shall use 4 staples per s.y. of material. This equates to 200 staples with stiched blanket and 400 stapels with non–stiched blanket per 100 s.y. of material.
2. Staple or push pin lengths shall be selected based on soil type and conditions. (minimum staple length is 6")
3. Erosion control material shall be placed in contact with the soil over a prepared seedbed.
4. All anchor slots shall be stapled at approximately 12" intervals.

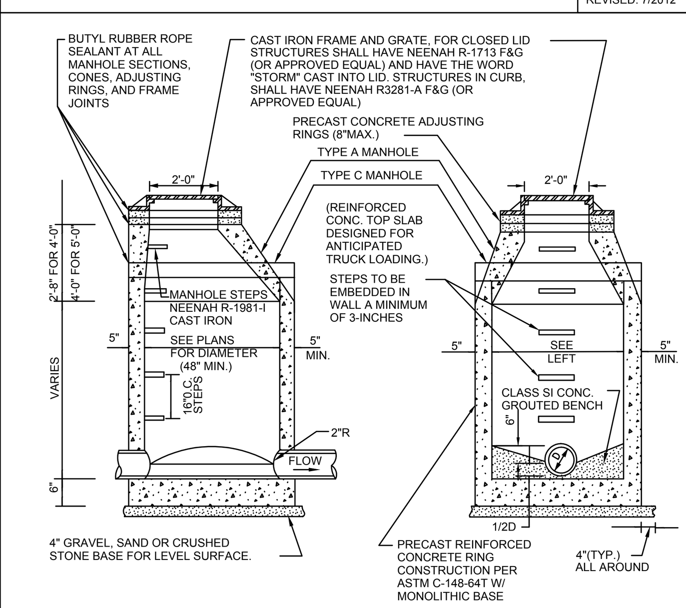
Sheet 1 of 1	Drawing No. IUM-530
EROSION CONTROL BLANKET INSTALLATION DETAILS	
Designed	
Drawn	B. JOHNSON 11/08
Checked	
Approved	



NOTE:
EXTERNAL BAND TO BE INSPECTED PRIOR TO BACKFILL AND AGAIN JUST PRIOR TO ANY PAVING OPERATIONS.

SANITARY MANHOLE

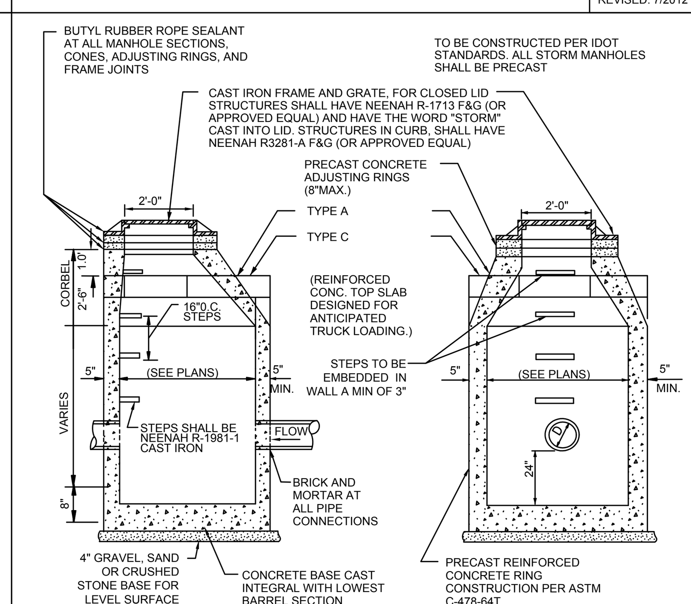
MC - SAN9
REVISED: 7/2012



NOTES:
1. TYPE A MANHOLES SHALL HAVE ECCENTRIC CONES, TYPE C MANHOLES SHALL HAVE FLAT TOP SLABS.
2. REFER TO PLANS FOR SIZE, ORIENTATION, AND ELEVATION OF ALL PIPE OPENINGS.
3. CONE OPENING AND STEPS SHALL BE LOCATED SO NOT TO BE DIRECTLY OVER PIPE OPENING BUT GENERALLY PERPENDICULAR TO THE WATER FLOW LINE.
4. ALL STRUCTURE SECTIONS AND ADJUSTING RINGS SHALL BE WATER TIGHT BY USE OF RESILIENT, FLEXIBLE, NON-HARDENING, PREFORMED BITUMINOUS MASTIC/RAM-NEK OR APPROVED EQUAL).
5. THE MANHOLE BENCH FOR STORM SEWER MANHOLES SHALL BE IN ACCORDANCE WITH I.D.O.T. REQUIREMENTS. THE BENCH SHALL BEGIN AT THE SPRINGLINE OF THE PIPE.
6. PROVIDE MOLDED INVERT CHANNEL.

STORM MANHOLE TYPE A OR C

MC - STM6
REVISED: 7/2012

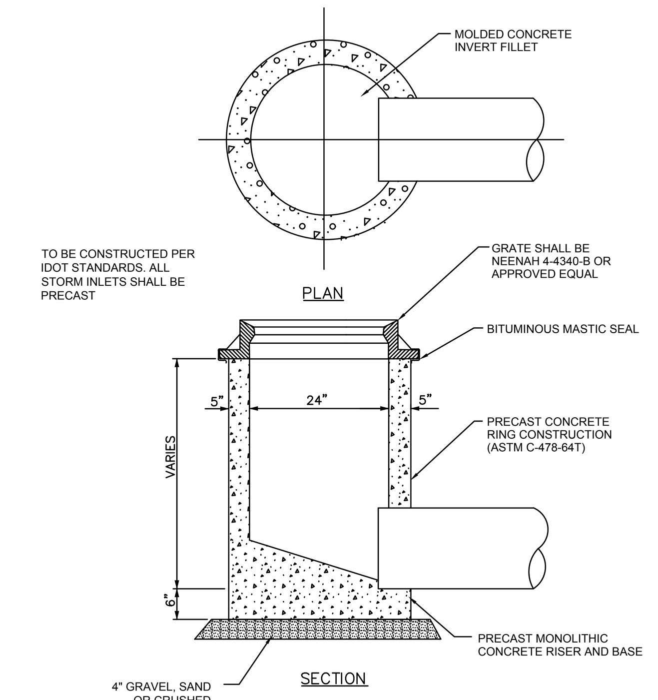


NOTES:
1. TYPE A MANHOLES SHALL HAVE ECCENTRIC CONES, TYPE C MANHOLES SHALL HAVE FLAT TOP SLABS.
2. REFER TO PLANS FOR SIZE, ORIENTATION, AND ELEVATION OF ALL PIPE OPENINGS.
3. STEPS SHALL BE NEENAH R-1981-I CAST IRON.
4. CONE OPENING AND STEPS SHALL BE LOCATED SO AS NOT TO BE DIRECTLY OVER PIPE OPENING BUT GENERALLY PERPENDICULAR TO THE WATER FLOW LINE.
5. ALL STRUCTURE SECTIONS AND ADJUSTING RINGS SHALL BE WATER TIGHT BY USE OF RESILIENT, FLEXIBLE, NON-HARDENING, PREFORMED BITUMINOUS MASTIC/RAM-NEK OR APPROVED EQUAL).

STORM CATCH BASIN TYPE A OR C

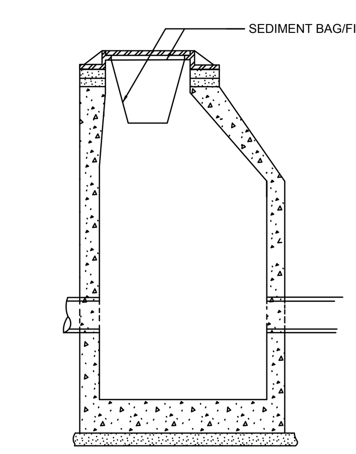
MC - STM9
REVISED: 7/2012

TO BE CONSTRUCTED PER IDOT STANDARDS. ALL STORM INLETS SHALL BE PRECAST



STORM INLET, TYPE A

MC - STM4
REVISED: 7/2012



NOTES:
1. FILTER BAG SHALL BE MAINTAINED UNTIL THE AREA TRIBUTARY TO THE STRUCTURE HAS STABILIZED GROUND COVER, AS DETERMINED BY ENGINEER.

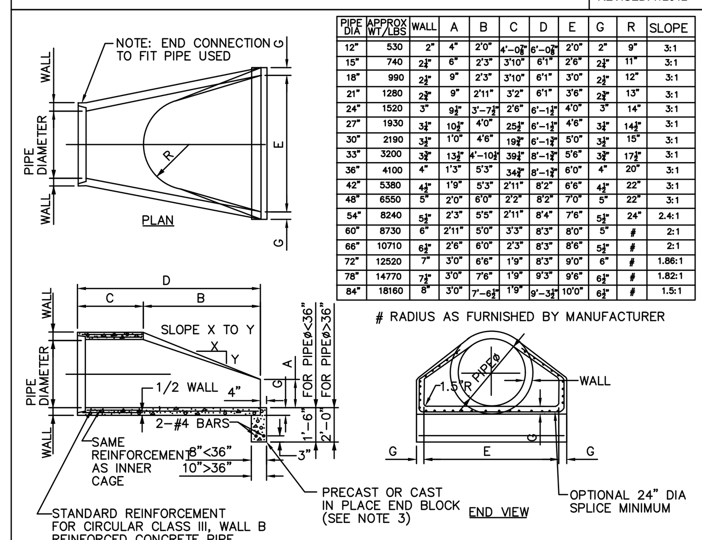
INLET PROTECTION

MC - SE10
REVISED: 1/2014

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	
CEREAL RYE OR WHEAT													TEMPORARY SEEDING DATES
OATS													
PERENNIAL RYEGRASS													
NON IRRIGATED													PERMANENT SEEDING DATES
IRRIGATED													
DORMANT SEEDING													

OPTIMAL SEEDING DATES

Species	Lbs./Acre	Lbs./1000 ft.2	Seeding Dates
Oats	90	2	Early spring – July 1
Cereal Rye	90	2	Early spring – Sept. 30
Wheat	90	2	Early spring – Sept. 30
Perennial Ryegrass	25	0.6	Early spring – Sept. 30



PIPE DIA	APPROX WT/LBS	WALL	A	B	C	D	E	G	R	SLOPE
12"	530	2"	4"	2'0"	4'-0 7/8"	6'-0 7/8"	2'0"	2"	9"	3:1
15"	740	2 1/4"	6"	2'3"	3'10"	6'1"	2'6"	2 1/4"	11"	3:1
18"	990	2 1/2"	9"	2'3"	3'10"	6'1"	3'0"	2 1/2"	12"	3:1
21"	1280	2 3/4"	9"	2'11"	3'2"	6'1"	3'6"	2 3/4"	13"	3:1
24"	1520	3"	9 1/2"	3'-7 1/2"	2'6"	6'-1 1/2"	4'0"	3"	14"	3:1
27"	1930	3 1/4"	10 1/2"	4'0"	25 1/2"	6'-1 1/2"	4'6"	3 1/4"	14 1/2"	3:1
30"	2190	3 1/2"	1'0"	4'6"	19 3/4"	6'-1 3/4"	5'0"	3 1/2"	15"	3:1
33"	3200	3 3/4"	13 1/2"	4'-10 1/2"	39 1/4"	8'-1 3/4"	5'6"	3 3/4"	17 1/2"	3:1
36"	4100	4"	1'3"	5'3"	34 3/4"	8'-1 3/4"	6'0"	4"	20"	3:1
42"	5380	4 1/2"	1'9"	5'3"	2'11"	8'2"	6'6"	4 1/2"	22"	3:1
48"	6550	5"	2'0"	6'0"	2'2"	8'2"	7'0"	5"	22"	3:1
54"	8240	5 1/2"	2'3"	5'5"	2'11"	8'4"	7'6"	5 1/2"	24"	2.4:1
60"	8730	6"	2'11"	5'0"	3'3"	8'3"	8'0"	5"	#	2:1
66"	10710	6 1/2"	2'6"	6'0"	2'3"	8'3"	8'6"	5 1/2"	#	2:1
72"	12520	7"	3'0"	6'6"	1'9"	8'3"	9'0"	6"	#	1.86:1
78"	14770	7 1/2"	3'0"	7'6"	1'9"	9'3"	9'6"	6 1/2"	#	1.82:1
84"	18160	8"	3'0"	7'-6 1/2"	1'9"	9'-3 1/2"	10'0"	6 1/2"	#	1.5:1

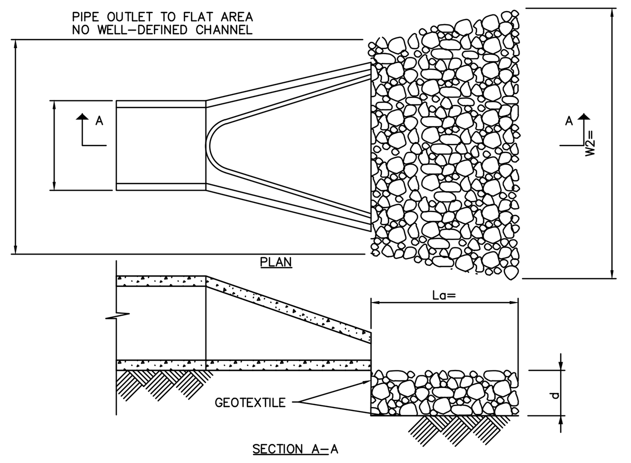
RADIUS AS FURNISHED BY MANUFACTURER

DESIGN NOTES:

1. CONCRETE FLARED END SECTIONS SHALL BE CONSIDERED FOR USE WITH CONCRETE PIPE CULVERTS HAVING SKEWS NO GREATER THAN 15°.
2. STANDARDS 2364 AND 2379 (GRATING FOR CONCRETE FLARED END SECTIONS) SHOULD BE CONSIDERED FOR USE WITH THIS STANDARD WHENEVER FLARED END SECTIONS FOR 24" THRU 54" DIAMETER ACROSS ROAD CULVERTS ARE, OR WILL BE, LOCATED WITHIN THE CLEAR ZONE OF THE ROADWAY.
3. THE END BLOCK SHALL BE PLACED PRIOR TO THE INSTALLATION.

PRECAST RCP FLARED END SECTION

MC - STM12
REVISED: 7/2012



DIA. (inches)	La(ft)	W1 (inches)	W2 (ft)	ROCK SIZE	d (inches)	VOLUME(cy)
12	10	36	11	RR3	15	3.25
15	12	45	13.2	RR3	15	4.70
18	14	54	15.5	RR3	15	6.5
21	15	63	17	RR3	15	7.7
24	16	72	18	RR3	15	8.9
27	17	81	20	RR3	15	10.5
30	18	90	21	RR3	15	11.9
36	20	108	23	RR4	20	19.8
42	22	126	26	RR4	20	24.8
48	24	144	28	RR4	20	29.6

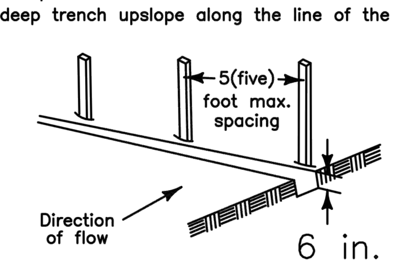
DESIGN VALUES BASED ON MINIMUM TAILWATER AND V=5 FPS IN ACCORDANCE WITH CODE 910 OF 'BLUE BOOK"

NOTES:
1. THE FILTER FABRIC SHALL MEET THE REQUIREMENTS IN IDOT MATERIAL SPECIFICATIONS 592 GEOTEXTILE TABLE 1 OR 2, CLASS I, II, III.
2. THE RIP RAP SHALL BE PLACED ACCORDING TO IDOT CONSTRUCTION SPECIFICATION 61 LOOSE ROCK RIP RAP. THE ROCK MAY BE EQUIPMENT PLACED.

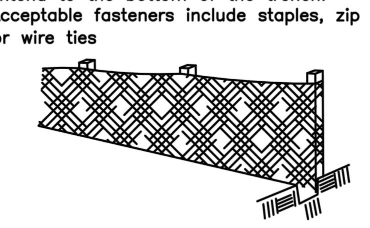
RIP RAP AT FLARED END SECTION

MC - STM10
REVISED: 7/2012

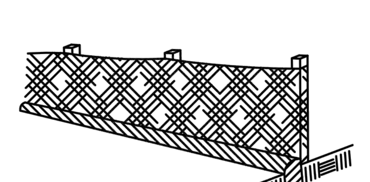
1. Set posts and excavate or slit–trench a 6–inch deep trench upslope along the line of the post



2. Attach the geotextile filter fabric to each post with a minimum of 3 (three) fasteners per post and extend to the bottom of the trench. Acceptable fasteners include staples, zip ties, or wire ties

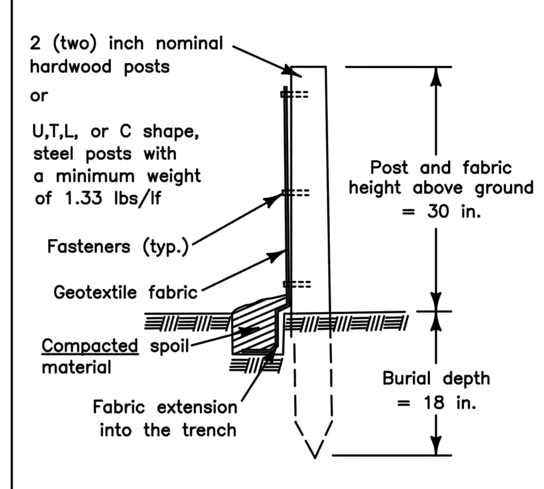


3. Backfill and compact the excavated spoil materials



Geotextile Requirement	Test Method	MARV
Grab strength	ASTM D 4632	
- Machine direction		550 N
- X-machine direction		450 N
Permittivity	ASTM D 4491	0.05 sec-1
Apparent opening size*	ASTM D 4751	0.60 mm
Ultraviolet stability (retained strength)	ASTM D 4355	70% after 500 hours

Note:
Value for apparent opening size represents maximum average roll value.



SILT FENCE DETAIL

DATE: 4/21/08 BY: KAW
REVISED: BY:

LAKE COUNTY
STORMWATER MANAGEMENT COMMISSION

ISSUED FOR BID
07-07-2017

A

C.A.F.T. Building

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

Wold RUCK PATE
WOLD | RUCK PATE
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3697 Darlene Ct., Aurora, IL 60504, Office 630.554.6655, Fax 630.554.7788
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I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed under the laws of the State of Illinois.

DATE: 7-7-2017
JAMES P. MEIER LICENSED PROFESSIONAL ENGINEER
Registration Number: 062-051277
EXP. DATE: NOVEMBER 30, 2017

Revisions		
Description	Date	Num

Comm: 173013
Date: 7-7-2017
Drawn: CLS
Check: JPM

North

STANDARD CONSTRUCTION DETAILS

Scale:

C5.0

BUILDING # 1 (FULLY SPRINKLER)

CODE ANALYSIS (IBC 2006)

1. OCCUPANCY CLASSIFICATIONS — SECTION 302

A. SECTION 304, BUSINESS: GROUP B
B. SECTION 311, STORAGE: GROUPS S-2 (LOW-HAZARD)

2. INCIDENTAL USE AREAS — TABLE 508

STORAGE ROOMS OVER 100 S.F. — 1 HR OR PROVIDE AUTOMATIC FIRE-EXTINGUISHING SYSTEM

3. MIXED OCCUPANCIES — SECTION 508

A. NO SEPARATION IS REQUIRED BETWEEN OCCUPANCIES PER SECTION 508.3.2

4. CONSTRUCTION TYPE / FIRE RESISTANCE — TABLE 601 / 602

A. TYPE V-B

BUILDING ELEMENT	FIRE RESISTANCE
STRUCTURAL FRAME	0 HR
EXT. BEARING WALLS	0 HR
INT. BEARING WALLS	0 HR
EXT. NON-BEARING WALLS	0 ⇔ 30 FT.
INT. NON-BEARING WALLS	0 HR
FLOOR CONSTRUCTION	0 HR
ROOF CONSTRUCTION	0 HR
VERTICAL SHAFTS AND ELEVATOR SHAFTS	N/A
CORRIDORS (TABLE 1011.1 / 708)	1 HR

5. GENERAL BUILDING HEIGHT AND AREA — SECTION 503 / 504

A. ALLOWABLE HEIGHT AND AREAS

GROUP	ALLOWABLE HEIGHT WITH SPRINKLER TABLE 503	ALLOWABLE AREA TABLE 503	MOST RESTRICTIVE NON-SEPARATED OCCUPANCY 508.3
B	3 STORIES / 60 FT.	9,000 S.F.	X
S-2	3 STORIES / 60 FT.	13,500 S.F.	

6. ALLOWABLE AREA MODIFICATIONS — SECTION 506

A. GROUP B

1. EQUATION 5-1 : ALLOWABLE BUILDING AREA PER STORY
**506.3 AREA INCREASE FOR SPRINKLER SYSTEM ⅓)#3

A(a) = [A(t) + (A(t) * I(f)) + (A(t) * I(s))]
A(a) = 9,000 + [9,000 * 0.25] + [9,000 * 3]

A(a) = 38,250 SF

2. EQUATION 5-2 : AREA INCREASE DUE TO FRONTAGE
I(f) = [F/P - 0.25] * W/30
I(f) = [136/272 - 0.25] * 30/30
I(f) = 0.25

B. ACTUAL AREA

GROUP	BASEMENT	MAIN LEVEL	* MEZZANINE
B	N/A	3,948 SF	N/A
TOTALS:	3,948 SF		

C. MIXED OCCUPANCY RATIO — 508.4.2

N/A - NON SEPARATED OCCUPANCIES PER 508.3.2

7. MEANS OF EGRESS — CHAPTER 10

A. BUILDING OCCUPANT LOAD — TABLE 1004.1.1

1. MAIN LEVEL

FUNCTION	S.F. / OCCUPANT	S.F. / SPACE	OCCUPANCY/ SPACE
STORAGE, MECH	300 GROSS	309 SF	2
*ASSEMBLY - LOOSE TABLES & CHAIRS	15 NET	1,165 SF	78
BUSINESS	100 GROSS	312 SF	4
PARKING GARAGE	200 GROSS	792 SF	4
TOTAL LOWER LEVEL			88

*A BUILDING OR TENANT SPACE USED FOR ASSEMBLY PURPOSES WITH AN OCCUPANT LOAD OF LESS THAN 50 PERSONS SHALL BE CLASSIFIED AS A GROUP B OCCUPANCY PER SECTION 303.1 EXCEPTION 1.

8. MEANS OF EGRESS — CHAPTER 10

B. EGRESS WIDTH — 1005.3.1, 1005.3.2

1. MAIN LEVEL OCCUPANCY 88

A. OTHER

FACTOR	REQUIRED WIDTH	DR WIDTH	# DOORS REQUIRED
.15	13.2"	/ 32" *	1

* MINIMUM DOOR WIDTH TO BE 36" TO ACHIEVE 32" CLEAR WIDTH PER 1008.1.1.

** MINIMUM STAIRWAY WIDTH TO BE 44" (INCLUDING LANDING WIDTH) UNLESS SERVING LESS THAN 50 OCCUPANTS PER 1004.4 FOR ACCESS TO UNOCCUPIED ROOFS- 1204.3.1

B. TRAVEL DISTANCES/ EXIT SYSTEMS

1. COMMON PATH OF TRAVEL (TABLE 1014.3) = 100 FT.
(TO A POINT WHERE OCCUPANT HAS TWO MEANS OF EGRESS.)

2. EXIT ACCESS TRAVEL DISTANCE — TABLE 1016.1
(TRAVEL DISTANCE TO AN EXIT OR A RATED EXIT SYSTEM.)

OCCUPANCY	W/ SPRINKLER
B	300
S-2,	400

3. CORRIDORS — 1017

A. MINIMUM WIDTH (TABLE 1017.2) = 44" OR 36" FOR LESS THAN 50 OCCUPANTS
MINIMUM WIDTH 72" FOR GROUP E OVER 100 OCCUPANTS.

B. DEAD ENDS (1017.3):
20' IN GROUPS A AND H AND ALL OTHER GROUPS WITH NON-SPRINKLERED CONSTRUCTION;
50' IN ALL GROUPS EXCEPT A AND H WITH SPRINKLERED CONSTRUCTION;
OR
LENGTH = 2.5 TIMES THE LEAST WIDTH OF THE DEAD-END CORRIDOR.

9. WALL AND CEILING FINISHES — TABLE 803.5

SPRINKLERED / NON-SPRINKLERED

GROUP	EXIT ENCLOSURES AND EXIT PASSAGEWAYS	CORRIDORS	ROOMS AND ENCLOSED SPACES
B	B / A	C / B	C / C
S	C / B	C / B	C / C

10. FIRE PROTECTION — CHAPTER 9

A. BUILDING SHALL BE FULLY SPRINKLERED IN ACCORDANCE WITH NFPA-13 AND VILLAGE ORDINANCE: 15.04.020 SEC. 903.2 AND 903.1.2

11. PLUMBING FIXTURE COUNT — TABLE 2902.1

A. "B" OCCUPANCY

1. OCCUPANTS	MEN			WOMEN		TOTAL	
	44			44		88	
2. FIXTURE RATIO	WC	URINAL	LAV	WC	LAV	DRINKING FOUNTAINS	SERVICE SINK
	1:25 1ST 50 THEN 1:50	4/3 OF WC	1:40 1ST 80 THEN 1:80	1:25 1ST 50 THEN 1:50	1:40 1ST 80 THEN 1:80	1:100	1
3. FIXTURES REQUIRED	2	NONE	2	2	2	1	1
4. ACTUAL FIXTURES	2*	0	2	2*	2	1	1

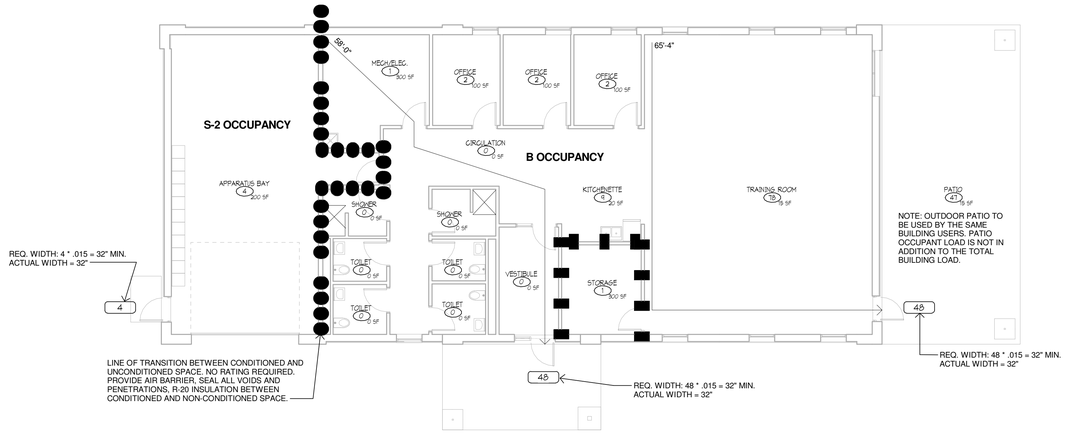
* 4 UNISEX TOILET ROOMS ARE BEING SUBSTITUTED FOR SHARED TOILET ROOMS.

12. ENERGY CODE

THE ENERGY CODE USED FOR THIS PROJECT IS

2015 INTERNATIONAL ENERGY CONSERVATION CODE

D4 SITE PLAN
1/16" = 1'-0" 0 12' 24'



F3 CODE PLAN
1/8" = 1'-0" 0 6' 12'

CODE LEGEND

MAIN PATH OF EGRESS

EXIT LOAD

OCCUPANT LOAD

OCCUPANT FACTOR

NEW 1 HOUR FIRE BARRIER
(SHAFT ENCLOSURES: 707.3.1, INCIDENTAL USE AREAS: 509, OCCUPANCY SEPARATIONS: 508.4, STAIR/ VERTICAL EXIT ENCLOSURES: 1022.2, /707 /711)

OPENINGS:	60 MIN. (SHAFT ENCLOSURES) 45 MIN. (INCIDENTAL USE AREAS, OCCUPANCY SEPARATIONS)
GLAZING:	60 MIN. OPENINGS: 100 SQ IN MAX, 33" MAX HT, 10" MAX WIDTH 45 MIN. OPENINGS: 1296 SQ IN MAX, 54" MAX HT, 54" MAX WIDTH
DUCTWORK:	90 MIN. FIRE DAMPER (NOT REQUIRED WITH DUCTED HVAC) 90 MIN FIRE/ SMOKE DAMPER (AT SHAFT ENCLOSURES)

NEW ZERO RATED CORRIDOR
(1018.1 WITH SPRINKLER SYSTEM)

OPENINGS:	0 MIN.
GLAZING:	0 MIN.
DUCTWORK:	CORRIDOR CANNOT BE USED AS SUPPLY, RETURN, EXHAUST, RELIEF OR VENTILATION AIR DUCTS.
NOTE:	RETURN AIR PLENUMS ARE ALLOWED. (1018.5.1)

Combined Area Fire Training Facility

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

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110 North Brockway, Suite 220
Palatine, Illinois 60067
woldac.com | 847 241 6100

EFFECTIVE CODE REFERENCES

2006 INTERNATIONAL BUILDING CODE (AS AMENDED)
2006 INTERNATIONAL MECHANICAL AND FUEL GAS CODE
2005 NATIONAL ELECTRICAL CODE
2014 ILLINOIS PLUMBING CODE
2006 INTERNATIONAL FIRE CODE
2014 INTERNATIONAL COMMERCIAL ENERGY CODE
1997 ILLINOIS ACCESSIBILITY CODE

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **ARCHITECT** under the laws of the State of **ILLINOIS**

Matthew J. Bickel
License Number: 001.020883 Date July 7, 2017

Revisions		
Description	Date	Num
Issued for Bid	7-7-17	1

Comm: 173013
Date: July 7, 2017
Drawn: BDB
Check: MJB

SITE PLAN AND CODE PLAN

Scale: As indicated

A0.01

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Central \\server-c-wolds\wdac\Jobs\Grant\17-170\140_ROOF\Bldg1_R17_central_ENG.rvt
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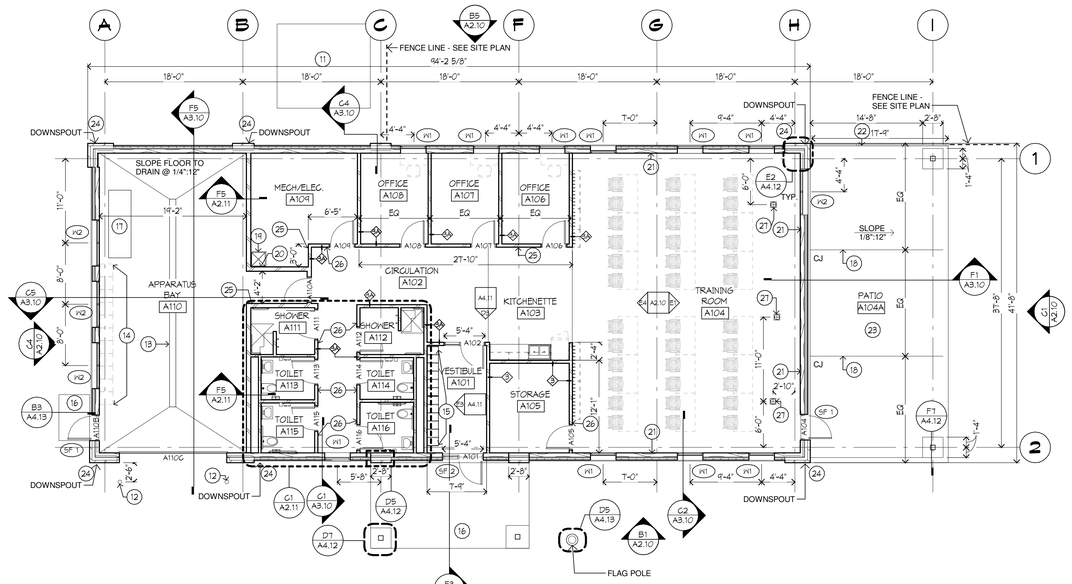
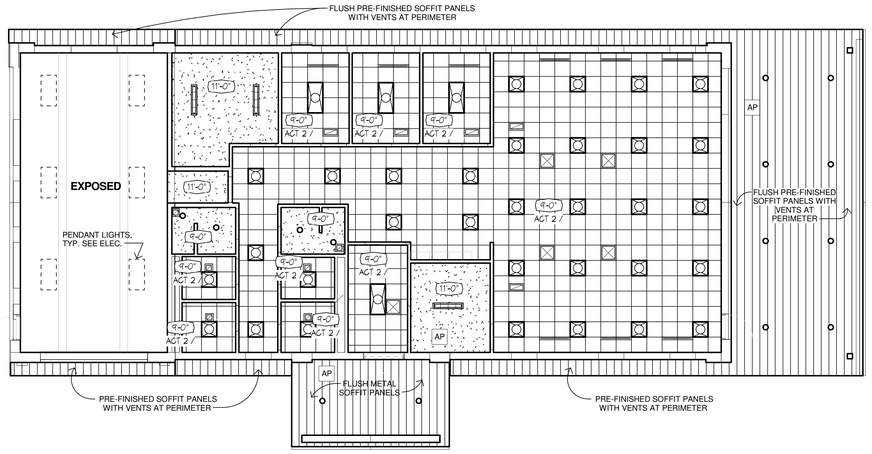
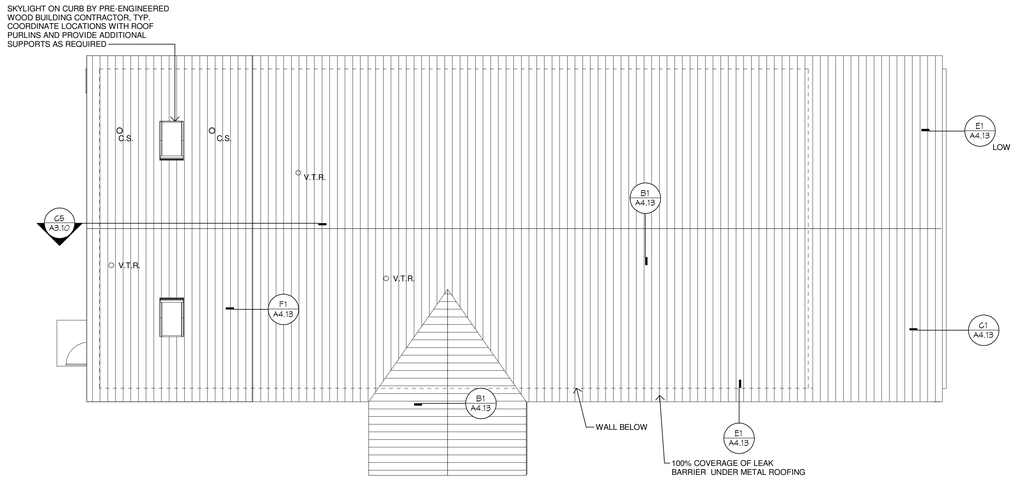


C1 MAIN LEVEL FLOOR PLAN
1/8" = 1'-0"



D1 MAIN LEVEL REFLECTED CEILING PLAN
1/8" = 1'-0"



F1 T.O. RIDGE
1/8" = 1'-0"

FLOOR PLAN GENERAL NOTES:

1. ALL PLAN DIMENSIONS ARE NOMINAL TO FACE OF WALL. WALL THICKNESS ARE SHOWN NOMINAL. SEE WALL TYPES FOR ACTUAL THICKNESS.
2. ALL GYP. WALLS ARE TO BE 5 INCHES THICK UNLESS OTHERWISE NOTED.
3. COORDINATE SIZE AND LOCATION OF ALL DUCT AND SHAFT OPENINGS IN WALLS AND FLOORS W/ MECH. AND ELEG. PROVIDE ALL REQUIRED LINTELS FOR OPENINGS. SEE LINTEL SCHEDULE.
4. FIELD VERIFY ALL MILLWORK OPENINGS.
5. SET FLOOR DRAINS 3/4" BELOW FINISHED CONCRETE FLOORS UNLESS OTHERWISE NOTED. PROVIDE CONSISTENT SLOPE FROM WALL TO DRAIN BY SLOPING CONCRETE, MIN. 1/4" PER FOOT.
6. VERIFY LOCATION, SIZE AND QUANTITY OF ALL MECHANICAL AND ELECTRICAL EQUIPMENT PADS.
7. ALL DOOR/SIDELITE OPENINGS TO BEGIN 4" FROM ADJACENT WALL UNLESS OTHERWISE NOTED.
8. ALL GYP. WALLS ARE CENTERED ON GRID UNLESS OTHERWISE NOTED.
9. FIRE RATED WALLS ARE INDICATED ON CODE PLANS.

RCP GENERAL NOTES

1. FOR WALLS THAT PENETRATE CEILINGS SEE WALL TYPES SHOWN ON THE FLOOR PLAN.
2. SPRINKLER HEADS ARE NOT SHOWN. LOCATE ALL SPRINKLER HEADS IN THE CENTER OF CEILING TILES.
3. FOR DIFFUSER AND RETURN GRILL SIZES, SEE MECHANICAL PLANS.
4. FOR LIGHT FIXTURE TYPES, SEE ELECTRICAL LIGHTING PLANS.
5. CEILINGS HEIGHTS INDICATED ON PLAN (E.G. 9'-0") ARE FROM FINISHED FLOOR OF LEVEL OF PLAN SHOWN OR INDICATED AS 10'-0".
6. ACOUSTICAL TILE CEILING GRID IS TO BE CENTERED IN RECTANGULAR ROOM OR CENTERED BETWEEN LONGEST WALLS OF IRREGULARLY SHAPED ROOMS UNLESS OTHERWISE NOTED.
7. VERIFY GYP. BD. CONTROL JOINT LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION.

RCP LEGEND

- CANLIGHT
- 4' STRIP LIGHT FIXTURE
- 2 X 2 LIGHT FIXTURE (IN CEILING GRID)
- 2 X 4 LIGHT FIXTURE (IN CEILING GRID)
- AIR DIFFUSER (IN CEILING GRID)
- RETURN AIR GRILLE (IN CEILING GRID)
- AP — ACCESS PANEL
- LINEAR DIFFUSER (IN CEILING GRID)
- PTD. GYPSUM BOARD CEILING / SOFFIT
- PENDANT LIGHT FIXTURE

ROOF PLAN GENERAL NOTES

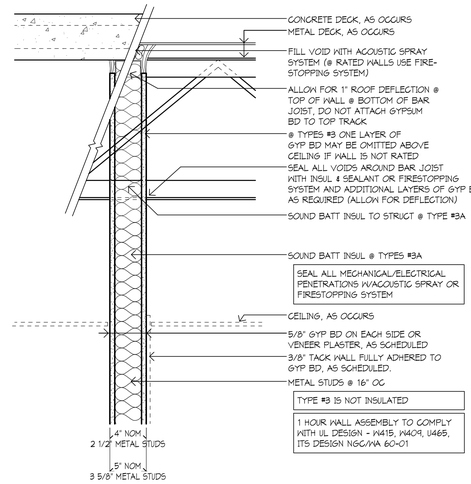
1. MECHANICAL ITEM LOCATIONS ARE SHOWN FOR REFERENCE ONLY. REFER TO MECH. DRAWINGS FOR EXTENT OF MECH. EQUIP. AND SIZE AND LOCATION OF ALL ROOF PENETRATIONS.
2. ALL MECHANICAL AND ELECTRICAL ROOFTOP EQUIPMENT, PIPING, CONDUIT, ETC. TO BE PAINTED.
3. REFER TO EXTERIOR ELEVATIONS FOR LOCATION OF OVERFLOW SCUPPERS AND OUTFLOWS.

ROOF LEGEND

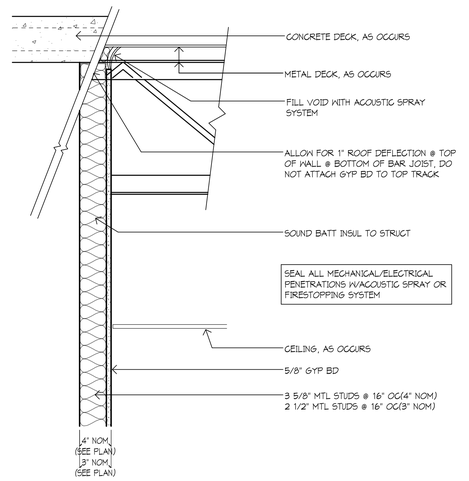
- VENT STACK, PIPE OR CONDUIT
- COMBUSTION STACK
- SKYLIGHT

FLOOR PLAN KEY NOTES:

1. DOOR ACTUATORS
2. BOLLARD - SEE DETAIL 21001.
3. TUB SINK - SEE MECHANICAL
4. EAN WASH - SEE DETAIL 43010.
5. EMERGENCY EYE WASH. SEE MECH.
6. CABINET UNIT HEATER. SEE DETAIL 43046. SEE MECH. FOR SPECIFICATIONS, COORDINATE LOCATION WITH MECH.
7. SALVAGED LOCKERS TO BE INSTALLED BY CONTRACTOR.
8. LOCATION OF SEMI-RECESSED DEFIBRILLATOR CABINET - SEE DETAIL B/43004
9. LOCATION OF STACKED WASHER AND DRYER (N.I.C.)
10. SQUARE BRICK ACCENT - SEE ELEVATONS/ SECTIONS FOR ADDITIONAL INFORMATION
11. CONC. EQUIPMENT PAD. COOR. WITH MECHANICAL
12. CONCRETE FILLED STEEL PIPE BOLLARD - SEE DETAIL (F3 / A4.12)
13. TRENCH DRAIN - SEE MECH.
14. EQUIPMENT STORAGE LOCKERS (N.I.C.)
15. BOOT LOCKERS
16. CONC. STOOP - SEE STRUCT.
17. TRIPLE BASIN - SEE MECH.
18. CONTROL JOINT TO BE TOOLED.
19. MOP SINK - SEE MECH.
20. SHELF AND MOP HOLDER.
21. PROVIDE BLOCKING IN WALLS FOR OWNER PROVIDED TV MOUNTING HARDWARE.
22. DECORITIVE FENCING.
23. CONCRETE PATIO SLOPED AT 1/8":12" - SEE STRUCT.
24. SPLASH BLOCK - SEE DETAIL (E5 / A4.13)
25. FIRE EXTINGUISHER
26. 9X9 ADA PLAQUE SIGNAGE
27. ELECTRICAL FLOOR BOX. FACE OF BOX TO BE FLUSH WITH FINISHED CONCRETE FLOOR.

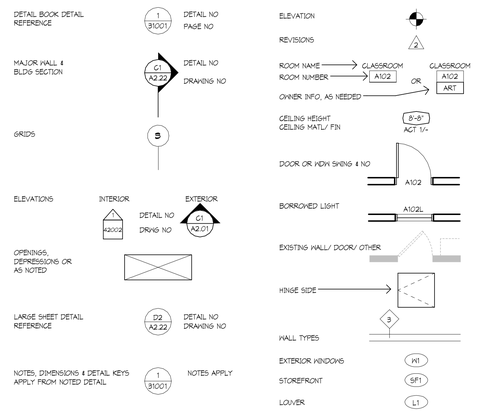


B7 WALL TYPES #3,3A
1 1/2" = 1'-0"



D7 WALL TYPES #7A
1 1/2" = 1'-0"

SYMBOLS



SYMBOLS
1 : 1

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Comm: **173013**
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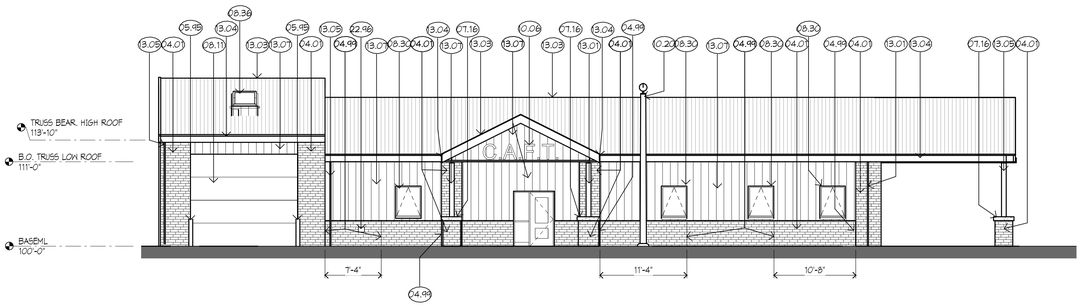
Drawn: **BDB**
Check: **MJB**
North

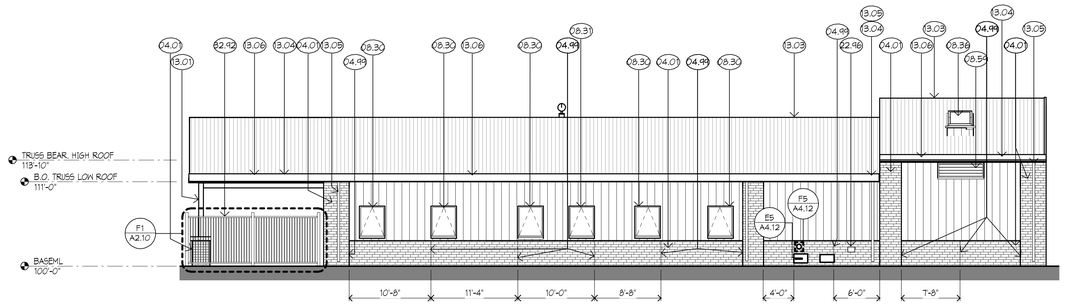
FLOOR, REFLECTED CEILING AND ROOF PLANS

Scale: **As Indicated**

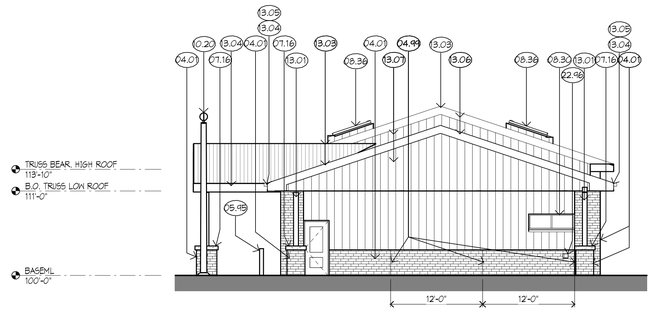
A1.10



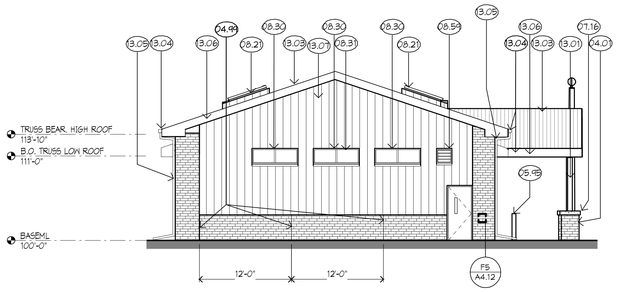
B1 SOUTH ELEVATION
1/8" = 1'-0"



B5 NORTH ELEVATION
1/8" = 1'-0"

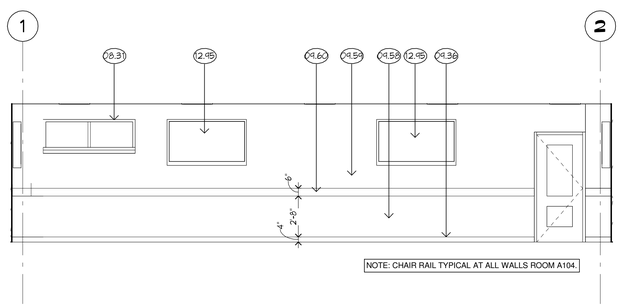


C1 EAST ELEVATION
1/8" = 1'-0"

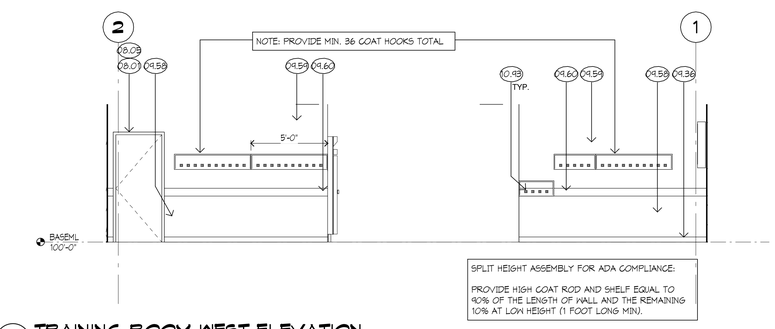


C4 WEST ELEVATION
1/8" = 1'-0"

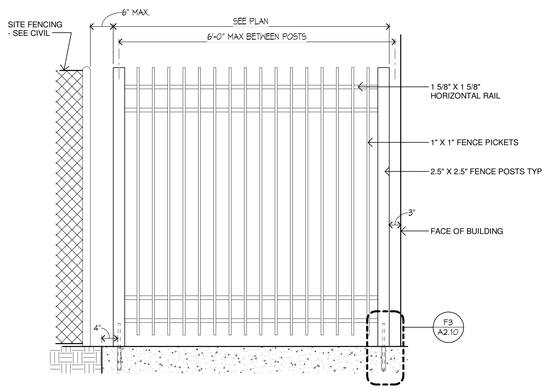
MATERIALS KEY	
KEY	MATERIAL
04.01	FACE BRICK NO. 1
04.99	BRICK EXPANSION JOINT
05.45	BOLLARD
07.16	SHEET METAL FLASHING AND TRIM
08.01	HOLLOW METAL FRAME
08.05	WOOD DOOR
08.11	SECTIONAL METAL OVERHEAD DOOR
08.21	PREFINISHED ALUMINUM TRANSLUSCENT SKYLIGHT FRAMING
08.30	PREFINISHED ALUMINUM WINDOW
08.31	ANODIZED ALUMINUM WINDOW
08.36	PREFINISHED ALUMINUM SKYLIGHT
09.54	PREFINISHED METAL LOUVER
09.66	VINYL BASE
09.68	PAINT 1 OIL
09.69	PAINT 2
09.60	WOOD CHAIR RAIL (PAINT 3)
10.06	ALUMINUM DIMENSION LETTER SIGNAGE
10.20	FLAGPOLE
10.43	COAT HOOKS
12.45	VIDEO DISPLAY (NIC)
13.01	PRE-ENGINEERED WOOD STRUCTURE - COLUMN
13.03	STANDING SEAM SHEET METAL ROOF
13.04	GUTTER
13.05	DOWNSPOUT
13.06	EAVE FLASHING
13.07	METAL WALL PANELS
22.46	HOSE BIB (SEE MEP.)
32.92	ORNAMENTAL FENCING



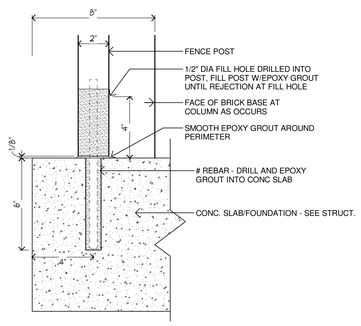
E1 TRAINING ROOM EAST ELEVATION, TYP.
1/4" = 1'-0"



E4 TRAINING ROOM WEST ELEVATION
1/4" = 1'-0"



F1 FENCE ELEVATION
3/4" = 1'-0"



F3 POST DETAIL
3" = 1'-0"

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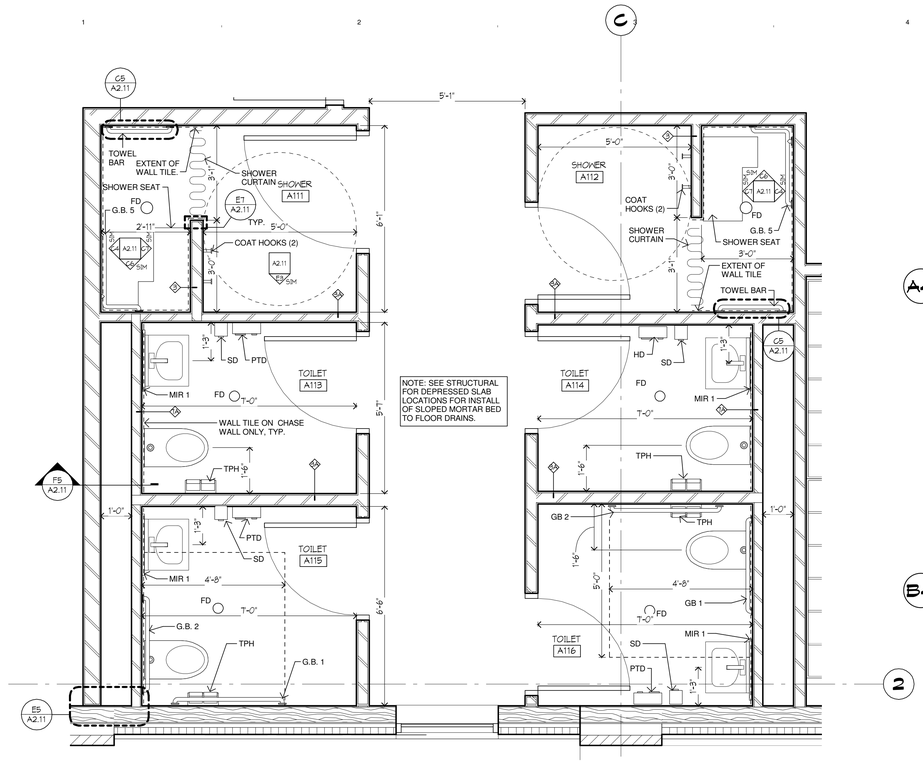
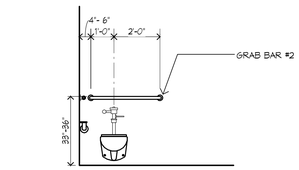
EXTERIOR ELEVATIONS

Scale: **As indicated**

A2.10

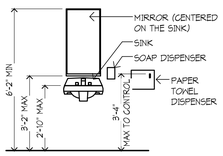


C1 ENLARGED TOILET PLAN
1/2" = 1'-0"

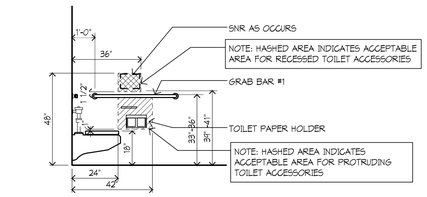


A4 ADULT HCAP WC
3/8" = 1'-0"

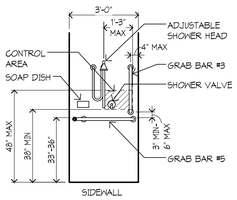
A5 ADULT WC
3/8" = 1'-0"



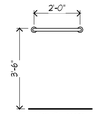
B4 LAV ELEV
3/8" = 1'-0"



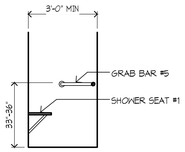
B5 ADULT HCAP WC
3/8" = 1'-0"



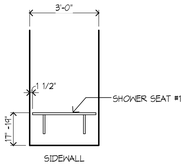
C4 TRANSFER SHOWER STALL
3/8" = 1'-0"



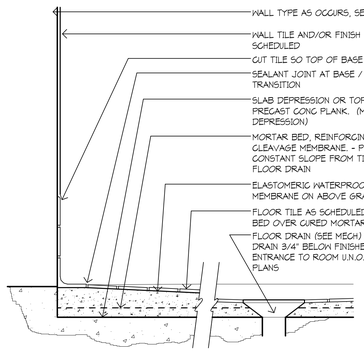
C5 TOWEL BAR
3/8" = 1'-0"



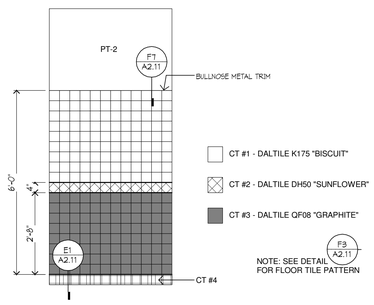
C6 TRANSFER SHOWER STALL
3/8" = 1'-0"



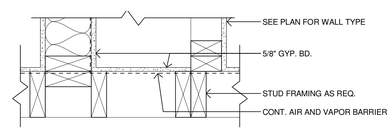
C7 TRANSFER SHOWER STALL
3/8" = 1'-0"



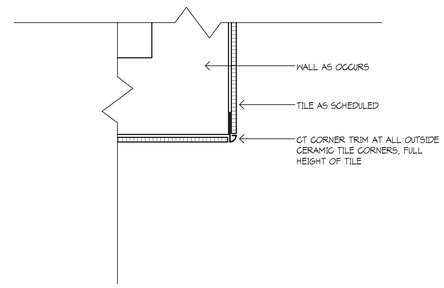
E1 TYP TOILET ROOM SECTION
3" = 1'-0"



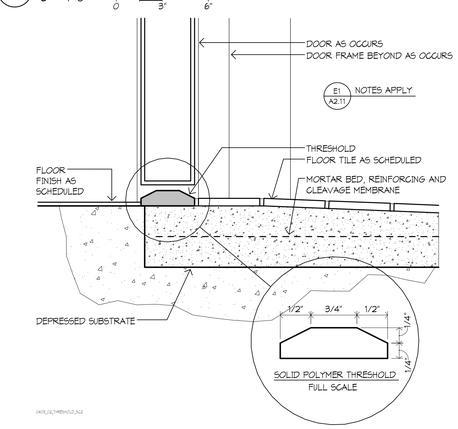
E3 WALL TILE PATTERN, TYP.
1/2" = 1'-0"



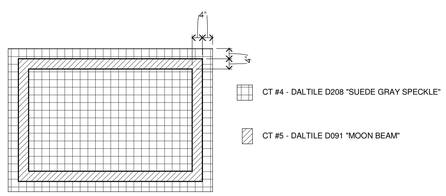
E5 TOLIET CHASE PLAN DETAIL
1 1/2" = 1'-0"



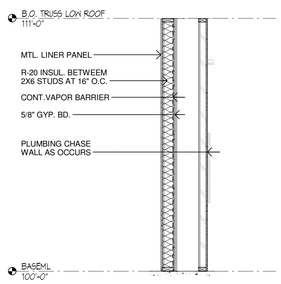
E7 PLAN AT CORNER TRIM
3" = 1'-0"



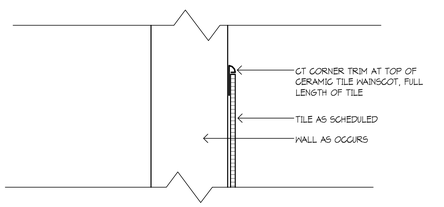
F1 TYP TOILET ROOM THRESHOLD
6" = 1'-0"



F3 FLOOR TILE PATTERN
1/2" = 1'-0"



F5 WALL SECTION AT TOILET CHASE
3/8" = 1'-0"



F7 SECTION AT CORNER TRIM
3" = 1'-0"

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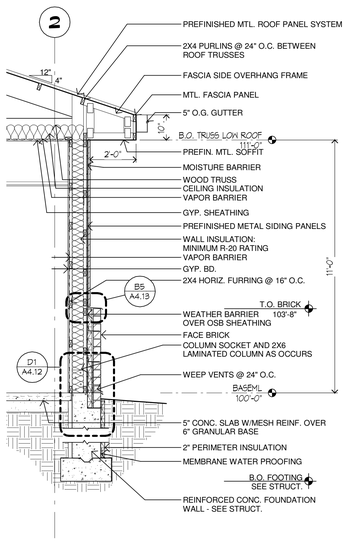
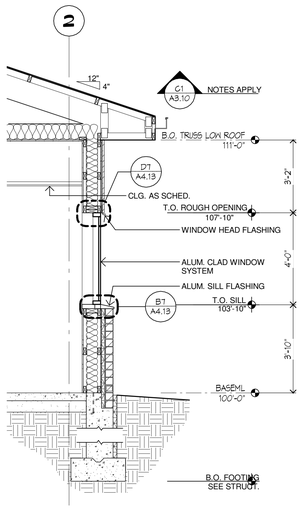
ENLARGED PLANS

Scale: **As indicated**

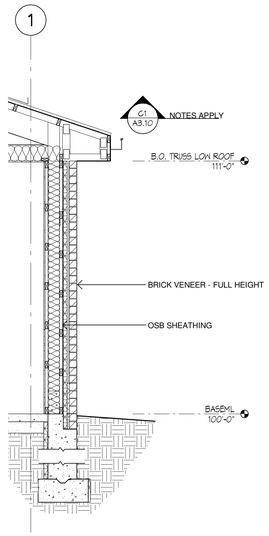
A2.11



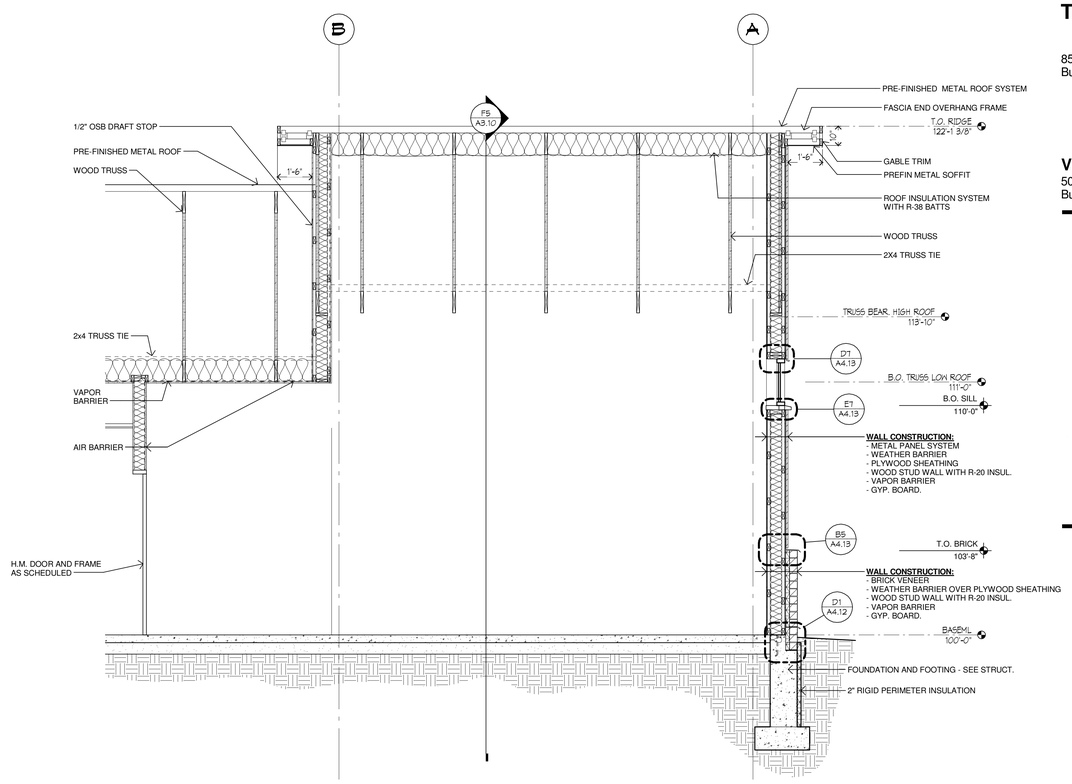
C1 SECTION AT LOW ROOF, TYP.
3/8" = 1'-0"



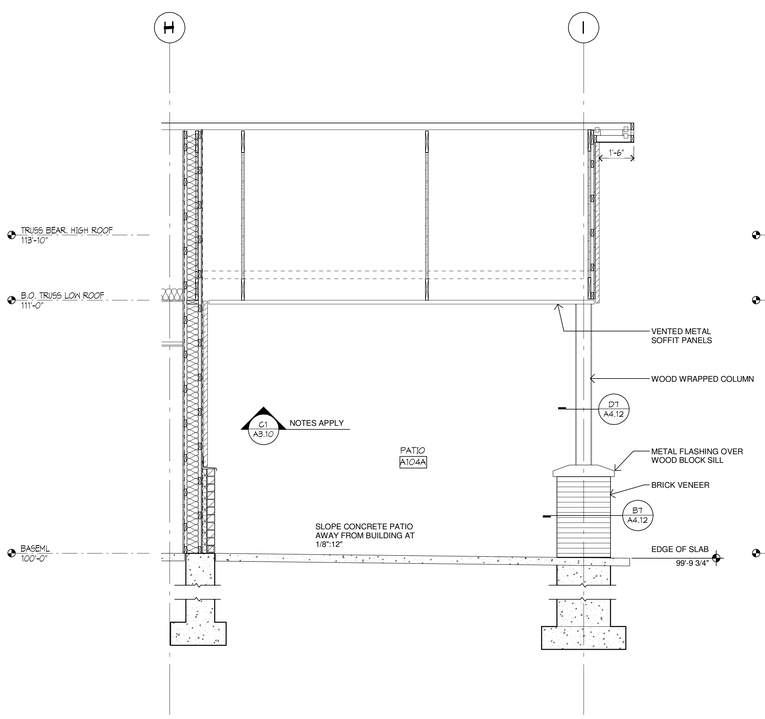
C2 SECTION AT WINDOW
3/8" = 1'-0"



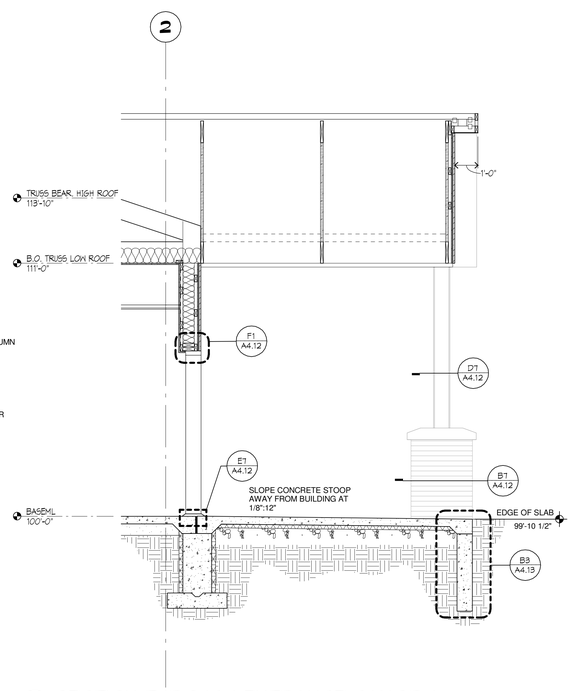
C4 SECTION AT BRICK PIER
3/8" = 1'-0"



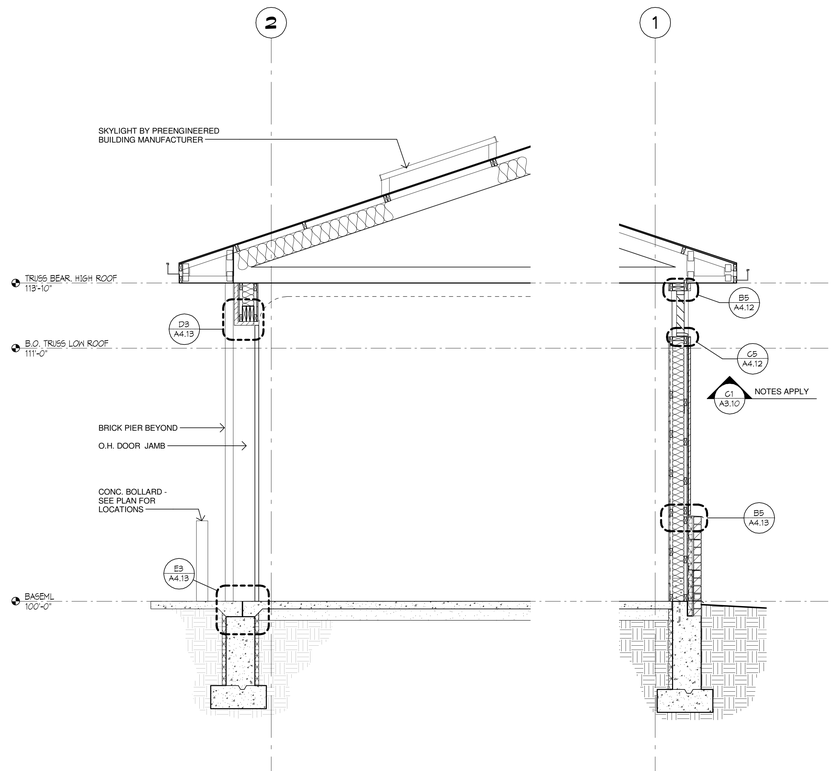
C5 SECTION THROUGH HIGH ROOF GABLE
3/8" = 1'-0"



F1 SECTION THROUGH PATIO GABLE
3/8" = 1'-0"



F3 SECTION THROUGH ENTRANCE CANOPY
3/8" = 1'-0"



F5 SECTION THROUGH HIGH ROOF
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WALL SECTIONS

Scale: **3/8" = 1'-0"**

A3.10

ROOM FINISH SCHEDULE												
ROOM NO	ROOM NAME	FLOOR	BASE	N WALL - TYP		E WALL		S WALL		W WALL		REMARKS
				MATL	FIN	MATL	FIN	MATL	FIN	MATL	FIN	
A101	VESTIBULE	P.CONC	VB	GYP BD	PT-2							
A102	CIRCULATION	P.CONC	VB	GYP BD	PT-2							
A103	KITCHENETTE	P.CONC	VB	--	--	--	--	GYP BD	PT-2	--	--	6
A104	TRAINING ROOM	P.CONC	VB	GYP BD	SEE ELEV							3
A104A	PATIO	P.CONC	VB	--	--							
A105	STORAGE	P.CONC	VB	GYP BD	PT-2							
A106	OFFICE	P.CONC	VB	GYP BD	PT-2							
A107	OFFICE	P.CONC	VB	GYP BD	PT-2							
A108	OFFICE	P.CONC	VB	GYP BD	PT-2							
A109	MECH/ELEC.	CONC	VB	GYP BD	PT-2							
A110	APPARATUS BAY	QUARTZ	QUARTZ	MTL PNL	--							1
A111	SHOWER	CT4/CT5	CT-4	GYP BD	C.TILE/PT-2	--	--	--	--	--	--	2
A112	SHOWER	CT4/CT5	CT-4	GYP BD	C.TILE/PT-2							2
A113	TOILET	CT4/CT5	CT-4	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	C.TILE/PT-2	2,4,5
A114	TOILET	CT4/CT5	CT-4	GYP BD	C.TILE/PT-2	GYP BD	C.TILE/PT-2	GYP BD	PT-2	GYP BD	PT-2	2,4,5
A115	TOILET	CT4/CT5	CT-4	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	C.TILE/PT-2	2,4,5
A116	TOILET	CT4/CT5	CT-4	GYP BD	C.TILE/PT-2	GYP BD	C.TILE/PT-2	GYP BD	PT-2	GYP BD	PT-2	2,4,5

IL

ROOM FINISH SCHEDULE GENERAL NOTES

1. SEE DETAILS OF CONSTRUCTION FOR ABBREVIATIONS
2. IF ALL WALLS IN ROOM HAVE THE SAME FINISH, THE "N WALL-TYP" COLUMN WILL BE USED.
3. DISCREPANCIES BETWEEN THE ROOM FINISH SCHEDULE AND DRAWINGS SHALL BE REPORTED TO THE ARCHITECT FOR FINISH DETERMINATION.
4. ON WALLS WHIGH ARE COVERED WITH MILLWORK, A FINISH SHALL NOT BE APPLIED TO THE WALL BEHIND EXCEPT FOR LOCATIONS WHICH MAY BE EXPOSED (I.E. SPACE BETWEEN MILLWORK AND TACK SURFACE.)
5. FOR CEILING MATERIAL WHEN MORE THAN ONE CEILING MATERIAL OCCURS THE CEILING FINISH IS INDICATED THUS: '/'
6. PAINT FINISHES INDICATED BY PT- # TO BE THE FOLLOWING:
   PT-1 - SW 7076 "CITYSCAPE" (ACCENT/WAINSCOT)
   PT-2 - SW 7570 "ESAET WHITE" (FIELD)
   PT-3 - SW 6902 "DECISIVE YELLOW" (ACCENT/CHAIR RAIL/BOLLARDS)
   PT-4 - SW 6991 "BLACK MAGIC" (H.M. FRAMES)
7. VINYL BASE TO BE ROPPE "100 BLACK"
8. REFER TO SHEET A2.11 FOR TILE PATTERNS AND DETAILS FOR CERAMIC TILE COLORS.
9. PLASTIC LAMINATE COLORS:
   P.LAM 1 - FORMICA 156-58 "NATURAL MAPLE" (VERTICAL SURFACES)
   P.LAM 2 - FORMICA 515-58 "GRAPHITE GRAFIX" (COUNTERTOP)
10. WOOD DOOR SPECIES/COLOR: MARSHFILED - WHITE MAPLE "CLEAR 0-45"
11. DECORATIVE QUARTZ FLOORING COLOR: STRATA SHIELD G205

ROOM FINISH SCHEDULE REMARKS

1. WALLS TO BE FINISHED WITH METAL LINER PANEL BY PRE-ENG. WOOD BUILDING MANUFACTURER.
2. PROVIDE CERAMIC TILE TO A HEIGHT OF 6'-6" WITH EPOXY PAINT ABOVE. SEE DRAWING G1/A2.11 FOR LOCATIONS.
3. SEE ELEVATION FOR WOOD CHAIR RAIL AND PAINT AGGENTS.
4. SEE SHEET A2.11 FOR AND TILE FLOOR PATTERN INFORMATION.
5. PAINT CEILING AND ALL EXPOSED STRUCTURE, PIPING, CONDUIT, MECHANICAL DUCTS AND VENTS.
6. PROVIDE VINYL BASE AT CASEWORK.

DOOR / OPENING SCHEDULE																
DOOR NO	DOOR / OPENING					LABEL	FRAME			GL	MOUNTING CONDITIONS			HDW GRP	REMARKS
	TYPE	QTY	WIDTH	HEIGHT	MATL		TYPE	DEPTH	MATL		HEAD	JAMB	SILL		
A101	FG2	1	3'-0"	7'-0"	AL	--	SF 2	--	AL	--	F1/A4.12	F1/A4.12	E1/A4.12		
A102	FG2	1	3'-0"	7'-0"	HM	--	FR 3A	--	HM	--	F5/A4.13	F5/A4.13	F5/A4.13		
A104	FG2	1	3'-0"	7'-0"	AL	--	SF 1	--	AL	--	F1/A4.12	F1/A4.12	E1/A4.12		
A105	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--		
A106	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--		
A107	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--		
A108	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--		
A109	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--		
A110A	N	1	3'-0"	7'-0"	HM	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--		
A110B	N	1	3'-0"	7'-0"	AL	--	SF 1	--	AL	--	F1/A4.12	F1/A4.12	E1/A4.12		
A110C	OH	1	14'-0"	12'-0"	ST	--	OH	--	--	--	D3/A4.13	C3/A4.13	E3/A4.13		
A111	F	1	3'-8"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	F1/A2.11		
A112	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	F1/A2.11		
A113	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	F1/A2.11		
A114	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	F1.A2.11		
A115	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	F1/A2.11		
A116	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	F1/A2.11		

DOOR SCHEDULE GENERAL NOTES

1. ALL DOORS ARE 1 3/4" THICK UNLESS OTHERWISE NOTED.
2. FOR FRAME DEPTH, ONLY EXCEPTIONS TO THE FOLLOWING TABLE ARE SCHEDULED:

   GYPSUM BOARD PARTITIONS: THROAT OF FRAME TO MATCH WALL THICKNESS.

   FRAME DEPTHS ARE SCHEDULED IN NOMINAL DIMENSIONS. SEE FRAME/ DOOR TYPES FOR CORRESPONDING ACTUAL DIMENSIONS.
3. FOR GLASS TYPES, ONLY EXCEPTIONS TO THE FOLLOWING TABLE ARE SCHEDULED:

   INTERIOR NON RATED:

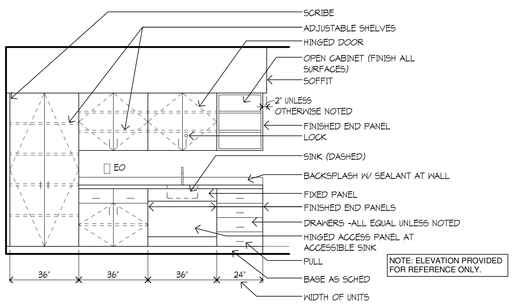
   CLEAR (SAFETY WHEN REQUIRED BY TABLE IN GLAZING SPECIFICATION.)

   EXTERIOR NON-RATED:

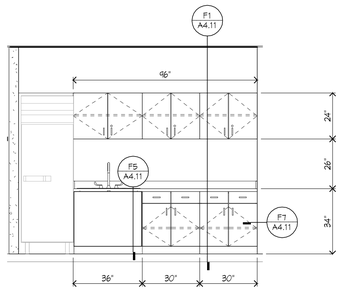
   CLEAR INSULATED (SAFETY INSULATED WHEN REQUIRED BY TABLE IN GLAZING SPECIFICATION.)
4. SEE SHEET A4.11 FOR FRAME TYPES.
5. SEE SHEET A4.11 FOR DOOR TYPES.

DOOR SCHEDULE REMARKS

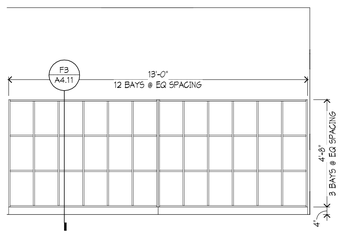
1. NONE



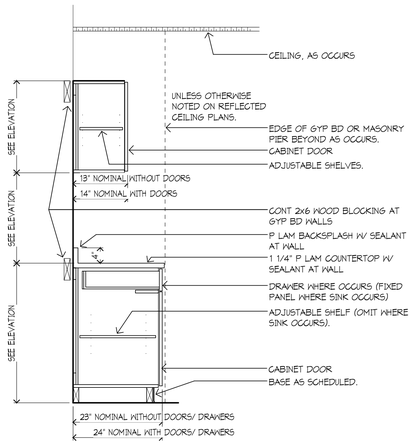
D1 MILLWORK GENERAL INFORMATION
3/8" = 1'-0"



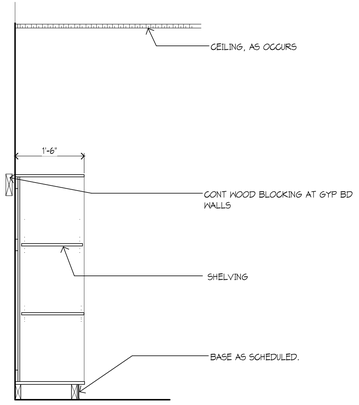
D3 KITCHEN ELEVATION
3/8" = 1'-0"



E3 BOOT LOCKER ELEVATION
3/8" = 1'-0"

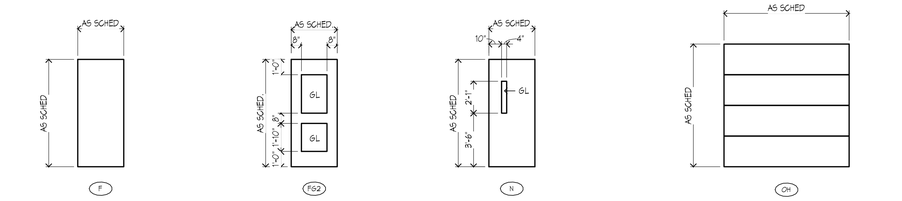


F1 TYPICAL CASEWORK SECTION
3/4" = 1'-0"



F3 BOOT LOCKER STORAGE
3/4" = 1'-0"

A

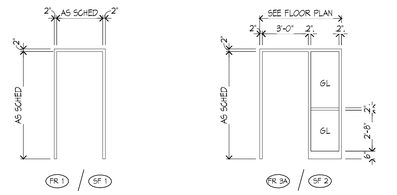


DOOR TYPE F
1/4" = 1'-0"

DOOR TYPE FG2
1/4" = 1'-0"

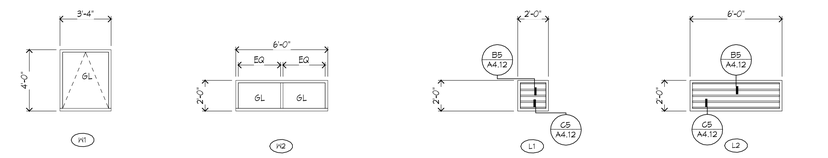
DOOR TYPE N
1/4" = 1'-0"

DOOR TYPE OH
1/4" = 1'-0"



FRAME TYPE 1
1/4" = 1'-0"

FRAME TYPE 3A
1/4" = 1'-0"

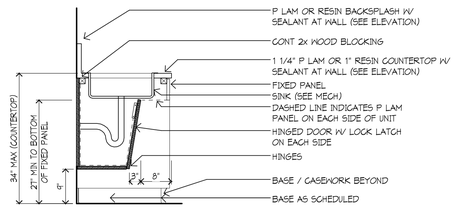


WINDOW TYPE W1
1/4" = 1'-0"

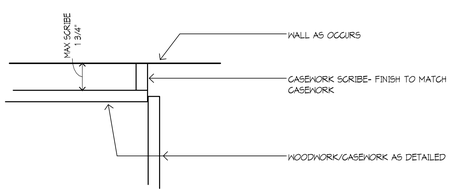
WINDOW TYPE W2
1/4" = 1'-0"

LOUVER TYPE L1
1/4" = 1'-0"

LOUVER TYPE L2
1/4" = 1'-0"



F5 SECTION AT ACCESSIBLE SINK
3/4" = 1'-0"



F7 PLAN AT CASEWORK
3" = 1'-0"

Combined Area Fire Training Facility

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

WOLD | RUCK PATE
110 North Brockway, Suite 220
Palatine, Illinois 60067
woldac.com | 847 241 6100

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **ARCHITECT** under the laws of the State of **ILLINOIS**

Matthew J. Bickel
License Number: **001.020883** Date: **July 7, 2017**

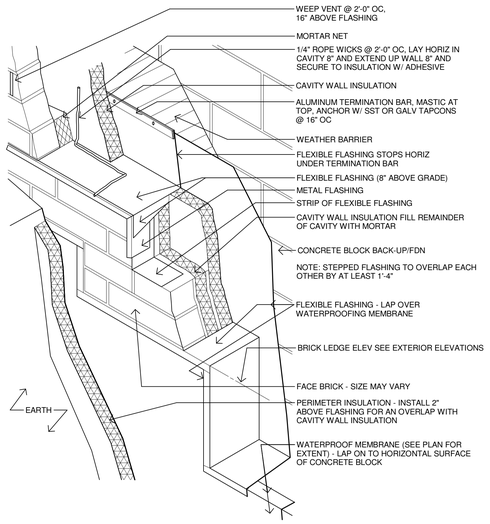
Revisions		
Description	Date	Num
Issued for Bid	**7-7-17**	**1**

Comm: **173013**
Date: **July 7, 2017**
Drawn: **BDB**
Check: **MJB**
North

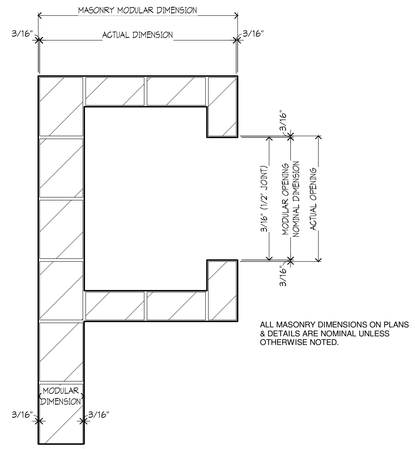
SCHEDULES AND DETAILS

Scale: **As Indicated**

A4.11

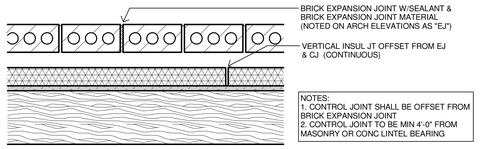


C1 FLASHING DETAIL
1" = 1'-0"



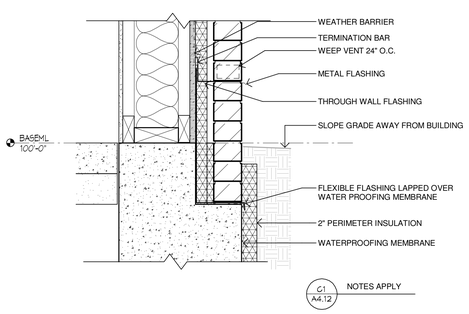
ALL MASONRY DIMENSIONS ON PLANS & DETAILS ARE NOMINAL UNLESS OTHERWISE NOTED.

C3 MASONRY DIMENSIONING
3/4" = 1'-0"

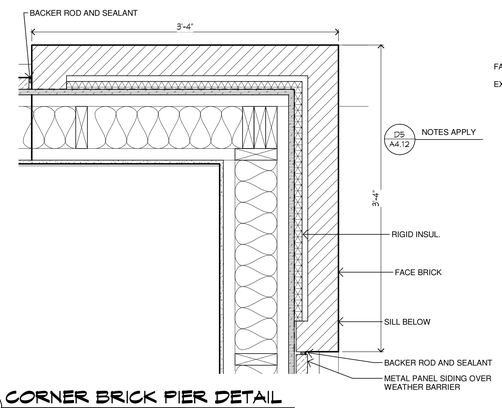


NOTES:
1. CONTROL JOINT SHALL BE OFFSET FROM BRICK EXPANSION JOINT
2. CONTROL JOINT TO BE MIN 4'-0" FROM MASONRY OR CONC LINTEL BEARING

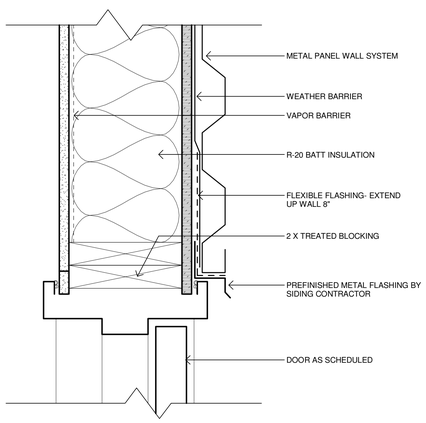
D3 TYPICAL EXT CONTROL/ EXP JOINT
1 1/2" = 1'-0"



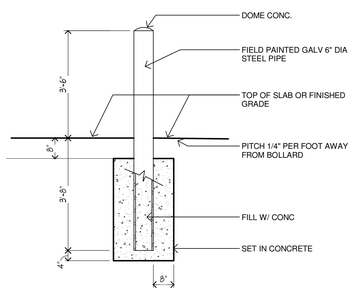
D1 BRICK LEDGE DETAIL
1 1/2" = 1'-0"



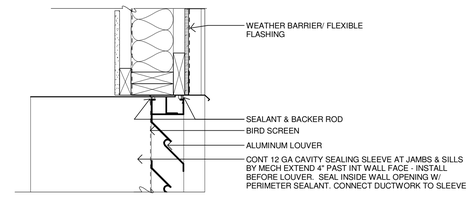
E2 CORNER BRICK PIER DETAIL
1 1/2" = 1'-0"



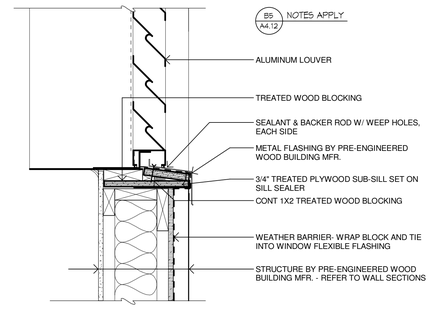
F1 EXT HM HEAD/ JAMB
3" = 1'-0"



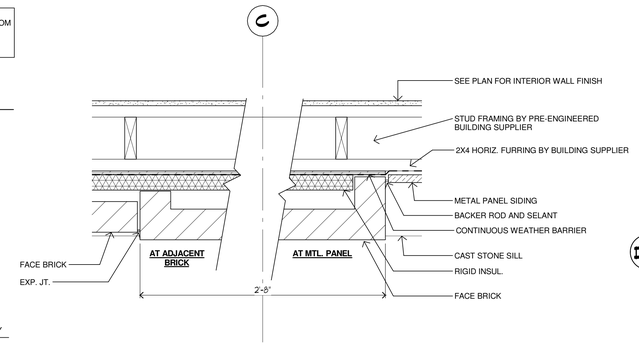
F2 BOLLARD DETAIL
1/2" = 1'-0"



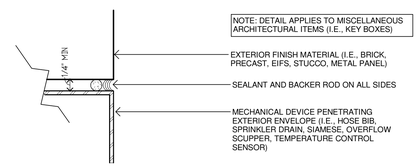
B5 LOUVER HEAD
1 1/2" = 1'-0"



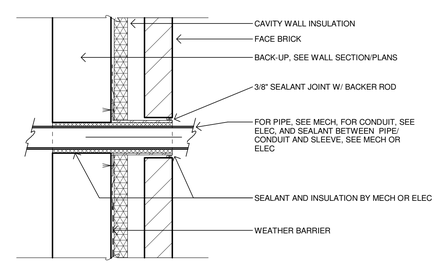
C5 LOUVER SILL
1 1/2" = 1'-0"



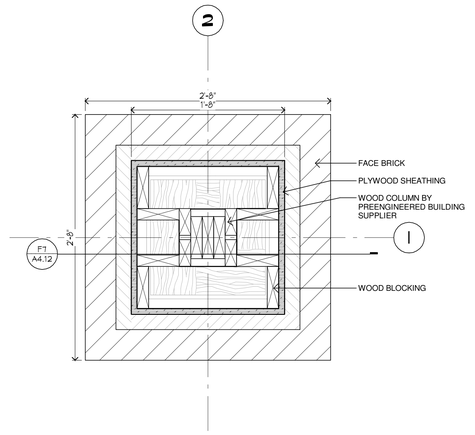
D5 BRICK PIER DETAIL
1 1/2" = 1'-0"



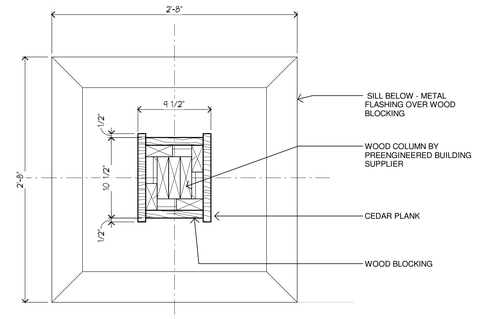
E5 SECTION AT TYP MECH DEVICE
6" = 1'-0"



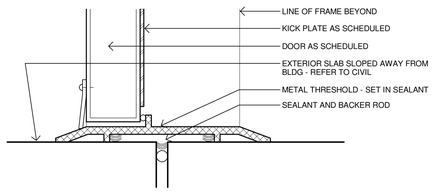
F5 PIPE OR CONDUIT PENETRATION
1 1/2" = 1'-0"



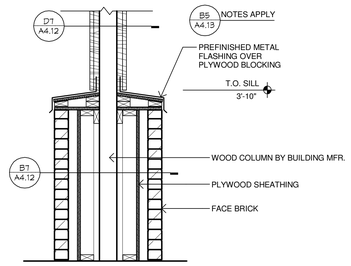
B7 COLUMN DETAIL AT BRICK, TYP.
1 1/2" = 1'-0"



D7 COLUMN DETAIL AT WOOD COLUMN
1 1/2" = 1'-0"



E7 EXTERIOR DOOR THRESHOLD
6" = 1'-0"



F7 COLUMN SECTION DETAIL
3/4" = 1'-0"

Combined Area Fire Training Facility

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

WOLD | RUCK PATE
110 North Brockway, Suite 220
Palatine, Illinois 60067
woldac.com | 847 241 6100

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **ARCHITECT** under the laws of the State of **ILLINOIS**

Matthew J. Bickel
License Number: **001.020883** Date **July 7, 2017**

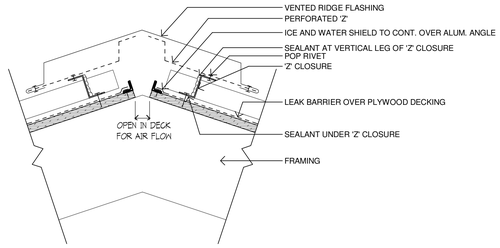
Revisions		
Description	Date	Num
Issued for Bid	7-7-17	1

Comm: **173013**
Date: **July 7, 2017**
Drawn: **BDB**
Check: **MJB**
North

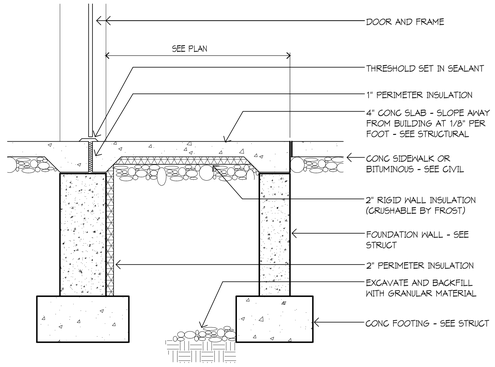
DETAILS

Scale: **As indicated**

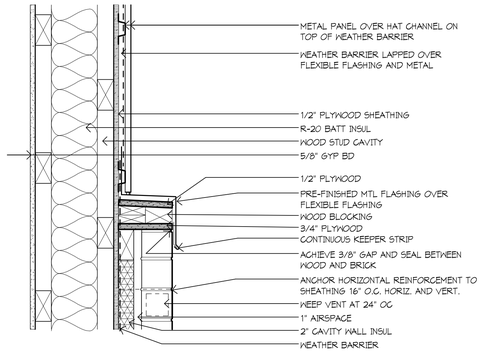
A4.12



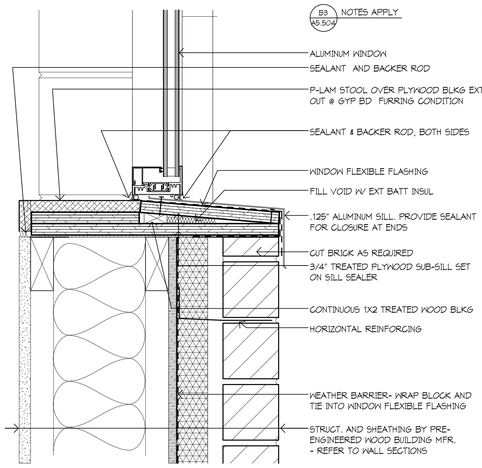
B1 RIDGE VENT
1 1/2" = 1'-0"



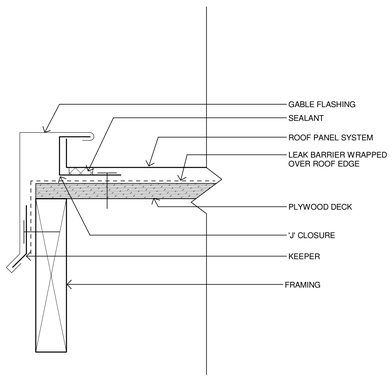
B3 SECTION AT STOOP - TYPICAL
3/4" = 1'-0"



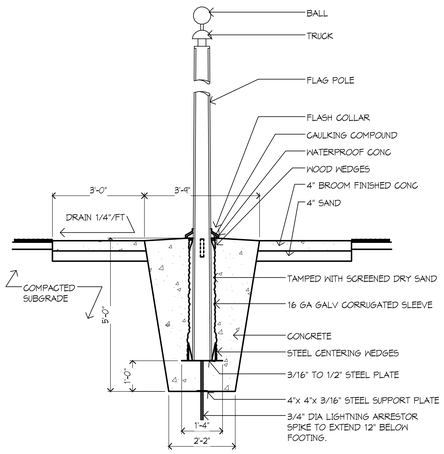
B5 SECTION AT SIDING/ BRICK
1 1/2" = 1'-0"



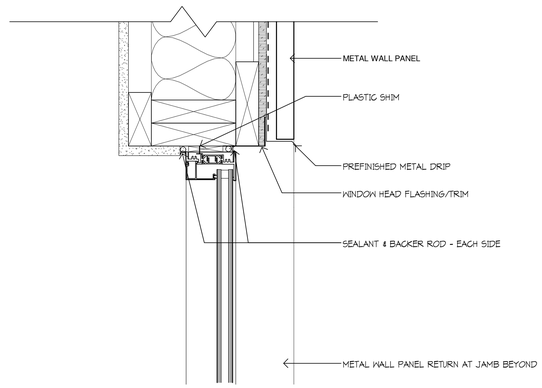
B7 SILL DETAIL
3" = 1'-0"



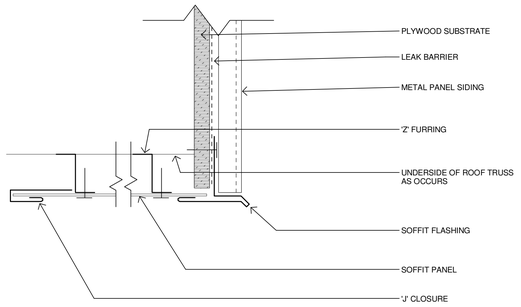
C1 GABLE FLASHING
3" = 1'-0"



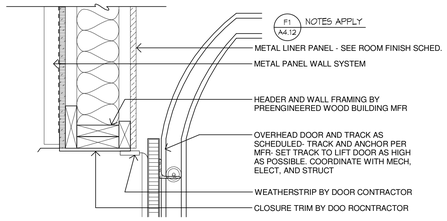
D5 FLAGPOLE DETAIL
1/2" = 1'-0"



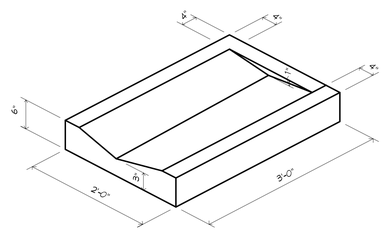
D7 WINDOW HEAD DETAIL
3" = 1'-0"



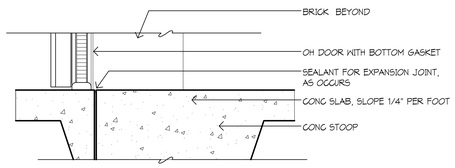
E1 FASCIA TO SOFFIT TRANSITION
3" = 1'-0"



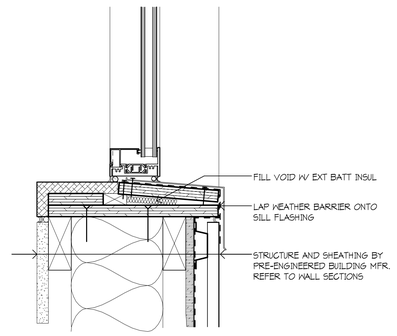
D3 EXT OH DOOR HEAD (JAMB SIM)
1 1/2" = 1'-0"



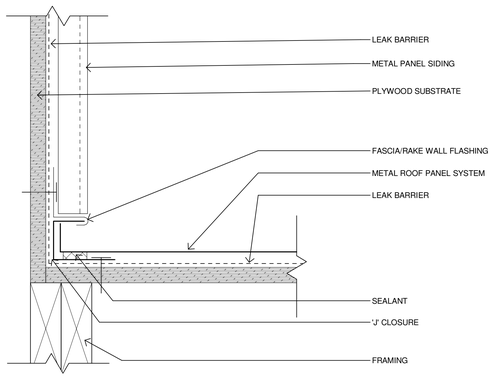
E5 CONCRETE SPLASHBLOCK
1" = 1'-0"



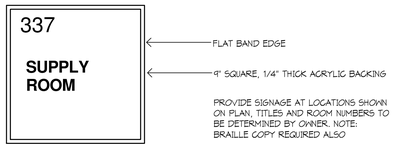
E3 EXT OH DOOR SILL
1 1/2" = 1'-0"



E7 WINDOW SILL AT METAL PANEL
3" = 1'-0"

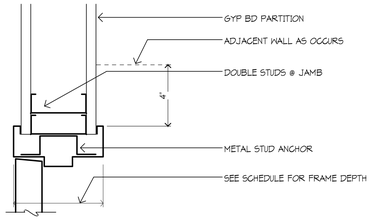


F1 RAKE DETAIL
3" = 1'-0"



PROVIDE SIGNAGE AT LOCATIONS SHOWN ON PLAN. TITLES AND ROOM NUMBERS TO BE DETERMINED BY OWNER. NOTE: BRAILLE COPY REQUIRED ALSO

F3 PANEL SIGNAGE
3" = 1'-0"



F5 JAMB (HEAD & SILL AT BORROWED LITE, SIMILAR)
3" = 1'-0"

IL

A

Combined Area Fire Training Facility

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

Wold
RUCK PATE

WOLD | RUCK PATE
110 North Brockway, Suite 220
Palatine, Illinois 60067

woldac.com | 847 241 6100

I thereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **ARCHITECT** under the laws of the State of **ILLINOIS**

Matthew J. Bickel
License Number: **001.020883** Date **July 7, 2017**

Revisions		
Description	Date	Num
Issued for Bid	**7-7-17**	**1**

Comm: **173013**
Date: **July 7, 2017**
Drawn: **BDB**
Check: **MJB**
North

DETAILS

Scale: **As indicated**

A4.13

STRUCTURAL GENERAL NOTES

BUILDING CODE IBC 2006

OCCUPANCY CATEGORY II

STRUCTURAL LOADING DATA

ROOF LOAD
DEAD LOAD 5 psf
COLLATERAL LOAD 10 psf
LIVE LOAD 30 psf
MECHANICAL LOAD: SEE MECHANICAL DRAWINGS FOR ROOF SUPPORTED EQUIPMENT LOCATION AND LOADS

FLOOR LIVE LOAD 100 psf

SNOW LOAD
GROUND SNOW LOAD Pg 25 psf
IMPORTANCE FACTOR Is 1.0
SNOW EXPOSURE FACTOR Ce 1.0
SNOW THERMAL FACTOR Ct 1.0
FLAT ROOF SNOW LOAD Pf 17.5 psf

WIND LOADS
MWFRS
BASIC WIND SPEED 90 mph
IMPORTANCE FACTOR Iw 1.0
OCCUPANCY CATEGORY II
WIND EXPOSURE B
INTERNAL PRESSURE COEFFICIENT +/- .18

SEISMIC LOADS
OCCUPANCY CATEGORY II
SEISMIC IMPORTANCE FACTOR 1.0
Ss 0.159
S1 0.056
SITE CLASS D
Sds 0.170
Sd1 0.090
SEISMIC DESIGN CATEGORY B

GENERAL

THE STRUCTURAL DRAWINGS ARE TO BE USED IN CONJUNCTION WITH THE ARCHITECTURAL, MECHANICAL AND ELECTRICAL DRAWINGS. REFERENCE MUST BE MADE TO ALL BID DOCUMENTS AS WELL AS THE PROJECT SPECIFICATIONS.
THE CONTRACTOR SHALL COORDINATE WITH THE MECHANICAL AND ARCHITECTURAL DRAWINGS AND WITH THE MECHANICAL CONTRACTOR, THE LOCATION OF ALL MECHANICAL EQUIPMENT.
THE CONTRACTOR SHALL NOTIFY THE ARCHITECT IF THE WEIGHT OF MECHANICAL UNITS ETC. ARE DIFFERENT FROM THE WEIGHTS POSTED ON THE DESIGN DRAWINGS.
DISCREPANCIES SHALL BE RESOLVED BEFORE PROCEEDING WITH CONSTRUCTION.
THE CONTRACTOR SHALL NOTIFY THE ARCHITECT/ENGINEER IMMEDIATELY OF ANY DISCREPANCIES TO AVOID THE POSSIBILITY OF UNNECESSARY FUTURE PROBLEMS AND POSSIBLE FIELD ORDERS. FAILURE TO DO SO WILL PUT THE FULL RESPONSIBILITY OF CORRECTION ON THE CONTRACTOR.
THE CONTRACTOR SHALL COORDINATE THE WORK OF ALL TRADES AND MAKE NECESSARY INVESTIGATIONS AND FIELD MEASUREMENTS.
DO NOT SCALE DRAWINGS.
THE STRUCTURAL ENGINEER HAS NO SUPERVISORY RESPONSIBILITY, HAS NO CONTROL OF OR RESPONSIBILITY FOR THE MEANS, METHODS, TECHNIQUES, PROCEDURES OR SEQUENCE OF CONSTRCUCTION. HAS NO RESPONSIBILITY FOR THE FAILURE OF ANY CONTRACTOR TO PERFORMTHE WORK IN ACCORDANCE WITH THE DESIGN DOCUMENTS AND NO RESPONSIBILITY TO DEVISE, IMPLEMENT OR ENFORCE ANY SAFETY PRECAUTIONS OR PROGRAMS FOR THE PROJECT.

EXCAVATION

CONTRACTOR SHALL LOCATE ALL EXISTING BELOW GRADE UTILITIES AND INERFERENCES PRIOR TO START OF WORK. NOTIFY THE ARCHITECT OF ANY INTERFERENCES.
STRIP TOPSOIL OVER THE ENTIRE BUILDING AREA.
FOUNDATIONS SHALL BEAR AT SUFFICIENT DEPTH TO PROVIDE ADEQUATE FROST COVERAGE PER LOCAL REQUIREMENTS. IN NO CASE SHALL DEPTHS BE LESS THAN THE MINIMUM DEPTHS SHOWN ON PLANS AND DETAILS.
MAINTAIN ALL EXCAVATIONS FREE OF WATER CONTINUOUSLY.
BACKFILL BEHIND EXTERIOR WALLS ON THE OUTSIDE OF THE BUILDING WITH COMPACTED GRANULAR FILL PLACED IN 10" LOOSE LIFTS COMPACTED TO 85% OF MAXIMUM DENSITY.
BACKFILL ON INSIDE OF BUILDING WITH COMPACTED GRANULAR FILL PLACED IN 10" LOOSE LIFTS COMPACTED TO 95% OF MAXIMUM DENSITY.
REFER TO REPORT BY RUBINO ENGINEERING DATED JUNE 30, 2017, FOR ADDITIONAL DETAILS AND GEOTECHNICAL REQUIREMENTS.

SHORING AND UNDERPINNING FOUNDATIONS

ALL SHORING OF EXISTING FOUNDATIONS REQUIRED BY THE CONTRACTOR DUE TO EXCAVATIONS NEAR EXISTING STRUCTURES AND UNDERPINNING OF EXISTING FOUNDATIONS AS INDICATED ON THE DESIGN DRAWINGS SHALL BE DESIGNED BY THE CONTRACTOR'S GEOTECHNICAL AND LICENSED STRUCTURAL ENGINEERS. ANY UNDERPINNING PROCEDURES INDICATED ON THE DESIGN DRAWINGS ARE CONCEPTUAL ONLY AND SHALL BE CONFIRMED BY THE CONTRACTOR'S GEOTECHNICAL AND STRUCTURAL ENGINEERS. SUBMIT SHORING AND UNDERPINNING PROCEDURES AND SEALED CALCULATIONS TO THE ARCHITECT FOR RECORD PURPOSES ONLY.

CONCRETE

GENERAL REQUIREMENTS
ALL WORK SHALL CONFORM TO ALL REQUIREMENTS OF ACI 301-02, SPECIFICATION FOR STRUCTURAL CONCRETE, EXCEPT AS MODIFIED BY THE REQUIREMENTS OF THE CONTRACT DOCUMENTS.

SUBMITTALS
CONCRETE MIXES WITH HISTORICAL TEST DATA.
MATERIAL CERTIFICATES: CEMENT, AGGREGATES, ADMIXTURES, REINFORCING STEEL
REINFORCING STEEL PLACEMENT DRAWINGS

PRODUCTS
REINFORCING BARS: ASTM A615 GRADE 60
REINFORCING BARS WELDABLE: ASTM A706 GRADE 60
PLAIN WIRE FABRIC: ASTM A185
PORTLAND CEMENT: ASTM C150 TYPE I OR II.
AGGREGATES: ASTM C33
WATER: POTABLE ASTM C94
ADMIXTURES
AIR ENTRAINING ASTM C260
CHEMICAL ADMIXTURES ASTM C 494
AIR CONTENT FOR CONCRETE EXPOSED TO WEATHER: 4 TO 7%.
SLUMP: 4"
CONCRETE STRENGTH: F'C 4,000 PSI AT 28 DAYS.
MIXING PER ASTM C94
CURING COMPOUNDS: ASTM C309 OR C1315

EXECUTION
CONCRETE COVER
CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH 3"
CONCRETE EXPOSED TO EARTH OR WEATHER 2"
CONCRETE NOT EXPOSED TO WEATHER 1-1/2"
ALL FOOTINGS, WALL FOOTINGS, GRADE BEAMS AND PILE/CAISSON CAPS SHALL BE FORMED UNLESS NOTED.
LAP SPLICE LENGTHS PER ACI 318 CHAPTER 12 USING A CLASS B SPLICE. ALL WELDED WIRE FABRIC SHALL BE LAPPED ONE GRID MINIMUM
ALL SLAB-ON-GRADE CONSTRUCTION JOINTS SHALL BE KEYED; REINFORCING SHALL NOT PASS THROUGH. 24 HOURS MINIMUM BETWEEN ADJACENT POURS.
LOCATE JOINTS AS SHOWN ON PLANS; WHERE NOT SHOWN, CONTROL OR CONSTRUCTION JOINTS SHALL BE PLACED IN ACCORDANCE WITH ACI RECOMMENDATIONS I.E., A MAXIMUM PANEL SIZE (IN FEET) EQUAL TO APPROXIMATELY THREE TIMES THE THICKNESS OF THE SLAB (IN INCHES) IN BOTH DIRECTIONS.
HOOK ENDS OF BARS INTERRUPTED BY OPENINGS. HOOK TOP BARS AT ALL EDGES, AT ALL WALL AND SLAB OPENINGS, PROVIDE 2 #5 BARS X OPENING WIDTH PLUS 4 FEET (2 FEET EACH SIDE) EACH FACE, UNLESS SHOWN OTHERWISE.
PLACEMENT OF CONCRETE IN COLD WEATHER SHALL COMPLY WITH ACI306
PLACEMENT OF CONCRETE IN HOT WEATHER SHALL COMPLY WITH ACI305
TOLERANCES SHALL MEET ACI 117, ACI 301 AND ACI 318 AS A MINIMUM.

PRE-ENGINEERED BUILDING & COMPONENTS

THE PRE-ENGINEERED BUILDING SHALL BE DESIGNED FOR ALL REQUIRED LOADS DETERMINED BY ALL GOVERNING LOCAL, STATE AND NATIONAL CODES. IN NO INSTANCE SHALL THE DESIGN LOADS BE LESS THAN THOSE LISTED ABOVE UNDER STRUCTURAL LOADS. IN ADDITION TO THE LOADS LISTED ABOVE, THE FOLLOWING LOADS MUST BE INCLUDED:

ROOF COLLATERAL LOAD 10 PSF
SPRINKLER LOADS SEE MECHANICAL DRAWINGS
ROOF TOP UNITS SEE MECHANICAL DRAWINGS
HANGING LOADS SEE ARCHITECTURAL AND MECHANICAL DRAWINGS

LIMIT ROOF LIVE LOAD DEFLECTION TO L/240
LIMIT ROOF TOTAL DEFLECTION TO L/180
LIMIT LATERAL DEFLECTION OF WALLS FOR A 10 YEAR WIND TO L/240 TYPICAL AND L/600 AT BRICK VENEER LOCATIONS.
LIMIT STORY DRIFT OF FRAME FOR A 10 YEAR WIND TO H/240

BUILDING DESIGNER SHALL FOLLOW ACI 318 APPENDIX D SECTION D.8 FOR SPACING OF ANCHOR RODS ASSUMING SUPPLEMENTAL REINFORCEMENT IS NOT PROVIDED TO CONTROL SPLITTING. IN NO CASE SHALL ANCHOR RODS BE SPACED CLOSER THAN 6d (d = DIAMETER OF ANCHOR ROD).
MINIMUM EDGE DISTANCE FROM CONCRETE TO CENTER OF ANCHOR BOLTS SHALL BE 6d.
FOOTINGS AS SHOWN ARE FOR BIDDING PURPOSES ONLY, AND ARE BASED UPON ONE SPECIFIC BUILDING TYPE. ACTUAL FOOTINGS MAY DIFFER BASED UPON THE ACTUAL BUILDING MANUFACTURER SELECTED. THE CONTRACTOR SHALL SUBMIT FOUNDATION LOADS TO THE ARCHITECT/ENGINEER FOR VERIFICATION PRIOR TO EXCAVATION FOR AND PLACEMENT OF FOUNDATIONS. CONTRACTOR SHALL COORDINATE ANCHOR BOLT SIZES, SPACING, ETC. WITH REQUIREMENTS OF THE PRE-ENGINEERED BUILDING.
PRIOR TO FABRICATION, THE PRE-ENGINEERED BUILDING MANUFACTURER SHALL SUBMIT CALCULATIONS AND DRAWINGS PREPARED UNDER THE DIRECT SUPERVISION OF, AND SEALED BY AN ILLINOIS LICENSED STRUCTURAL ENGINEER FOR REVIEW.
SUBMITTALS
COLUMN LOADS (NON-FACTORED ALLOWABLE STRENGTH DESIGN) BROKEN DOWN INTO EACH LOAD CASE. THE ORIENTATION OF ALL LOADS MUST BE CLEARLY DEFINED ALONG WITH THE DESCRIPTION OF THE LOAD, i.e., DEAD, LIVE, SNOW, COLLATERAL, WIND, ETC.
ANCHOR ROD LAYOUT PLAN AND DETAILS.

SLEEVES, ANCHORAGES, OPENINGS, ETC.

IN GENERAL, STRUCTURAL DRAWINGS DO NOT SHOW EQUIPMENT PADS, DRAINS, HOLES, ANCHORAGES, INSERTS AND SLEEVES FOR ITEMS PASSING THROUGH OR ATTACHED TO CONCRETE OR FRAMING. REFER TO ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS AND PROJECT SPECIFICATIONS.
ADJUST EQUIPMENT PADS AND SUBFRAMING TO FIT EQUIPMENT FURNISHED.
PROVIDE SUBFRAMING FOR EQUIPMENT SUPPORTED ON OR SUSPENDED FROM THE STRUCTURE.

STRUCTURAL STABILITY AND CONSTRUCTION

INDIVIDUAL STRUCTURAL COMPONENTS ARE DESIGNED TO SUPPORT LOADS IN THEIR FINAL ERECTED POSITION AS PART OF THE TOTAL COMPLETED STRUCTURE.
PROVIDE TEMPORARY GUYING AND BRACING AS REQUIRED UNTIL ALL CONSTRUCTION AFFECTING LATERAL STABILITY IS COMPLETED.
CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR STABILITY OF STRUCTURE, ITS PARTS AND JOB SITE SAFETY BY USE OF GUYING, BRACING, SHORING, BARRICADES, SAFETY RAILINGS AND DEVICES DURING THE ENTIRE PERIOD OF CONSTRUCTION.

SHOP DRAWINGS AND TEST REPORTS

GENERAL CONTRACTOR SHALL CHECK ALL SHOP DRAWINGS BEFORE SUBMITTAL TO ARCHITECT/ENGINEER FOR REVIEW.
REVIEW BY ARCHITECT/ENGINEER WILL BE FOR CONFORMANCE TO GENERAL LAYOUT AND DESIGN INTENT ONLY. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ACCURACY OF DIMENSIONS, FABRICATION, FIT UP OF PARTS AND BILLS OF MATERIALS. CONTRACTOR SHALL COORDINATE WORK OF VARIOUS TRADES AND MAKE NECESSARY FIELD MEASUREMENTS.

THE CONTRACT SPECIFICATIONS PROVIDE A COMPLETE LISTING OF SUBMITTALS. THE FOLLOWING IS A SUMMARY OF THE REQUIRED SUBMITTALS:

CONCRETE
PRODUCT DATA SHEETS
PROPOSED CONCRETE MIX DESIGNS WITH ASSOCIATED HISTORICAL TEST DATA.
MATERIAL CERTIFICATIONS
REINFORCING STEEL PLACEMENT DRAWINGS PER ACI 315
FIELD QUALITY CONTROL TESTS: SLUMP, AIR CONTENT, COMPRESSIVE STRENGTH ETC.
PRE-ENGINEERED WOOD BUILDING
PRODUCT DATA SHEETS
MATERIAL CERTIFICATIONS
SHOP DRAWINGS
DESIGN CALCULATIONS SIGNED AND SEALED BY STRUCTURAL ENGINEER.
GALLERY WORK (HANDRAIL/GUARD RAIL/LADDERS ETC)
PRODUCT DATA SHEETS
MATERIAL CERTIFICATIONS
STRUCTURAL STEEL SHOP DRAWINGS
DESIGN CALCULATIONS SIGNED AND SEALED BY PROFESSIONAL ENGINEER.
UNDERPINNING SHORING PROCEDURES AND SEALED CALCULATIONS

DESIGN DELEGATION
CERTAIN COMPONENTS OF THE COMPLETED CONSTRUCTION ARE BEING DESIGN DELEGATED TO THE MANUFACTURER OF THE COMPONENT. THE FOLLOWING ARE DESIGNATED TO BE DESIGN DELEGATED ON THIS PROJECT
TEMPORARY SHORING AND BRACING
TEMPORARY EARTH RETENTION SYSTEMS
PRE-ENGINEERED WOOD BUILDING
GUARDRAIL, HANDRAIL, LADDERS, ETC.
OTHER WORK AS LISTED ON DRAWINGS, SPECIFICATIONS AND CUSTOMARY INDUSTRY STANDARDS.
WHERE DELEGATION OF DESIGN IS SPECIFIED, THE MANUFACTURER SHALL BE RESPONSIBLE FOR RETAINING THE SERVICES OF A LICENSED STRUCTURAL ENGINEER IN THE STATE HAVING JURISDICTION IS LOCATED. THE LICENSED STRUCTURAL ENGINEER SHALL DESIGN AND DETAIL COMPONENTS TO MEET GOVERNING BUILDING CODES, STANDARDS AND THE SPECIFIED PERFORMANCE CRITERIA. SIGNED AND SEALED CALCULATIONS SHALL BE SUBMITTED FOR RECORD. THE DESIGN DELEGATED STRUCTURAL ENGINEER SHALL BE SOLELY RESPONSIBLE FOR THE DESIGN OF THE COMPONENT.

STRUCTURAL TESTS AND INSPECTIONS (IBC 2006)

ALL TESTS AND INSPECTIONS SHALL BE PERFORMED BY AN INDEPENDENT TESTING AND INSPECTION AGENCY IN ACCORDANCE WITH CHAPTER 17 OF IBC 2006. THE SPECIAL INSPECTOR SHALL OBSERVE THE WORK ASSIGNED FOR CONFORMANCE TO THE APPROVED DESIGN DRAWINGS AND SPECIFICATIONS.

THE SPECIAL INSPECTOR SHALL FURNISH INSPECTION REPORTS TO THE BUILDING OFFICIAL AND THE ENGINEER OF RECORD OR ARCHITECT OF RECORD. ALL DISCREPANCIES SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE CONTRACTOR FOR CORRECTION. IF UNCORRECTED, THE SPECIAL INSPECTOR SHALL NOTIFY THE BUILDING OFFICIAL AND THE ENGINEER OR ARCHITECT OF RECORD.

THE SPECIAL INSPECTOR SHALL SUBMIT A FINAL REPORT STATING WHETHER THE WORK REQUIRING SPECIAL INSPECTION WAS IN CONFORMANCE WITH THE APPROVED PLANS AND SPECIFICATIONS AND THE APPLICABLE WORKMANSHIP PROVISIONS OF THIS CODE.

JOB SITE VISITS BY THE STRUCTURAL ENGINEER OF RECORD DOES NOT CONSTITUTE AN OFFICIAL SPECIAL INSPECTION.

THE FOLLOWING LIST OF MATERIALS AND WORK REQUIRE SPECIAL INSPECTIONS

		VERIFICATION AND INSPECTION	YES	
			CONTINUOUS	PERIODIC
1		**CONCRETE CONSTRUCTION (IBC 1705.4)**		
	A	Inspection of reinforcing steel		X
	B	Inspection of bolts installed in concrete	X	
	C	Verify use of required mix design		X
	D	Sampling fresh concrete and performing slump, air content and determining the temperature of fresh concrete at time of making specimens for strength tests.	X	
	E	Inspection of concrete placement	X	
	F	Inspection for maintenance of specified curing techniques		X
2		**WOOD CONSTRUCTION (IBC - 1704.6)**		
	A	VERIFY, SIZE, SPECIES AND GRADE OF LUMBER/SHEATHING COMPLIES WITH CONSTRUCTION DOCUMENTS		X
	B	VERIFY NAILING OF DIAPHRAM ROOF DECK AND SHEAR WALLS COMPLIES WITH CONSTRUCTION DOCMENTS		X
	C	VERIFY WOOD SHEAR WALL HOLD DOWNS CONFORM TO CONSTRUCTION DOCUMENTS	X	
3		**SOILS (IBC - 1705.70**		
	A	Verify site has been prepared in accordance with approved soils report.		X
	B	Fill placement - verify material, maximum lift thickness and compaction of fill are in accordance with the soils report.		X
	C	Verify in place dry density of fill complies with soils report.		X
	D	Confirm allowable soil bearing pressure complies with soils report.	X	

COMBINED AREA FIRE TRAINING FACILITY
851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

WOLD | RUCK PATE
110 North Brockway, Suite 220
Palatine, Illinois 60067
woldac.com | 847 241 6100

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **ENGINEER** under the laws of the State of **Illinois**

Engineers Name
License Number: **081-005394** Date **Issue Date**

Revisions

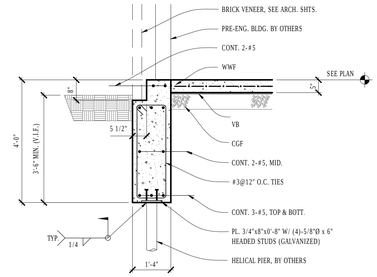
Description	Date	Num
Issued for Bidding	07/07/17	

Comm: **173013**
Date: **07/07/2017**
Drawn: **PW**
Check: **KA**
North

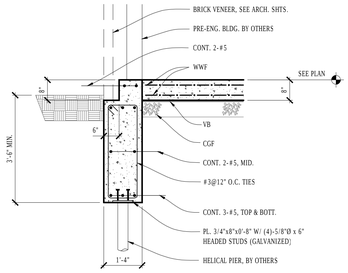
STRUCTURAL GENERAL NOTES

Scale: **As Indicated**

S0.10



9 S1.10 SECTION
SCALE: 1/2" = 1'-0"



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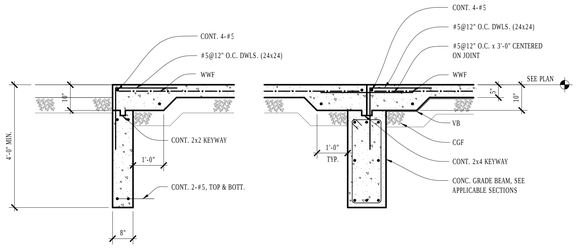
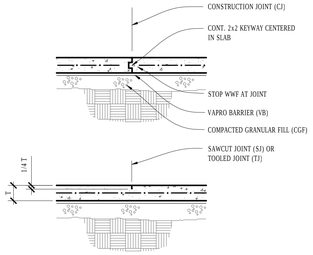
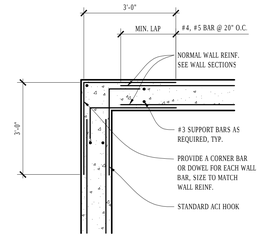


5 S1.10 STOOP SECTION
SCALE: NONE

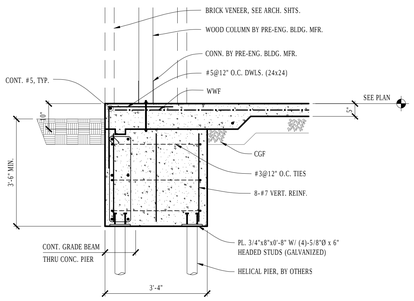


SEE PLAN FOR JOINT TYPES & LOCATIONS
400 SQ. FT. SLAB AREA WITHIN JOINTS MAX., U.N.

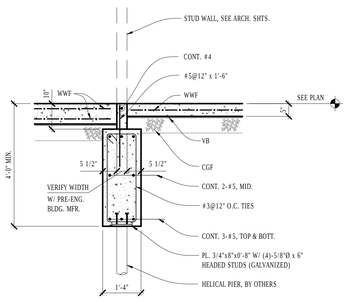
3 S1.10 TYP. SLAB JOINTS
SCALE: NONE



1 S1.10 TYP. BEAM CORNER
SCALE: NONE



14 S1.10 SECTION
SCALE: 1/2" = 1'-0"



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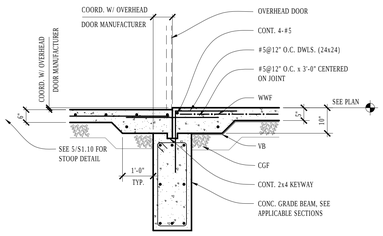

6 S1.10 SECTION
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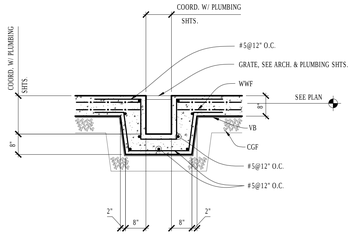
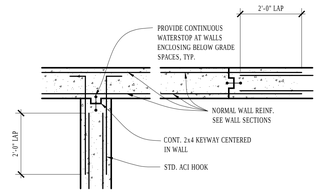
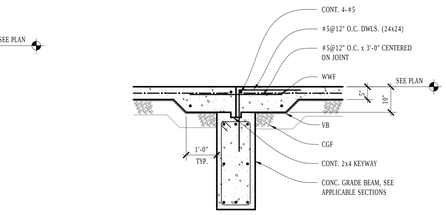


4 S1.10 TRENCH DRAIN
SCALE: NONE

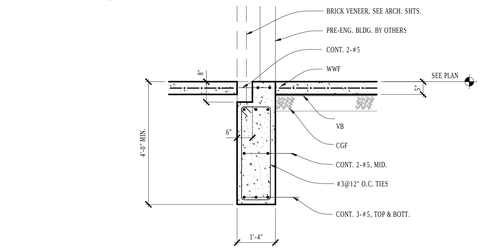


PROVIDE CONCRETE WALL JOINTS @ 40'-0" O.C., MAX.

2 S1.10 TYP. BEAM JOINTS
SCALE: NONE



7 S1.10 SECTION
SCALE: 1/2" = 1'-0"



10 S1.10 SECTION
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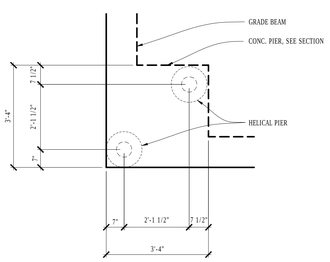
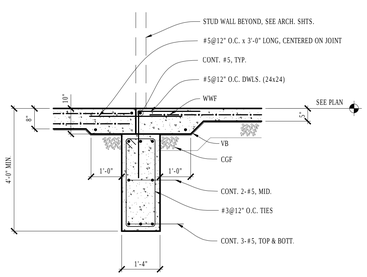
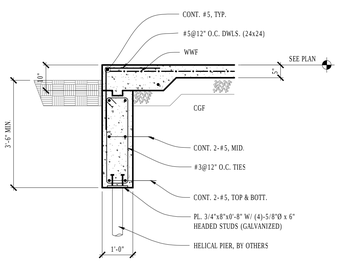


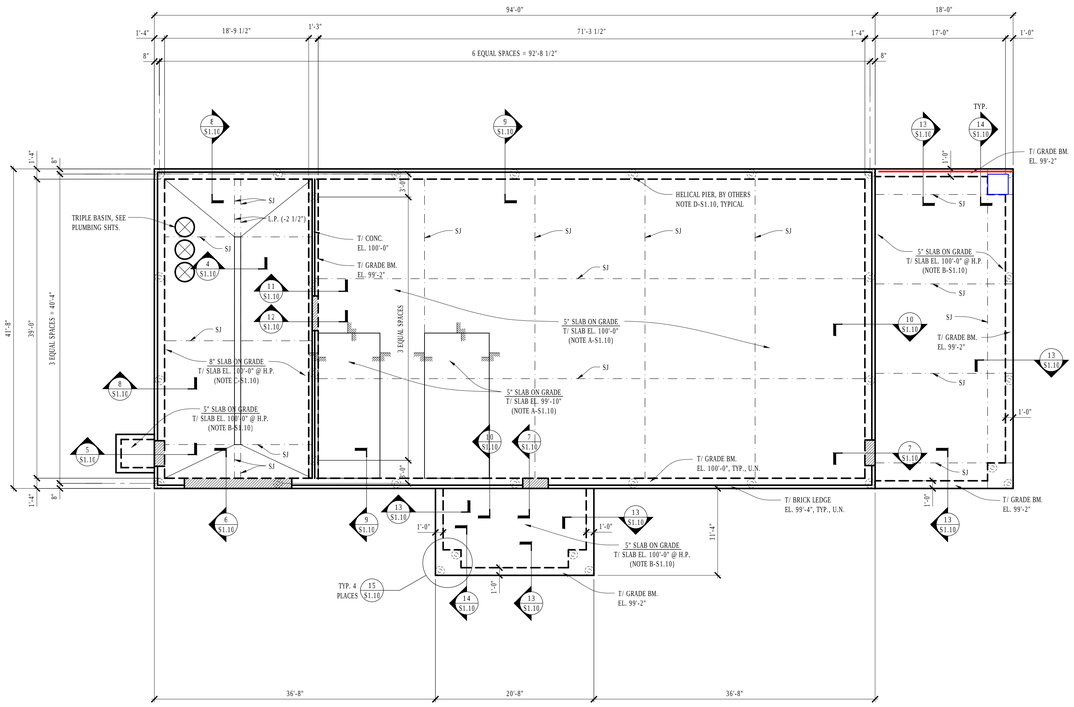
15 S1.10 DETAIL
SCALE: 1/2" = 1'-0"



12 S1.10 SECTION
SCALE: 1/2" = 1'-0"



13 S1.10 SECTION
SCALE: 1/2" = 1'-0"



DRAWING S1.10 GENERAL NOTES:

: INDICATES TOP OF FOUNDATION WALL TO BE DEPRESSED, SEE APPLICABLE SECTION

DRAWING S1.10 KEYNOTES:

A-S1.10: PROVIDE 5" SLAB ON GRADE REINFORCED WITH 6x6-W2.1xW2.1 WELDED WIRE FABRIC. PLACE SLAB ON VAPOR BARRIER OVER 6" OF COMPACTED GRANULAR FILL. SLOPE SLAB TO FLOOR DRAINS. SEE ARCHITECTURAL AND PLUMBING SHEETS FOR DRAIN LOCATIONS AND SLOPE.

B-S1.10: PROVIDE 5" SLAB ON GRADE REINFORCED WITH 6x6-W2.1xW2.1 WELDED WIRE FABRIC. PLACE SLAB OVER 6" OF COMPACTED GRANULAR FILL. SLOPE SLAB TO DRAIN AWAY FROM BUILDING. SEE ARCHITECTURAL SHEETS FOR DRAINAGE SLOPE.

C-S1.10: PROVIDE 8" SLAB ON GRADE REINFORCED WITH 2 LAYERS OF 6x6-W2.9xW2.9 WELDED WIRE FABRIC. PLACE SLAB ON VAPOR BARRIER OVER 6" COMPACTED GRANULAR FILL. SLOPE SLAB TO FLOOR DRAINS. SEE ARCHITECTURAL AND PLUMBING SHEETS FOR DRAIN LOCATIONS AND SLOPE.

D-S1.10: HELICAL PIER BY FOUNDATION CONTRACTOR. EACH PILE SHALL HAVE AN ALLOWABLE VERTICAL DESIGN CAPACITY OF 40 k WITH A MINIMUM FACTOR OF SAFETY OF 2. PILES SHALL BE PLACE AT CENTERLINE OF FOUNDATION WALL, U.N.O.. ADDITIONAL PIERS SHALL BE ADDED AS REQUIRED TO ACHIEVE LOADS INDICATED.

N

FOUNDATION PLAN
SCALE: 1/8" = 1'-0"

COMBINED AREA FIRE TRAINING FACILITY
851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

Wold
RUCK PATE
WOLD | RUCK PATE
110 North Brockway, Suite 220
Palatine, Illinois 60067
woldac.com | 847 241 6100

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **ENGINEER** under the laws of the State of **Illinois**

Engineers Name
License Number: **081-005394** Date **Issue Date**

Revisions

Description	Date	Num
Issued for Bidding	07/07/17	

Comm: **173013**
Date: **07/07/2017**
Drawn: **PW**
Check: **KA**
North

FOUNDATION PLAN AND DETAILS

Scale: **As Indicated**

S1.10

MN

SPRINKLER SYSTEM HANGER NOTES

1. SPRINKLER SYSTEMS SHALL BE INSTALLED WITH HANGARS AND BRACING ACCORDING TO NFPA 13 REQUIREMENTS FOR THE SEISMIC ZONE OF THE PROJECT'S LOCATION. FORM THE EDITION YEAR REFERENCED IN THE CODE THAT IS RECOGNIZED BY THE AUTHORITY HAVING JURISDICTION.
2. THE UNSUPPORTED LENGTH BETWEEN THE END SPRINKLER AND THE LAST HANGAR SHALL NOT EXCEED 36" FOR 1" DIAMETER (DIA.) PIPES, 48" FOR 1-1/4" DIA. PIPES AND 60" FOR 1-1/2" DIA. PIPES.
3. MAXIMUM DISTANCES BETWEEN HANGARS SHALL NOT EXCEED 12'-0" FOR 1" AND 1-1/4" DIA. PIPES AND 15'-0" FOR 1-1/2" THROUGH 8" DIA. PIPES.
4. SPRINKLER PIPES 1" TO 4" DIA. SHALL BE SUPPORTED BY 3/8" ALL THREAD RODS AND 3/8" HANGER ASSEMBLIES.
5. SPRINKLER PIPES 5" THOUGH 8" DIA. SHALL BE SUPPORTED BY 1/2" ALL THREAD RODS AND 1/2" HANGER ASSEMBLIES.
6. THERE SHALL NOT BE LESS THAN 1 HANGER PER PIPE SECTION.
7. WHEN THE MAXIMUM PRESSURE AT THE SPRINKLER EXCEEDS 100 PSI AND A BRANCH LINE ABOVE THE CEILING SUPPLIES SPRINKLERS IN A PENDENT POSITION BELOW THE CEILING, THE HANGER ASSEMBLY SUPPORTING THE PIPE SUPPLYING AN END SPRINKLER IN A PENDENT POSITION SHALL BE OF A TYPE THAT PREVENTS UPWARD MOVEMENT OF THE PIPE.
8. ALL ARM OVERS GREATER THAN 24" TO SPRINKLER DROP NIPPLES SHALL BE SUPPORTED BY A HANGER. WHEN THE MAXIMUM PRESSURE AT THE SPRINKLER EXCEEDS 100 PSI, THE HANGER ASSEMBLY SUPPORTING THE ARM OVER TO THE SPRINKLER IN A PENDENT POSITION SHALL BE OF A TYPE THAT PREVENTS UPWARD MOVEMENT OF THE PIPE.

FIRE PROTECTION HYDRAULIC DESIGN CRITERIA SCHEDULE.

NOTES:
1.CONSTRUCTION IS CONSIDERED TO BE NON-COMBUSTIBLE, UNOBSTRUCTED

ROOM FUNCTION	OCCUPANCY HAZARD CLASSIFICATION	FLOW DENSITY (GPM/SQ.FT.)	MINIMUM AREA OF APPLICATION	MAXIMUM COVERAGE PER SPRINKLER	SPRINKLER TYPE	SPRINKLER TEMPERATURE RATING
MECHANICAL ROOMS	ORDINARY HAZARD GRP-1	0.15	1500 SF	130 SF	UPRIGHT OR PENDANT	WET SYSTEM: 212°F
ELECTRICAL EQUIPMENT ROOMS	ORDINARY HAZARD GRP-1	0.15	1500 SF	130 SF	UPRIGHT OR PENDANT	WET SYSTEM: 212°F
ELECTRICAL AND TELEPHONE CLOSETS	ORDINARY HAZARD GRP-1	0.15	1500 SF	130 SF	CONCEALED	WET SYSTEM: 212°F
STORAGE ROOMS, JANITORS CLOSETS	ORDINARY HAZARD GRP-2	0.20	1500 SF	130 SF	UPRIGHT, PENDANT, OR CONCEALED	WET SYSTEM: 212°F
CORRIDORS, OFFICES, ELEVATOR LOBBIES, TOILETS CLOSETS, CONFERENCE, LOUNGES, SHOWERS, LOCKERS, DRESSING, AND WAITING.	LIGHT HAZZARD	0.10	1500 SF	225 SF	QUICK RESPONSE, CONCEALED	WET SYSTEM: 165°F
UNFINISHED SHELL, WORK AREAS	LIGHT HAZZARD	0.10	1500 SF	225 SF	UPRIGHT OR PENDANT	WET SYSTEM: 165°F
STAIRWAYS	LIGHT HAZZARD	0.10	1500 SF	225 SF	QUICK RESPONSE UPRIGHT OR PENDANT	WET SYSTEM: 165°F
EXAM, PROCEDURE, PATIENT CARE	LIGHT HAZZARD	0.10	1500 SF	225 SF	QUICK RESPONSE, CONCEALED	WET SYSTEM: 165°F

FIRE PROTECTION BACKFLOW PREVENTOR SCHEDULE

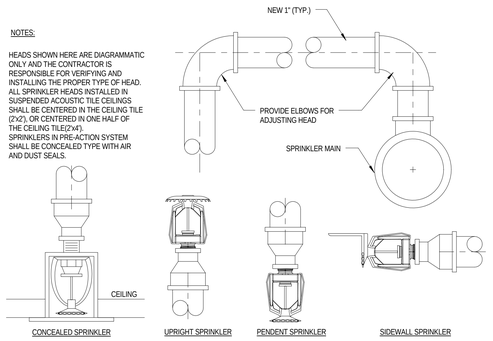
TAG	QTY	SIZE	MANUFACTURER	MODEL	DISCRIPTION	RATED CONDITIONS	
						FLOW	PRESSURE
FPBFP-1	1	4"	AMES	LFM300 OSY	DCDA DOUBLE CHECK DETECTOR ASSEMBLY WITH OUTSIDE STEM AND YOKE RESILIENT SEATED GATE VALVE	500 GPM	3.80 psi

DRY VALVE SCHEDULE

MARK	MANUFACTURER	MODEL	DRY CONNECTION	WET CONNECTION	DESCRIPTION
DV 1	VICTAULIC	768N	4"	4"	FIRELOCK ALARM CHECK VALVE. PROVIDE WITH VICTAULIC SERIES 7C7 AIR MAINTENANCE / COMPRESSOR ASSEMBLY TO BE MOUNTED ON RISER. 1/2 HP 115V-1Ø, 6.6 AMPS.

NOTES:

1. HEADS SHOWN HERE ARE DIAGRAMMATIC ONLY AND THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING AND INSTALLING THE PROPER TYPE OF HEAD.
2. ALL SPRINKLER HEADS INSTALLED IN SUSPENDED ACOUSTIC TILE CEILINGS SHALL BE CENTERED IN THE CEILING TILE (2'x2'), OR CENTERED IN ONE HALF OF THE CEILING TILE(2'x4').
3. SPRINKLERS IN PRE-ACTION SYSTEM SHALL BE CONCEALED TYPE WITH AIR AND DUST SEALS.



5 SPRINKLER HEAD TYPES
NOT TO SCALE

GENERAL FIRE PROTECTION NOTES

1. ALL WORK SHALL COMPLY WITH NFPA 13, LOCAL BUILDING CODES, AND ALL BUILDING STANDARDS.
2. NEW DRY-SPRINKLER SYSTEM PIPING SHALL BE GALVANIZED STEEL PIPE NO LESS THAN SCHEDULE 40.
3. SYSTEM SHALL BE TESTED AND FLUSHED IN ACCORDANCE WITH NFPA, THE FIRE INSURANCE CARRIER, AND THE LOCAL BUILDING DEPARTMENT.
4. FIRE PROTECTION CONTRACTOR SHALL OBTAIN THE RESULTS FOR A FLOW TEST PERFORMED WITHIN THE LAST 6 MONTHS OR SHALL PERFORM A NEW FLOW TEST.
5. EXTEND 1" STEEL PIPE FROM EXISTING MAINS TO NEW SPRINKLERS.
6. ALL NEW SYSTEMS SHALL BE TESTED HYDROSTATICALLY AT NOT LESS THAN 300 POUNDS PER SQUARE INCH FOR TWO HOURS OR AT 50 POUNDS PER SQUARE INCH IN EXCESS OF THE MAXIMUM STATIC PRESSURE WHEN THE MAXIMUM STATIC PRESSURE IS IN EXCESS OF 150 POUNDS. TESTS SHALL BE WITNESSES BY OWNER'S REPRESENTATIVE AND THE AUTHORITY HAVING JURISDICTION.
7. PROVIDE SYSTEM LOW POINT DRAINS AND AUXILIARY DRAINS AS NECESSARY.
8. THE OWNER SHALL PROVIDE A MINIMUM 40°F AMBIENT TEMPERATURE THROUGHOUT ALL AREAS OF THE BUILDING WHERE WET PIPE SPRINKLER SYSTEMS ARE PROVIDED. WET SPRINKLER PIPING SHALL NOT BE ROUTED THRU AREAS SUBJECT TO FREEZING.
9. DELIVER MATERIAL TO THE JOB SITE, UNLOAD AND STORE IT IN A LOCATION AS DETERMINED BY THE OWNER'S REPRESENTATIVE AS TO PREVENT DAMAGE TO MATERIAL.
10. THE SPRINKLER CONTRACTOR SHALL PROVIDE SPRINKLER PROTECTION UNDER ALL OBSTRUCTIONS, INCLUDING DUCTWORK, IN EXCESS OF 4'-0" WIDE IN EXPOSED STRUCTURE AREAS IN ACCORDANCE WITH NFPA #13 REQUIREMENTS.
11. SPRINKLER GUARDS SHALL BE PROVIDES FOR ALL SPRINKLERS 7'-0" OR LESS ABOVE FINISHED FLOOR AND IN AREAS SUBJECT TO MECHANICAL DAMAGE.
12. FIRE PROTECTION CONTRACTOR SHALL VERIFY SPRINKLER DESIGN CRITERIA WITH THE FIRE DEPARTMENT AND INSURANCE CARRIER PRIOR TO INSTALLATION OF SYSTEM(S).FIRE PROTECTION CONTRACTOR SHALL PREPARE HYDRAULIC CALCULATIONS AND SHOP DRAWINGS ("WORKING DRAWINGS") IN ACCORDANCE WITH NFPA 13 AND SUBMIT (4) FOUR COMPLETE SETS TO THE FIRE PREVENTION BUREAU, TO THE FIRE INSURANCE CARRIER FOR REVIEW AND/OR PRIOR TO FABRICATION OR INSTALLATION OF SYSTEM. THE SHOP DRAWINGS SHALL INCLUDE THE FOLLOWING INFORMATION AS APPLICABLE TO THE WORK SPACE: (A) FLOW TEST RESULTS AT SUPPLY CONNECTION. (B) FLOW AND PRESSURE REQUIRED AND AVAILABLE AT BASE OF RISERS. (C) TYPE OF PIPE, FITTINGS, TYPE OF JOINTS, DIMENSIONS AND LENGTHS OF PIPE. (D) AREA OF COVERAGE FOR EACH SPRINKLER. (E) NUMBER, TYPE, AND TEMPERATURE RATING FOR ALL SPRINKLER HEADS. (F) BUILDING OCCUPANCY INCLUDING BUILDING USE AND/OR COMMODITY STORED. (G) SECTION AND PLAN VIEWS OF RACK STORAGE, IF ANY. (H) STORAGE HEIGHTS OR RACK STORAGE. (I) DESCRIPTION OF SPECIAL SYSTEMS, INCLUDING VALVES AND TRIM. (J) LOCATION OF GAUGES, MAIN DRAINS, AUXILIARY DRAINS, AND TEST VALVES. (K) ARRANGEMENT OF FIRE DEPARTMENT CONNECTION INCLUDING DRAINAGE, THREADS, AND MOUNTING HEIGHT. (L) STATEMENT INDICATING THAT TESTS AND SLUSHING WILL BE COMPLETED. (M) HOSE RACK LAYOUT. (N) DETAIL AND LOCATION OF PIPE HANGARS. (O) INDICATE WHICH VALVES WILL HAVE TAMPER SWITCHES. (P) FLOW SWITCHES. (Q) PORTABLE FIRE EXTINGUISHER LAYOUT.
13. SUBMIT (4) FOUR SETS OF COMPLETE SHOP DRAWINGS TO THE OWNER (INCLUDING CATALOG CUTS AND HYDRAULIC CALCULATIONS) FOR REVIEW PRIOR TO FABRICATION AND/OR INSTALLATION OF THE WORK.
14. CONTRACTOR SHALL VISIT THE CONSTRUCTION SITE AND FAMILIARIZE HIMSELF WITH THE LOCAL CONDITIONS OF THE PROJECT AREA AND IDENTIFY CONDITIONS HE BELIEVES MAY IMPEDE THE EFFICIENT PERFORMANCE OF HIS CONTRACT REQUIREMENTS. SUBMISSION OF BID SHALL REPRESENT EVIDENCE THAT SUCH AN INSPECTION HAS BEEN MADE AND THAT CONDITIONS UNDER WHICH THE WORK IS TO BE INSTALLED, ARE SATISFACTORY TO THE CONTRACTOR. ADDITIONAL COMPENSATION FOR PREVIOUSLY EXISTING FIELD CONDITIONS, ARISING AFTER START OF WORK, THAT WERE NOT IDENTIFIED IN THE BID SUBMISSION, WILL BE DENIED.
15. THE MUNICIPAL WATER MAIN SHALL BE PROTECTED FROM BACKFLOW AND BACK SIPHONAGE CONDITIONS BY AN APPROVED BACKFLOW ASSEMBLY IN THE SERVICE ENTRANCE OR FIRE PUMP SUCTION PIPE, MEETING ALL THE REQUIREMENTS OF THE LOCAL WATER DEPARTMENT.
16. DESIGN WET SPRINKLER SYSTEMS HYDRAULICALLY FOR LIGHT AND ORDINARY HAZARD OCCUPANCIES, IN ACCORDANCE WITH BOTH THE REQUIRED AND ADVISORY PROVISIONS OF NFPA 13, AS MODIFIED BY THE LOCAL CODE AMENDMENTS, FROM THE EDITION YEAR REFERENCES IN THE BUILDING CODE THAT IS RECOGNIZED BY THE AUTHORITY HAVING JURISDICTION (AHJ).
17. THE DRAWINGS ARE DIAGRAMMATIC AND PROVIDED TO SUGGEST THE DESIRED ZONE DIVISIONS AND SYSTEM SEPARATIONS, THE ARRANGEMENT AND LOCATION OF MAINS, VALVES, EQUIPMENT, ALARMS, PANELS, DEVICES AND SYSTEM ATTACHMENTS, AND MAY NOT INDICATE ALL REQUIRED COMPONENTS NECESSARY FOR FINAL APPROVAL. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE EACH SYSTEM INSTALLATION TO INCLUDE ALL REQUIRED MATERIALS, ACCESSORIES AND EQUIPMENT INSIDE AND OUTSIDE OF THE BUILDING, NECESSARY TO PROVIDE EACH SYSTEM COMPLETE, TESTED AND IN WORKING ORDER, APPROVED BY THE AHJ AND READY FOR USE.
18. EACH FLOOR SHALL BE A SEPARATE SPRINKLER ZONE, ISOLATED FROM OTHER SYSTEMS BY A SUPERVISED CONTROL VALVE, ALARMED BY A WATER FLOW SWITCH AND ATTENDED BY AN INSPECTOR'S TEST AND DRAIN ASSEMBLY THAT IS PIPED TO A DRAIN RISER OR DISCHARGED OUTDOORS AT A LOCATION ACCEPTABLE TO THE AHJ.
19. WATER DISCHARGE FROM INDIVIDUAL SPRINKLERS IN THE HYDRAULICALLY MOST REMOTE AREAS SHALL BE BETWEEN 100% MINIMUM AND 125% MAXIMUM, OF THE CODE REQUIRED MINIMUM APPLICATION DENSITIES OR AS THE DRAWINGS SPECIFY, WHICHEVER IS GREATER, WITH A MAXIMUM PIPING VELOCITY THAT SHALL NOT EXCEED 20 FEET PER SECOND IN ANY PIPE SECTION. CALCULATIONS SHALL INCLUDE 250 GPM HOSE STREAM ALLOWANCE FIGURED AT THE BASE OF THE SPRINKLER RISER OR INCOMING WATER SERVICE ENTRANCE POINT.
20. DESIGN AND PROVIDE EACH SYSTEM GIVING FULL CONSIDERATION TO SPRINKLER SPRAY PATTERN OBSTRUCTIONS OF STRUCTURAL SUPPORT AND FRAMING, MEZZANINES, CONCEALED BLIND SPACES, AND ENCLOSED COMBUSTIBLE ROOF CONSTRUCTION.
21. DESIGN AND PROVIDE EACH SYSTEM GIVING FULL CONSIDERATION TO AVOIDING CONFLICTS WITH THE INSTALLATION WORK OF ALL OTHER TRADES, INCLUDING DUCTS, ELECTRICAL CONDUIT RUNS, ELECTRICAL AND HVAC EQUIPMENT AND PIPING. ARRANGE COMPONENTS AND EQUIPMENT AND ESTABLISH POSITIONS OF CONTROL VALVES, FLOW ALARMS, AND TESTDRAIN ASSEMBLIES TO MINIMIZE ACCESS PANELS AND PROVIDE ADEQUATE ACCESS SPACE FOR EQUIPMENT OPERATION, INSPECTION, TESTING, AND NORMAL MAINTENANCE. SPRINKLER PIPING MUST BE ROUTED TO ALLOW CLEAR ACCESS TO EQUIPMENT ABOVE.
22. FIRE STOP ALL PENETRATIONS OF FIRE RATED WALLS, PARTITIONS, AND FLOORS. PROVIDE A 2 PART MINIMUM, TESTED AND U.L. LISTED DETAIL, EQUAL TO THE RATING OF THE WALL OR FLOOR BEING PENETRATED.
23. PREPARE HYDRAULIC CALCULATIONS WITH A MINIMUM SAFETY FACTOR OF 10% OF THE STATIC PRESSURE (5 PSI MINIMUM), WITH DETAILED WORKING DRAWINGS, ACCORDING TO THE REQUIREMENTS OF NFPA 13 AND THE AHJ. COORDINATE INSTALLATION WITH ALL OTHER TRADES, ON SCALED PLANS SHOWING THE SERVICE ENTRANCE AND BACKFLOW PREVENTION ASSEMBLY, SPRINKLER POSITIONS, PIPING LAYOUTS, HANGAR LOCATIONS AND ATTACHMENT DETAILS, ELEVATIONS, AND SECTIONS OF THE SYSTEM'S PIPING LAYOUT, INDICATING ALL DATA ESSENTIAL FOR PROPER INSTALLATION. SHOW SCHEMATIC PIPING ARRANGEMENTS OF SPECIALTY VALVES, PIPE, FITTINGS, ALARM DEVICES, AND SWITCHES, INCLUDING ELECTRICAL AND WIRING DIAGRAMS.
24. SUBMIT PLANS AND HYDRAULIC CALCULATIONS FOR APPROVAL OF AHJ AND ENGINEER OF RECORD, ALONG WITH PRODUCT DATA SHEETS FOR ALL PIPE, FITTINGS, VALVES, EQUIPMENT AND SYSTEM ATTACHMENTS, PROPOSED FOR USE IN THE SYSTEM. EACH ITEM SHALL BARE A U.L. LISTING APPROPRIATE FOR THEIR INTENDED APPLICATION. INSTALLATION OF ANY WORK WITHOUT WRITTEN APPROVALS IS AT THE CONTRACTOR'S SOLE RISK AND ADDITIONAL COMPENSATION FOR ALL NECESSARY CHANGES SHALL BE DENIED.
25. PROVIDE PROTECTION TO FINISHED AREAS DURING THE INSTALLATION AND/OR DEMOLITION REQUIRED BY THIS PROJECT.

FIRE PROTECTION SYMBOLS

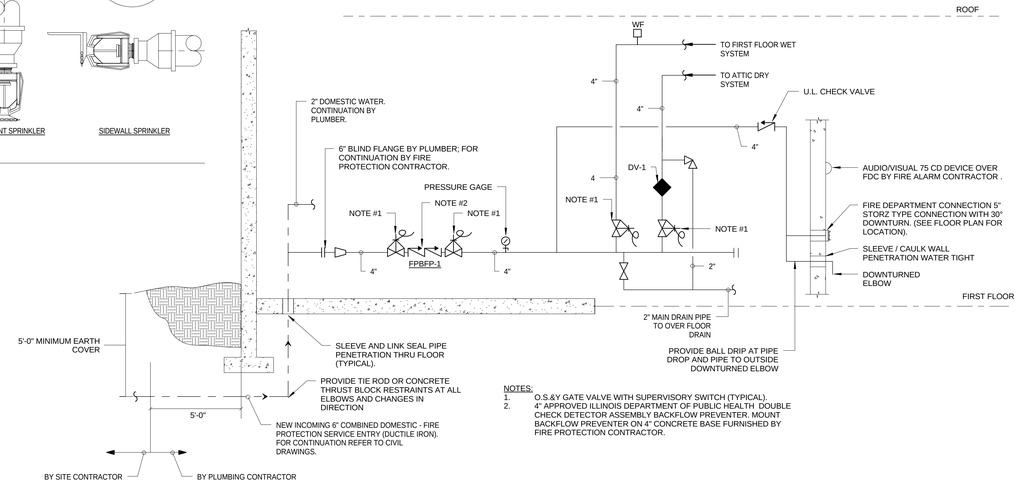
(NOTE: NOT ALL SYSMBOLS MAY BE REQUIRED OF THIS PROJECT.)

- ANGLE VALVE
- BALL VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- DRY VALVE ASSEMBLY — DV-XX VALVE TAG
- FIRE DEPARTMENT HOSE CONNECTION
- FLEX CONNECTION
- GATE VALVE - OS&Y
- HOSE END VALVE
- INCREASER/REDUCER
- NEW CONNECTION
- PIPE CAP
- PIPE CUT SYMBOL
- PRESSURE GUAGE
- PRESSURE REGULATING VALVE
- PUMP — P-1 PUMP TAG; T&P VALVE TYPE
- SAFETY RELIEF VALVE
- SHUT OFF VALVE
- STRIANER
- STRAINER WITH BLOW DOWN VALVE
- SUPERVISED INDICATING VAVLE
- UNION
- WF WATER FLOW SWITCH
- NEW CONNECTION
- DEMOLITION LIMIT
- KEY NOTE TAG — KEY NUMBER
- TYP EQUIPMENT TAG — EQUIPMENT TYPE; EQUIPMENT NUMBER
- MRK RISER TYPE — XX RISER TAG; XXX RISER NUMBER; SYSTEM ABBREVIATION
- 1" XXX PIPE TAG — PIPE SIZE
- PIPE RISE
- PIPE DROP

FIRE PROTECTION ABBREVIATIONS

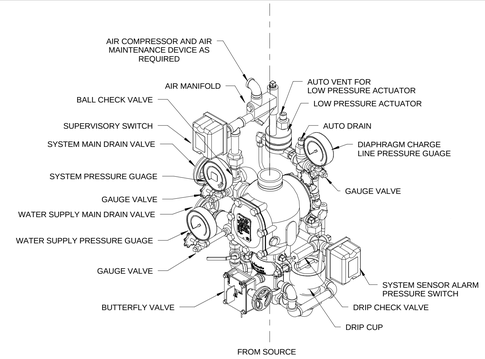
(NOTE: NOT ALL ABBREVIATIONS MAY BE REQUIRED OF THIS PROJECT.)

A	AMP
AD	ACCESS DOOR
ADA	AMERICANS WITH DISABILITIES ACT
AFF	ABOVE FINISH FLOOR
AHJ	AUTHORITY HAVING JUSTIDICTION
AI	ANALOG INPUT
APX	APROXIMATE
AO	ANALOG OUTPUT
ARCH	ARCHITECT
BAS	BUILDING AUTOMATION SYSTEM
BFV	BACK FLOW PREVENTER
BFV	BUTTERFLY VALVE
BHP	BREAK HORSE POWER
BI	BINARY INPUT
BMS	BUILDING MANAGEMENT SYSTEM
BO	BINARY OUTPUT
BTU	BRITISH THERMAL UNIT
BV	BALL VALVE
CA	COMPRESSED AIR
CD	CONDENSATE PIPING
CI	CAST IRON
CLG	CEILING
COV	CHAIN OPERATED VALVE
CPVC	CHLORINATED POLYVINYL CHLORIDE
CU IN	CUBIC INCH
CU FT	CUBIC FOOT
CW	COLD WATER
D	DRAIN
DCBP	DOUBLE CHECK VALVE
DCDA	DOUBLE CHECK VALVE DETECTOR ASSEMBLY
DDC	DIRECT DIGITAL CONTROL
DIA	DIAMETER
DN	DOWN
DS	DOWNSPOUT
DWG	DRAWING
EFF	EFFICIENCY
EL	ELEVATION
EX. (E)	EXITISTING
ETR	EXISTING TO REMAIN
EWT	ENTERING WATER TEMPERATURE
°F	DEGREE FAHRENHEIT
FD	FLOOR DRAIN
FLA	FULL LOAD AMPS
FP	FIRE PROTECTION / FIRE PUMP
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FPT	FEMALE PIPE THREAD
FS	FLOOR SINK
FT	FOOT / FEET
G	GAS (NATURAL)
GA	GAUGE
GAL	GALLON
GE	GROOVED END
GPM	GALLONS PER MINUTE
GPH	GALLON PER HOUR
HB	HOSE BIBB
HD	HUB DRAIN
HG	MERCURY
HP	HORSE POWER
HVAC	HEATING VENTILATING AND AIR CONDITIONING
I/O	INPUT OUTPUT
ID	INSIDE DIAMETER
IN	INCH, INCHES
IP	IRON PIPE
IPS	IRON PIPE SIZE
KW	KILOWATT
KO	KNOCK OUT
LBS	POIUNDS
LF	LINEAR FEET
LP	LIQUIFIED PETROLEUM
LRA	LOCKED ROTOR AMPS
MAX	MAXIMUM
MBH	THOUSAND BTU
MIN	MINIMUM
MOCP	MAXIMUM OVER-CURRENT PROTECTION
MOP	MAXIMUM OPERATING PRESSURE
MPT	MALE PIPE THREAD
N/A	NOT APPLICABLE
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NRS	NON-RISING STEM
NTS	NOT TO SCALE
OC	ON CENTER
ODP	OPEN DRIP PROOF
OS&Y	OUTSIDE STEM AND YOKE
OSD	OPEN SITE DRAIN
Ø	PHASE
P	PRESSURE / PUMP
PD	PRESSURE DROP
PE	POLYETHYLENE
P&ID	PIPING AND INSTRUMENTATION DRAWING
PPM	PARTS PER MILLION
PRV	PRESSURE REDUCING VALVE
PSI	POUND PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
R	RETURN
RLA	RUNNING LOAD AMPS
RM	ROOM
RPBP	REDUCED PRESSURE BACKFLOW PREVENTER
RPDA	REDUCED PRESSURE DETECTOR ASSEMBLY
RPM	REVOLUTIONS PER MINUTE
RPZ	REDUCED PRESSURE ZONE (VALVE)
SF	SERVICE FACTOR
SOV	SHUT OFF VALVE
SQ FT	SQUARE FEET
SV	SOLINOID VALVE
SW	SWITCH
T	TEMPRATURE
TS	TEMPRATURE SWITCH
TYP	TYPICAL
UL	UNDERWRITERS LABORATORY
V	VENT / VOLT
VB	VACUUM BREAKER
VEL	VELOCITY
VFD	VARIABLE FREQUERNCY DRIVE
W	WATTS
W/	WITH
W/O	WITHOUT
WH	WATER HEATER
WT	WEIGHT



NOTES:
1. O.S.&Y GATE VALVE WITH SUPERVISORY SWITCH (TYPICAL).
2. 4" APPROVED ILLINOIS DEPARTMENT OF PUBLIC HEALTH DOUBLE CHECK DETECTOR ASSEMBLY BACKFLOW PREVENTER. MOUNT BACKFLOW PREVENTER ON 4" CONCRETE BASE FURNISHED BY FIRE PROTECTION CONTRACTOR.

3 SCHEMATIC DIAGRAM OF BUILDING FIRE PROTECTION WATER SERVICE
NOT TO SCALE



4 DRY VAVLE ASSEMBLY DETAIL
NOT TO SCALE

M

C.A.F.T. Building

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

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GAGE CONSULTING ENGINEERS, INC.
PROFESSIONAL DESIGN FIRM LICENSE NO. 184.001566, EXPIRES ON 04/30/2019

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed
PROFESSIONAL ENGINEER
under the laws of the State of

License Number: Date **07-07-2017**

Revisions		
Description	Date	Num

Comm: **173013**
Date: **July 7, 2017**
Drawn: **Author**
Check: **Checker**
North

FIRE PROTECTION GENERAL NOTES AND SYMBOLS

Scale: **As Indicated**

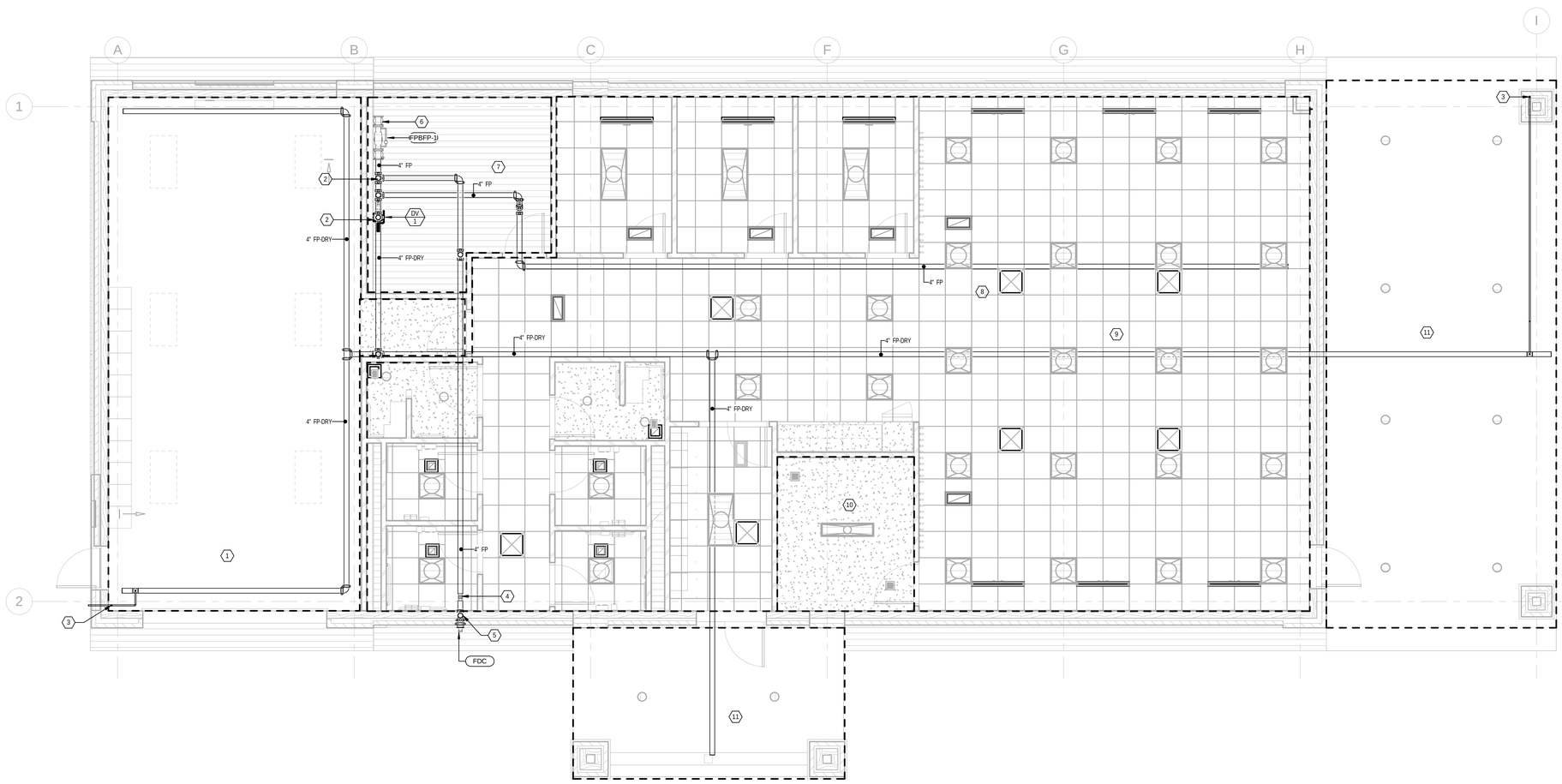
F001

FIRE PROTECTION PLAN PLAN NOTES

1. ALL INDOOR OCCUPIED SPACES SHALL BE COVERED BY THE WET SPRINKLER SYSTEM PER NFPA 13.
2. ALL WET SPRINKLER PIPING SHALL BE ROUTED COMPLETELY ON THE INTERNAL SIDE OF THE BUILDINGS THERMAL ENVELOPE.
3. THE ATTIC DRY SPRINKLER SYSTEM SHALL PROVIDE COVERAGE TO THE ATTIC AND OUTDOOR OVERHANGS AS NOTED.
4. SPECIAL APPLICATION LISTED ATTIC SPRINKLERS SHALL BE USED IN THE ATTIC PER U.L. RATING. ROOF CONSTRUCTION IS WOOD TRUSS AT 2'-0" O.C. WITH 4/12 SLOPE. PROVIDE UPRIGHT HANDS TO COVER OBSTRUCTED AREAS AS REQUIRED BY NEPA 13. SEE ARCHITECTURAL AND STRUCTURAL DOCUMENTS.
5. PROVIDE AUXILIARY DRAIN VALVES AT ALL LOCAL LOW POINTS IN PIPING OVER 5 GALLONS IN PIPE VOLUME AND OR WITHOUT A SPRINKLER HEAD. COORDINATE ACCESS VIA CEILING ACCESS PANEL WITH ARCHITECTURAL.
6. IN LOCATION WHERE BUILDING THERMAL INSULATION IS LOCATED ON FIRE RATED CEILING. ROUTE PIPING TIGHT TO TOP OF LOWER OF STRUCTURAL TRUSS MEMBER. INSTALL THERMAL INSULATOR OVER WET SPRINKLER PIPING. BUILDING THERMAL INSULATION SHALL NOT BE INSTALLED BENEATH WET SPRINKLER PIPING. COORDINATE WITH ARCHITECTURAL AND G.C.
7. ALL OVERHANGS OVER 48" WIDE SHALL BE COVERED BY DRY SYSTEM WHERE REQUIRED BY NFPA 13.

F100 KEY NOTES

KEY	NOTE
1	PROVIDE UPRIGHT HEAD COVERAGE FOR AREA OPEN TO STRUCTURE WITH PEAKED ROOF FROM DRY SYSTEM. ORDINARY HAZARD GROUP 1.
2	ROUTE SYSTEM DRAIN VALVE TO DISCHARGE OVER FLOOR DRAIN. SEE PLUMBING DRAWINGS.
3	INSPECTORS TEST VALVE FOR DRY SYSTEM BRANCH. ROUTE DRAIN TO OUTDOORS
4	CHECK VALVE ON FIRE DEPARTMENT CONNECTION LINE.
5	4" WET FIRE PROTECTION LINE DOWN IN WALL TO FIRE DEPARTMENT CONNECTION. PROVIDE BALL DRIP AT PIPE ELBOW. DRAIN TO OUTDOORS.
6	CONNECT TO INCOMING COMBINED DOMESTIC / FIRE PROTECTION SERVICE BLIND FLANGE PROVIDED BY PLUMBING CONTRACTOR. SEE PLUMBING DRAWINGS.
7	PROVIDE UPRIGHT HEAD COVERAGE FROM WET SYSTEM IN AREA OPEN TO GYP. BOARD DECK TIGHT TO BOTTOM OF STRUCTURE. ORDINARY HAZZARD GROUP 1.
8	PROVIDE CONCEALED HEAD COVERAGE FOR AREA WITH CEILING. LIGHT HAZARD. PROVIDE UPRIGHT HEAD COVERAGE FROM WET SYSTEM IN PLENUM CEILING SPACE ABOVE AREA.
9	PROVIDE ATTIC SPRINKLER COVERAGE FROM DRY SYSTEM.
10	PROVIDE CONCEALED HEAD COVERAGE FROM WET SYSTEM IN AREA WITH DROP CEILING. ORDINARY HAZARD GROUP 2. PROVIDE UPRIGHT HEAD COVERAGE FROM WET SYSTEM IN PLENUM CEILING SPACE ABOVE AREA.
11	PROVIDE ATTIC COVERAGE OF CONCEALED SPACE ABOVE CANOPY CEILING FROM THE DRY SYSTEM. PROVIDE CONCEALED HEAD COVERAGE OF THE AREA BELOW THE CANOPY FROM THE DRY SYSTEM.



1 FIRE PROTECTION PLAN
1/4" = 1'-0"

C.A.F.T. Building

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

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GAGE CONSULTING ENGINEERS, INC.
PROFESSIONAL DESIGN FIRM LICENSE NO.
184.001566, EXPIRES ON 04/30/2019

LICENSED PROFESSIONAL ENGINEER
DAVID P. MCVEY
062-048431
STATE OF ILLINOIS
Exp. 11/30/17

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed
PROFESSIONAL ENGINEER
under the laws of the State of

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FIRE PROTECTION PLAN

Scale: **As indicated**

F100

MN

CONTROL SYSTEM GENERAL NOTES

1 GENERAL - THE CONTROLS CONTRACTOR SHALL BE THE CONTROLS ENGINEER FOR THIS PROJECT: RESPONSIBLE FOR DESIGN AND ENGINEERING OF ALL CONTROL SYSTEMS TO OPERATE AS DESCRIBED IN THE SEQUENCE OF OPERATION, TO CONFORM WITH THE GOVERNING BUILDING CODES AND OPERATE IN A MANNER CONSISTENT WITH KNOWN GOOD CONTROLS ENGINEERING PRACTICE. THE CONTROLS CONTRACTOR/ENGINEER SHALL IDENTIFY ANY POTENTIAL CONDITIONS THAT COULD BE CONSTRUED TO DEVIATE FROM GOOD CONTROLS ENGINEERING PRACTICE PRIOR TO BIDDING AND INCLUDE ALL ENGINEERING AND INSTALLATION WORK REQUIRED TO MAKE ALL HVAC SYSTEMS COMPLETE AND OPERATIONAL, IN CONFORMANCE WITH GOOD CONTROLS ENGINEERING PRACTICE: PRIOR TO SUBMITTING HIS BID. THE CONTROLS CONTRACTOR SHALL PROVIDE ALL CONTROL COMPONENTS, WIRING, INTERLOCKS, ELECTRICAL POWER, TUBING AND ALL OTHER DEVICES REQUIRED TO MAKE ALL HVAC EQUIPMENT INSTALLED UNDER THIS PROJECT COMPLETE AND FULLY OPERATIONAL PER THE SEQUENCE OF OPERATION AND AS REQUIRED FOR SAFE AND ACCURATE CONTROL. THE CONTROLS CONTRACTOR SHALL PROVIDE ALL CONTROL VALVES AND ACTUATORS TO THE HEATING/VENTILATION CONTRACTOR FOR INSTALLATION. THE CONTROLS CONTRACTOR SHALL DIRECT THE HEATING/VENTILATION CONTRACTOR AS TO THE PROPER LOCATION AND ORIENTATION OF ALL DEVICES TO ACHIEVE A PROPER AND CORRECT CONTROL SEQUENCE. THE CONTROLS CONTRACTOR SHALL INCLUDE ADEQUATE TIME IN HIS BID FOR COMPLETE COMMISSIONING OF THE MECHANICAL SYSTEMS, ON SITE IN COORDINATION WITH THE HEATING/VENTILATION CONTRACTOR AND OTHER TRADES AS REQUIRED TO MAKE ALL EQUIPMENT COMPLETE AND FULLY OPERATIONAL. IN THE EVENT THAT ANY PART OF THE HEATING/VENTILATION DRAWINGS, SPECIFICATIONS OR NOTES CONFLICT WITH ANY OTHER: THE MOST STRINGENT REQUIREMENT SHALL APPLY, PROVIDING THE GREATEST SAFETY AND/OR AT THE HIGHEST COST OF THE CONFLICTING OPTIONS.

2 ELECTRICAL - THE CONTROLS CONTRACTOR SHALL PROVIDE ALL ELECTRICAL POWER AND CONTROL WIRING, CONDUIT, JUNCTION BOXES, RACEWAY, TRANSFORMERS, RELAYS AND ALL OTHER ELECTRICAL APPURTENANCES REQUIRED FOR A COMPLETE AND FULLY OPERATIONAL CONTROL SYSTEM. THIS INCLUDES ALL POWER WIRING FROM SPARE CIRCUIT BREAKERS PROVIDED IN BUILDING EMERGENCY PANELS FOR POWERING OF CONTROLS AND CONTROL PANELS AND ALL OTHER CONTROL SYSTEM COMPONENTS. ALL ELECTRICAL WORK SHALL BE IN CONFORMANCE WITH THE LATEST NATIONAL ELECTRICAL CODE AND APPLICABLE STATE AND LOCAL AMENDMENTS. THE CONTROLS CONTRACTOR SHALL PROVIDE AND INSTALL ALL HARDWIRED INTERLOCKS BETWEEN STARTERS AS REQUIRED TO ACHIEVE THE SEQUENCE OF OPERATION AND PROPER SYSTEM CONTROLS. PROVIDE RELAYS AS REQUIRED FOR AUTOMATIC START/STOP OF ALL SINGLE PHASE EXHAUST FANS AND INTERLOCK OF AUTOMATIC DAMPERS.

3 CONTROL VALVES - ALL CONTROL VALVES SHALL SPRING RETURN TO A FAIL SAFE POSITION. ALL HEATING CONTROL VALVES SHALL FAIL OPEN BY SPRING RETURN TO HEATING AND ALL COOLING CONTROL VALVES SHALL FAIL CLOSED BY SPRING RETURN. ALL CONTROL VALVES USED FOR POSITIVE SHUT-OFF ISOLATION, SUCH AS HOT/CHILLED WATER ISOLATION OR CHANGEOVER IN A TWO-PIPE SYSTEM, SHALL BE QUARTER TURN TYPE BUTTERFLY OR BALL VALVES RATED FOR 300 PSI, BUBBLE TIGHT SHUT-OFF SERVICE. THE CONTROLS CONTRACTOR/ENGINEER SHALL SIZE ALL MODULATING TEMPERATURE CONTROL VALVES WITH A Cv AND PRESSURE DROP SUCH THAT THERE IS LINEAR CONTROL OF WATER FLOW THROUGHOUT THE ENTIRE STROKE OF THE VALVE. COORDINATE WITH THE MECHANICAL CONTRACTOR TO PROVIDE REDUCERS AS REQUIRED FOR MODULATING VALVES THAT ARE NOT LINE SIZE.

4 AUTOMATIC CONTROL DAMPERS - ALL CONTROL DAMPERS SHALL BE EXTRUDED ALUMINUM, LOW LEAKAGE AIR FOIL BLADE TYPE WITH ELASTOMER BLADE EDGE SEALS AND STAINLESS STEEL OR ELASTOMER BLADE END SEALS. ALL CONTROL DAMPERS SHALL SPRING RETURN TO A FAIL SAFE POSITION FOR FREEZE PREVENTION BY SPRING RETURN. FACE AND BYPASS DAMPER SHALL FAIL OPEN, OUTDOOR AIR DAMPERS SHALL FAIL CLOSED, EXHAUST AIR DAMPERS SHALL FAIL CLOSED, AND RETURN AIR DAMPER SHALL FAIL OPEN. THE CONTROLS CONTRACTOR SHALL WIRE AND CONTROL ALL DAMPERS PROVIDED BY OTHERS WITH UNITARY EQUIPMENT TO OPERATE AS SPECIFIED BY THE MANUFACTURER. WIRE POWER TO MOTORIZE BACKDRAFT DAMPERS AND INTERLOCK TO OPEN ON FAN START AND CLOSE ON FAN STOP.

5 THERMOSTAT - THE CONTROLS CONTRACTOR SHALL PROVIDE THERMOSTATS FOR ALL CONTROLLED EQUIPMENT TO OPERATE AS DESCRIBED IN THE SEQUENCE OF OPERATION AND/OR PER MANUFACTURER'S REQUIREMENTS AND KNOWN STANDARDS OF GOOD CONTROL PRACTICE. INCLUDE ALL THERMOSTATS AS REQUIRED FOR EQUIPMENT TO BE COMPLETE AND FULLY OPERATIONAL WHETHER SHOWN SPECIFICALLY ON THE PLANS OR NOT.
ALL TEMPERATURE SENSORS IN DUCTWORK, AIR HANDLING UNITS AND PLENUMS SHALL BE OF AVERAGING TYPE. PROPERLY SUPPORT AVERAGING ELEMENT (MINIMUM TWENTY FEET LENGTH) ACROSS A REPRESENTATIVE AREA TO ACHIEVE A TRUE AVERAGE READING. SUPPORT USING HEAVY CABLE AND/OR HALF INCH CONDUIT WITH NYLON WIRE TIES. THE CONTROLS CONTRACTOR/ENGINEER SHALL SELECT ALL PRESSURE AND TEMPERATURE SENSORS WITH AN APPROPRIATE SPAN AND RANGE FOR THE APPLICATION. FURNISH AND INSTALL STATIC PRESSURE SENSORS FOR VAV SYSTEMS TWO THIRDS DOWN MEDIUM PRESSURE DUCT RUN OR IN LOCATIONS SHOWN ON PLANS IF SPECIFICALLY INDICATED. FURNISH WITH STATIC PRESSURE SENSING TIP AND SECURE MOUNTING TO DUCT WITH REMOVABLE ACCESS COVER. BUILDING/SPACE STATIC PRESSURE SENSORS SHALL BE INSTALLED IN THE CEILING IN A MAIN BUILDING CORRIDOR OPEN TO THE MAIN ENTRANCE OF THE BUILDING. STATIC PRESSURE SENSING TIP SHALL HAVE COVER PLATE TO MATCH CEILING AND AN EMBOSSED LABEL STATING "PRESSURE CONTROL SENSOR - DO NOT PAINT". ALL OUTDOOR AIR SENSORS SHALL BE INSTALLED WITH SUN SHIELD AND IN A LOCATION WHERE THEY CANNOT BE WASHED BY EXHAUST AIR OR OTHER SOURCES OF FALSE READINGS. ALL TEMPERATURE AND PRESSURE SENSORS SHALL BE INSTALLED IN LOCATIONS SUCH THAT THEY DO NOT MAKE FALSE READINGS. CONTROLS CONTRACTOR/ENGINEER SHALL REVIEW THE PLANS AND IDENTIFY ANY SUCH POTENTIAL CAUSES FOR FALSE READINGS AND NOTIFY THE ENGINEER IN WRITING THAT THESE SHOULD BE RELOCATED PRIOR TO ROUGH IN AND CONTROLS INSTALLATION. THE CONTROLS CONTRACTOR SHALL RELOCATE ANY SENSORS INSTALLED IN IMPROPER LOCATIONS AND GIVING FALSE READINGS AT HIS OWN EXPENSE. CONDITIONS TO BE AWARE OF SHALL INCLUDE BUT ARE NOT LIMITED TO LOCATIONS OF THERMOSTATS BEHIND DOORS, OUTDOOR AIR SENSORS NEAR EXHAUST OPENINGS, STATIC PRESSURE SENSORS IN TURBULENT LOCATIONS, THERMOSTATS INSTALLED ADJACENT TO HEAT SOURCES SUCH AS COFFEE POTS, COMPUTERS, VENDING MACHINES AND OTHER APPLIANCES, ETC.

6 SAFETY DEVICES - THE CONTROLS CONTRACTOR SHALL WIRE ALL SUPPLY FANS OVER 2000 CFM TO THE LOCAL DUCT SMOKE DETECTOR TO SHUT DOWN THE SUPPLY FAN ON SMOKE ALARM. THE CONTROLS CONTRACTOR/ENGINEER SHALL FURNISH AND INSTALL MANUAL RESET SAFETY DEVICES FOR ANY AND ALL CONDITIONS THAT COULD DAMAGE THE EQUIPMENT AND/OR REPRESENT A THREAT TO HUMAN SAFETY. ALL WATER COILS SHALL BE PROTECTED BY AN AVERAGING ELEMENT FREEZE-STAT WITH A NON-ADJUSTABLE 40°F SET POINT, MANUAL RESET, AND HARDWIRED INTERLOCK TO SHUT DOWN THE ASSOCIATED FAN ANY TIME THE TEMPERATURE ACROSS ANY 12" LENGTH OF THE AVERAGING ELEMENT FALLS BELOW 40°F. FREEZE STATS SHALL BE INSTALLED DOWNSTREAM OF PRE-HEAT COIL, UPSTREAM OF AND CLOSE TO CHILLED WATER COIL. VARIABLE AIR VOLUME SYSTEMS SHALL HAVE A MANUAL RESET MAXIMUM DUCT STATIC PRESSURE SENSOR TO SHUT DOWN THE FAN ANY TIME DUCT STATIC PRESSURE RISES MORE THAN TWO INCHES WATER COLUMN ABOVE THE DESIGN OPERATING PRESSURE. BOILERS SHALL BE INTERLOCKED TO ONLY FIRE AFTER PROOF OF WATER FLOW AND THAT THE COMBUSTION AIR DAMPER IS FULL OPEN. WATER CHILLERS SHALL BE INTERLOCKED SUCH THAT THEY CAN NOT START UNTIL FLOW IS PROVED THROUGH CHILLED WATER BUNDLES. INSTALL A FLOAT SWITCH IN THE EVAPORATOR DRAIN PAN OF ALL UNIT VENTILATORS OR OTHER AIR HANDLING EQUIPMENT INSTALLED ABOVE CEILINGS IN OCCUPIED SPACES TO SHUT DOWN THE ASSOCIATED SYSTEM.

7 PUMP CONTROL - THE CONTROLS CONTRACTOR SHALL WIRE HOT WATER COIL CIRCULATING PUMPS TO START AND RUN CONTINUOUSLY ANY TIME THE OUTDOOR AIR TEMPERATURE IS BELOW 40°F. (ADJ.) CENTRAL HEATING AND/OR COOLING PUMPS SHALL HAVE A LOCAL CONTROL FOR PROOF OF FLOW AND AUTOMATIC STARTING OF THE STANDBY PUMP WHEN THE LEAD PUMP FAILS.

GENERAL NOTES

1 ALL WORK SHALL COMPLY WITH ALL LOCAL BUILDINGS. THE CONTRACTOR SHALL FURNISH AND INSTALL THE MECHANICAL SYSTEM COMPLETE WITH ALL EQUIPMENT, PIPING, VALVES, DUCTWORK, DUCTWORK ACCESSORIES, INSULATION, HANGERS, CONTROLS, AND ALL ACCESSORIES IN ACCORDANCE WITH THE BUILDING CODE, ALL AUTHORITIES HAVING JURISDICTION, AND THIS SPECIFICATION.

2 DRAWINGS ARE GENERALLY DIAGRAMMATIC. ROUTING OF PIPING, DUCTWORK, CONDUITS,OFFSET, FITTING NOR EVERY STRUCTURAL ELEMENT THAT MAY BE ENCOUNTERED DURING THE INSTALLATION OF THIS WORK. CONTRACTOR SHALL MAKE ANY REQUIRED CHANGES FROM THE GENERAL ROUTING SHOWN ON THESE DRAWINGS, SUCH AS OFFSETS, BENDS OR CHANGES IN ELEVATION DUE TO COORDINATION WITH THE WORK OF OTHER TRADES AND BUILDING CONSTRUCTION. ALL CHANGES SHALL BE MADE WITHOUT ADDITIONAL COST TO THE OWNER OR DELAY IN COMPLETION DATE OF THE PROJECT.

3 IT IS INTENDED THAT EQUIPMENT SHALL BE LOCATED SYMMETRICALLY WITH THE ARCHITECTURAL ELEMENTS OF THE BUILDING, NOT WITHSTANDING THE FACT THAT LOCATIONS INDICATED BY THESE DRAWINGS MAY BE DISTORTED FOR CLEARNESS OF PRESENTATION.

4 CONTRACTOR SHALL CHECK DRAWINGS OF OTHER TRADES TO VERIFY THAT SPACES IN WHICH THEIR WORK WILL BE INSTALLED ARE CLEAR OF OBSTRUCTIONS. WORK SHALL BE INSTALLED TO MAINTAIN MAXIMUM HEADROOM AND SPACE CONDITION AT ALL POINTS IN THE BUILDING. WHERE HEADROOM OR SPACE CONDITIONS APPEAR INADEQUATE, CONTRACTOR SHALL NOTIFY ARCHITECT/ENGINEER BEFORE PROCEEDING WITH THE INSTALLATION OF THEIR WORK.

5 CONTRACTOR SHALL FURNISH OTHER TRADES ADVANCE INFORMATION AND/OR SHOP DRAWINGS ON LOCATIONS AND SIZES OF PIPING, DUCTWORK, CONDUIT, RACEWAYS, EQUIPMENT, FRAMES, BOXES, SLEEVES AND OPENINGS, ETC. NEEDED FOR THEIR WORK TO PERMIT OTHER TRADES AFFECTED TO INSTALL THEIR WORK PROPERLY AND WITHOUT DELAY.

6 WHERE THERE IS EVIDENCE THAT WORK OF ONE TRADE WILL INTERFERE WITH WORK OF OTHER TRADES, ALL TRADES SHALL MEET ON JOB SITE TO WORK OUT SPACE CONDITIONS AND MAKE SATISFACTORY ADJUSTMENTS TO INSTALLATION OF THE NEW WORK. CONTRACTORS SHALL VERIFY EXACT LOCATIONS OF ALL DEVICES AND EQUIPMENT WITH FIELD CONDITIONS, SHOP DRAWINGS, AND WORK OF OTHER TRADES PRIOR TO ROUGH IN. CONTRACTOR SHALL BE RESPONSIBLE, AT HIS OWN EXPENSE, FOR THE REMOVAL AND REINSTALLATION OF ANY PART OF THEIR WORK IF SAME WAS INSTALLED WITHOUT CONSULTING WITH OTHER TRADES BEFORE INSTALLING THEIR WORK.

7 CONTRACTOR SHALL PROVIDE SLEEVES IN BEAMS, FLOORS, COLUMNS AND WALLS AS SHOWN ON THE DRAWINGS, AS REQUIRED BY JOB SITE CONDITIONS, AND/OR AS SPECIFIED, WHEN INSTALLING THEIR WORK. ALL BEAMS AND COLUMNS WHICH ARE REQUIRED TO BE SLEEVED SHALL BE CUT AND REINFORCED AS REQUIRED BY FIELD CONDITIONS AND LOCATIONS AND SIZES SHALL BE CHECKED AND APPROVED BY ARCHITECT BEFORE CONTRACTOR CUTS ANY STRUCTURAL BUILDING MEMBER.

8 THE SEQUENCE FOR THE INSTALLATION OF ALL WORK SHALL BE COORDINATED BETWEEN CONTRACTORS AND IN STRICT ACCORDANCE WITH ARCHITECT/ENGINEER AND OWNERS STIPULATION AS CALLED FOR IN THE SPECIFICATION AND/OR AS DIRECTED.

9 CONTRACTOR SHALL REFER TO THE ARCHITECTURAL AND STRUCTURAL CONTRACT DRAWINGS (BEFORE SUBMITTING HIS BID) TO FAMILIARIZE HIMSELF WITH THE EXTENT OF THE GENERAL CONTRACTOR WORK, CEILING HEIGHTS AND CLEARANCE FOR INSTALLING HIS WORK.

10 CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CORING, CUTTING, PATCHING, REPAIRING,REFINISHING AND REMOVAL/REPLACEMENT OF NEW OR EXISTING BUILDING CONSTRUCTION REQUIRED TO ACCOMMODATE THE INSTALLATION OR REMOVAL OF THEIR WORK. ALL PATCHING, REPAIRING AND REFINISHING WORK SHALL BE PERFORMED BY THOSE REGULARLY POSSIBLE. CARE SHALL BE TAKEN SO AS NOT TO DAMAGE ANY EXISTING BUILDING CONSTRUCTION OR ITEMS THAT ARE TO REMAIN. ANY EXISTING FINISHES THAT ARE DAMAGED DURING THE INSTALLATION OF NEW WORK OR REMOVAL OF EXISTING WORK SHALL BE REPAIRED, REPLACED AND PAID FOR BY THE INSTALLING CONTRACTOR, TO THE SATISFACTION OF THE ARCHITECT AND OWNER. REFER TO ARCHITECTURAL DRAWINGS FOR EXISTING BUILDING CONSTRUCTION THAT IS TO REMAIN AND, THEREFORE, SUBJECT TO PATCHING, REPAIRING, REFINISHING AND REMOVAL/REPLACEMENT.

11 CONTRACTOR SHALL BE RESPONSIBLE FOR HIS OWN CLEAN UP DURING CONSTRUCTION. IF CONTRACTOR FAILS TO PROVIDE SUCH CLEAN UP, THE ARCHITECT/ENGINEER WILL DIRECT ANOTHER CONTRACTOR TO PERFORM THE CLEAN UP AND THE NEGLIGENT CONTRACTOR SHALL PAY THE ASSOCIATED BACK CHARGES AS DEEMED APPROPRIATE BY THE ARCHITECT/ENGINEER.
1.CONTRACTOR SHALL BE RESPONSIBLE FOR HIS OWN CLEAN UP DURING CONSTRUCTION. IF CONTRACTOR FAILS TO PROVIDE SUCH CLEAN UP, THE ARCHITECT/ENGINEER WILL DIRECT ANOTHER CONTRACTOR TO PERFORM THE CLEAN UP AND THE NEGLIGENT CONTRACTOR SHALL PAY THE ASSOCIATED BACK CHARGES AS DEEMED APPROPRIATE BY THE ARCHITECT/ENGINEER.

12 CONTRACTOR SHALL INSTALL ALL AUXILIARY SUPPORTING STEEL AS REQUIRED FOR THE SUPPORTING OF THEIR PIPING, DUCTWORK, CONDUIT, TANKS, EQUIPMENT, ETC. ALL SUPPORTING STEEL FOR ITEMS ABOVE A SUSPENDED CEILING SHALL BE FROM BUILDING STRUCTURAL MEMBERS ONLY.

13 UNLESS INDICATED OTHERWISE, THE ARCHITECT/ENGINEER MAKES NO REPRESENTATION AS TO WHETHER OR NOT ANY HAZARDOUS OR CONTAMINATED MATERIALS (INCLUDING BUT NOT LIMITED TO ASBESTOS, PCB'S, CONTAMINATED SOILS, ETC.) ARE PRESENT WITHIN THE EXISTING BUILDING OR ON THE SITE. WORK SHOWN ON THE DRAWINGS AND/OR INDICATED IN THE SPECIFICATIONS SHALL NOT BE CONSTRUED TO CALL FOR CONTACT WITH ANY OF THESE MATERIALS. IF THESE MATERIALS ARE ENCOUNTERED OR SUSPECTED, THE CONTRACTOR SHALL NOT DISTURB THEM AND SHALL CONTACT THE ARCHITECT/ENGINEER IMMEDIATELY.

14 CONTRACTOR SHALL STORE ALL MATERIALS AND EQUIPMENT SHIPPED TO THE SITE IN A PROTECTED AREA. IF MATERIAL IS STORED OUTSIDE OF THE BUILDING, IT MUST BE STORED OFF THE GROUND A MINIMUM OF SIX INCHES (6") SET ON 6X6 PLANKS AND/OR WOOD PALLETS. ALL MATERIAL AND EQUIPMENT MUST BE COMPLETELY COVERED WITH WATERPROOF TARPS OR VISQUIN. ALL PIPING AND DUCTWORK WILL HAVE THE ENDS CLOSED TO KEEP OUT DIRT AND OTHER DEBRIS. NO EQUIPMENT WILL BE ALLOWED TO BE STORED ON THE SITE UNLESS IT IS SITTING ON WOOD PLANKS AND COMPLETELY PROTECTED WITH WEATHERPROOF COVERS.

15 THE DRAWINGS, SCHEDULES AND SPECIFICATIONS HAVE BEEN PREPARED USING ONE MANUFACTURER FOR EACH PIECE OF EQUIPMENT AS THE BASIS FOR DIMENSIONAL DESIGN. IF THE CONTRACTOR PURCHASES EQUIPMENT LISTED AS A SPECIFIED ACCEPTABLE MANUFACTURER BUT IS NOT THE SCHEDULED MANUFACTURER USED FOR THE BASE DESIGN, THE CONTRACTOR SHALL BE RESPONSIBLE FOR CHECKING ALL THE DIMENSIONS, CAPACITIES AND RATINGS OF THE EQUIPMENT TO VERIFY THAT IT WILL FIT IN THE SPACE SHOWN ON THE DRAWINGS. MINOR DEVIATIONS IN DIMENSIONS WILL BE PERMITTED, PROVIDED ALL THE RATINGS MEET THOSE SHOWN ON THE DRAWINGS AND EQUIPMENT WILL PHYSICALLY FIT INTO THE SPACE ALLOCATED WITH SUITABLE ACCESS AROUND EQUIPMENT FOR OPERATION AND MAINTENANCE ON THE EQUIPMENT.

16 WHEN EQUIPMENT IS SUBMITTED FOR REVIEW AND DOES NOT MEET THE PHYSICAL SIZE OR ARRANGEMENT OF THAT SCHEDULED AND SPECIFIED, CONTRACTOR SHALL PAY FOR ALL ALTERATIONS REQUIRED TO ACCOMMODATE SUCH EQUIPMENT AT NO ADDITIONAL COST TO OWNER. CONTRACTOR SHALL ALSO PAY ALL COSTS FOR ADDITIONAL WORK REQUIRED BY OTHER CONTRACTORS, OWNER, ARCHITECT OR ENGINEER TO MAKE CHANGES WHICH WOULD ALLOW THE EQUIPMENT TO FIT IN THE SPACE AND FUNCTION AS INTENDED.

17 CONTRACTOR SHALL FIELD VERIFY THE SIZE OF EXISTING OPENINGS, WINDOWS, DOORS, CORRIDORS, ROOMS, ETC. FOR ACCESS OF THE NEW EQUIPMENT INTO OR REMOVAL OF EXISTING EQUIPMENT FROM THE BUILDING. IF OPENINGS ARE TOO SMALL FOR ACCESS, CONTRACTOR SHALL, AT HIS OWN EXPENSE, PROVIDE NEW OR ENLARGED OPENINGS AND RESTORE SAME TO ORIGINAL SIZE AND CONDITION. CONTRACTOR MAY ELECT TO ORDER THE EQUIPMENT DISASSEMBLED AND/OR WITH SPLIT HOUSING FOR ENTRANCE INTO THE EXISTING SPACE OR BUILDING. CONTRACTOR SHALL REASSEMBLE EQUIPMENT AFTER IT IS IN THE SPACE AT HIS OWN EXPENSE.

18 WHERE DRAWINGS, SPECIFICATIONS OR NOTES CONFLICT ONE ANOTHER THE CONTRACTOR SHALL IMMEDIATELY ADVISE THE ARCHITECT OF SUCH CONFLICTS. FOR PURPOSES OF BIDDING AND PENDING WRITTEN RECEIPT OF ANY DIRECTION TO THE CONTRARY, THE CONTRACTOR SHALL INCLUDE IN HIS PROPOSAL THE MORE EXPENSIVE ALTERNATE DESCRIBED.

19 WHERE CEILING PLENUM RETURN SYSTEM IS USED, CONTRACTOR SHALL MAKE SURE THE INTEGRITY/CONTINUITY OF THE CEILING PLENUM. WHERE CEILING PLENUM IS ISOLATED BY WALL(S), CONTRACTOR SHALL PROVIDE APPROPRIATE TRANSFER WALL OPENING(S) AND SHEETMETAL SLEEVE(S) AS INDICATED ON DRAWINGS, AS REQUIRED BY JOB SITE CONDITIONS, SIZED FOR NO GREATER THAN 500 FPM AIR VELOCITY THROUGH THE OPENING(S). FIRE DAMPER IS REQUIRED WHEN THE TRANSFER DUCT PENETRATES FIRE RATED WALL.

20 WHEREVER EXTENSION, CONNECTIONS, OR CAPPINGS ARE MADE TO EXISTING DUCTWORK OR PIPING AND DAMAGED INSULATION RESULTS FROM SUCH CONNECTION, EXTENSION OR CAPPING. INSULATION SHALL BE REPAIRED AND/OR REPLACED IN A MANNER TO MATCH EXISTING BY THE CONTRACTOR INVOLVED.

SYMBOLS & ABBREVIATIONS

Symbol	Description
	PIPE WITH FLOW DIRECTION
	ELBOW, TURNED DOWN
	ELBOW, TURNED UP
	TEE, OUTLET DOWN
	TEE, OUTLET UP
	TEE
	CONNECTION, BOTTOM
	CONNECTION, TOP
	PIPE BREAK
	PIPE CAP
	CLEAN OUT
	PIPE SLEEVE
	UNION
	ANCHOR POINT
	REDUCER - CONCENTRIC
	REDUCER - ECCENTRIC
	STRAINER
	PUMP
PSD	PUMP SUCTION DIFFUSER
TDV	TRIPLE DUTY VALVE
	SHUT OFF VALVE
	BALANCING FITTING
	BALL VALVE
	BUTTERFLY VALVE
	PLUG VALVE
	GATE VALVE NRS
	GATE VALVE OS&Y
	GLOBE VALVE
M	2-WAY CONTROL VALVE
M	3-WAY CONTROL VALVE
	CHECK VALVE TYPE
T&P	SAFTEY RELIEF VALVE
	PRESSURE REGULATING VALVE
	FLEXIBLE CONNECTION
	DRAIN VALVE WITH HOSE END CONNECTION
	AUTOMATIC AIR VENT
	THERMOMETER WITHERMOWELL
	PRESSURE GAGE
S	SWITCH
T	THERMOSTAT
H	HUMIDISTAT
	CONTROL POINT SENSORS
HWS	HEATING HOT WATER SUPPLY
HWR	HEATING HOT WATER RETURN
CWS	CHILLED WATER SUPPLY
CWR	CHILLED WATER RETURN
CS	CONDENSER WATER SUPPLY
CR	CONDENSER WATER RETURN
HCWS	HOT/CHILLED WATER SUPPLY
HCWR	HEATING HOT WATER RETURN
LPS	LOW-PRESSURE STEAM
MPS	MEDIUM-PRESSURE STEAM
LPC	LOW-PRESSURE CONDENSATE
D	CONDENSATE DRAIN
RL	REFRIGERANT LIQUID
RS	REFRIGERANT SUCTION
GAS	NATURAL GAS
CW	CITY WATER
WxD	DUCT W/ INSIDE DIMENSIONS, WIDTHxDEPTH
DIA	ROUND DUCT, DIAMETER
	FLEXIBLE DUCT
	DUCT TRANSITION
	FLEXIBLE CONNECTION, WIDTHxDEPTH
	SUPPLY DUCT, SECTION
	EXHAUST OR RETURN DUCT, SECTION
	VOLUME DAMPER (OR MANUAL DAMPER AS NOTED)
	MOTORIZED DAMPER
	SQUARE ELBOW WITH TURNING VANES * USED ONLY WHEN RADIUS ELBOW WILL NOT FIT AND VELOCITY IS LOWER THAN 1,500 FPM
R, W	RADIUS ELBOW R = W : NO SPLITER REQUIRED R = W/4 : MINIMUM 1 SPLITER REQUIRED
	NEW CONNECTION
	DEMOLITION LIMIT
	AIR FLOW DIRECTION
U	UNDERCUT DOOR (MIN. 1/2")
EQ 1	EQUIPMENT TAG: EQUIPMENT NAME, EQUIPMENT NUMBER
A:200 8"Ø	DIFFUSER TAG: DIFFUSER TYPE, CFM, NECK SIZE
0	KEY NOTE TAG

Abbreviation	Meaning
AD	ACCESS DOOR
AFF	ABOVE FINISHED FLOOR
BDD	ACKDRAFT DAMPER
BHP	BRAKE HORSE POWER
B.I.	BLACK IRON
C	COMMON PORT (CONTROL VALVE)
CC	COOLING COIL
CFM	CUBIC FEET PER MINUTE
DB	DRY BULB
DIA	DIAMETER
DN	DOWN
DS	DUCT SLEEVE WITH FIRE RATED SEALANT
DWG	DRAWING
EAT	ENTERING AIR TEMPERATURE
E.C.	ELECTRICAL CONTRACTOR
ELEC	ELECTRICAL
ESP	EXTERNAL STATIC PRESSURE DROP
EWT	ENTERING WATER TEMPERATURE
FA	FACE AREA
FD	FIRE DAMPER
FL.D	FLOOR DRAIN
FLA	FULL LOAD AMPS
FLR	FLOOR
FPM	FEET PER MINUTE
FS	FLOW SWITCH
FSD	COMBINATION FIRE AND SMOKE DAMPER
FT	FEET
G.C.	GENERAL CONTRACTOR
GPM	GALLONS PER MINUTE
HC	HEATING COIL
HP	HORSE POWER
HZ	HERTZ (FREQUENCY)
IN.	INCHES
LAT	LEAVING AIR TEMPERATURE
LF	LINEAR FOOT
LWT	LEAVING WATER TEMPERATURE
MCA	MINIMUM CIRCUIT AMPS
MD	MOTORIZED DAMPER
MOCP	MAXIMUM OVER CURRENT PROTECTION AMPS
NA	NOT APPLICABLE
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
OA	OUTSIDE AIR / OUTSIDE AIR DUCT
P.C.	PLUMBING CONTRACTOR
PH	PHASE
PLMB	PLUMBING
PS	PIPE SLEEVE
RA	RETURN AIR / RETURN AIR DUCT
RH	RELATIVE HUMIDITY
RPM	REVOLUTIONS PER MINUTE
SA	SUPPLY AIR / SUPPLY AIR DUCT
SHT	SHEET
SP	STATIC PRESSURE
SPEC	SPECIFICATION
TD	TRANSFER AIR DUCT
TSP	TOTAL STATIC PRESSURE DROP
U.N.O.	UNLESS NOTED OTHERWISE
V	VOLTS
VAV	VARIABLE AIR VOLUME / TERMINAL BOX
VD	VOLUME DAMPER
W	WATT
WB	WET BULB

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PROFESSIONAL DESIGN FIRM LICENSE NO.
184.001566, EXPIRES ON 04/30/2019

LICENSED PROFESSIONAL ENGINEER
DAVID P. MCVEY
062-048431
STATE OF ILLINOIS
Exp. 11/30/17

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed
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under the laws of the State of

License Number: Date **07-07-2017**

Revisions		
Description	Date	Num

Comm: **173013**
Date: **July 7, 2017**
Drawn: **EC**
Check: **DJP**

North

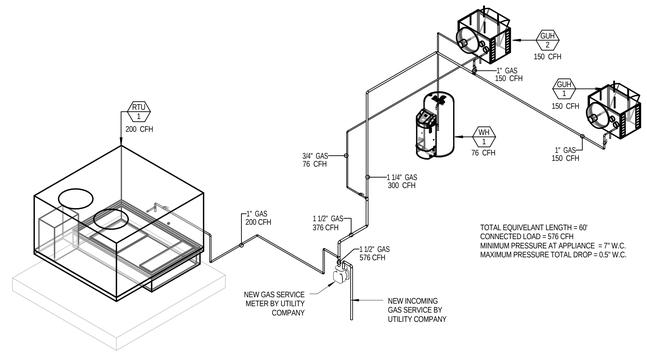
MECHANICAL GENERAL NOTES AND SYMBOLS

Scale: 1/8" = 1'-0"

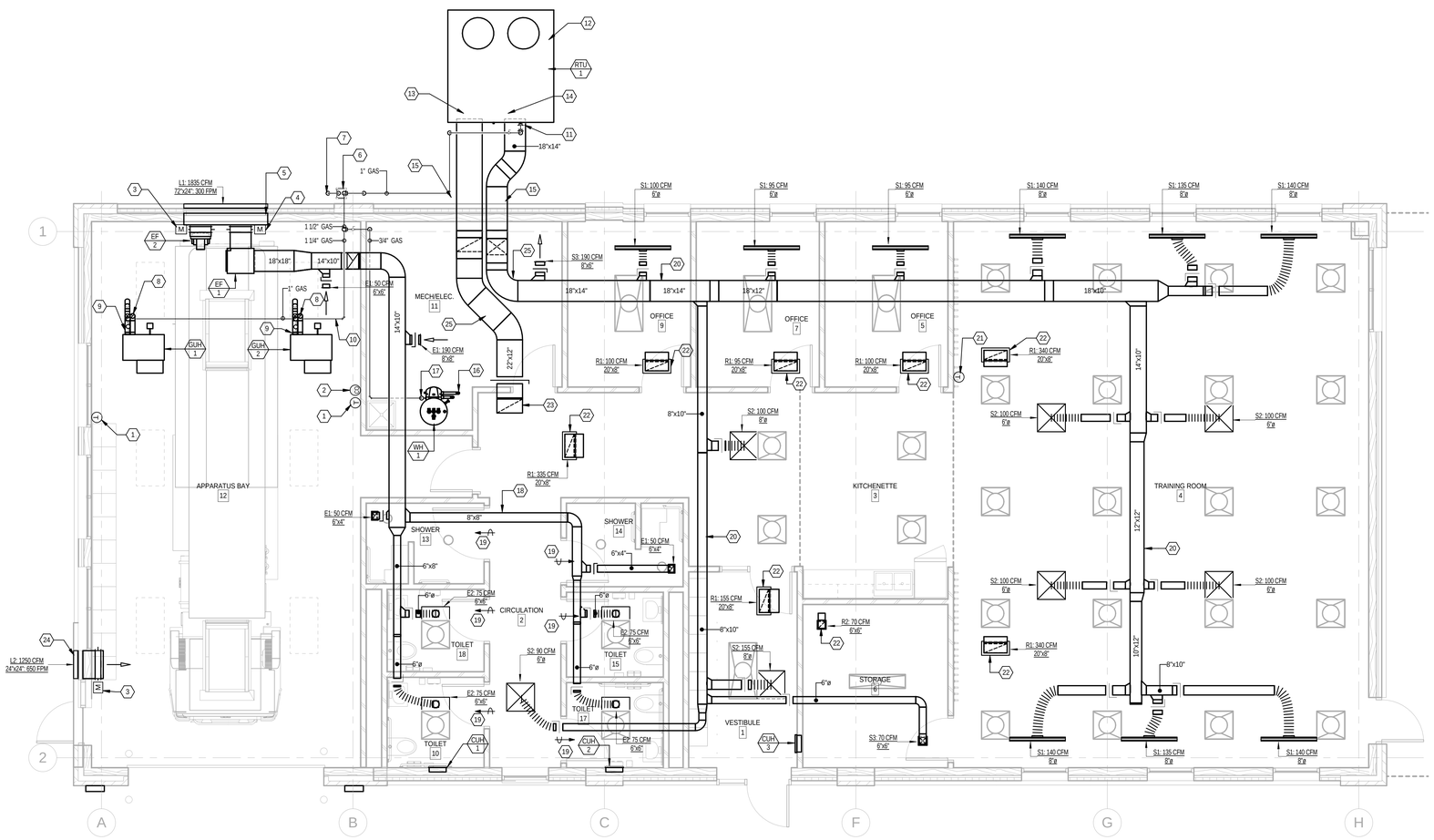
M001

M

MN



5 NATURAL GAS PIPING RISER DIAGRAM



1 MAIN LEVEL HVAC PLAN
1/4" = 1'-0"

MECHANICAL PIPING PLAN NOTES

1. CONTRACTOR SHALL FIELD VERIFY ALL FIELD CONDITIONS PRIOR TO BID.
2. PROVIDE AIR VENTS AT ALL LOCAL HIGH POINTS IN PIPING AND DRAIN VALVE AT ALL LOCAL LOW POINTS IN PIPING.
3. ALL BRANCH PIPING FROM GAS MAIN SHALL BE PROVIDED WITH ISOLATION VALVE. EACH NATURAL GAS FIRED APPLIANCE SHALL BE ABLE TO BE ISOLATED WITH OUT EFFECTING OTHER APPLIANCES.

MECHANICAL ROOF PLAN NOTES

1. ALL DUCTORK TO BE INSUALTED PER IECC 2015 AND ASHREA STANDARD 90.1-2013.
2. ALL DUCTWORK RUN OUTDOORS SHALL BE PROVIDED WITH WEATHER PROOF SHEATHING OVER DUCTWORK.
3. ALL VENITALTION INTAKES SHALL BE LOCATED MINIMUM 10' FROM ANY EXHAUST OPENINGS OR PLUMBING VENT TERMINATIONS.
4. ALL ROOF MOUNTED, NATURAL GAS, OR REFIGERANT PIPING SHALL BE ROUTED ON PIPING SUPPORTS.
5. ALL NATURAL GAS PIPING ROUTED ON THE EXTERIOR OF THE BUILDING SHALL BEPROVIDED WITH 2 COATES OF A WEATHER PROOF EPOXY COATING.

MECHANICAL VENTILATION PLAN NOTES

1. CONTRACTOR SHALL FIELD VERIFY ALL FIELD CONDITIONS PRIOR TO BID.
2. ALL RUNOUTS TO DIFFUSERS AND GRILLES SHALL BE NECK SIZE UNLESS OTHERWISE NOTED.
3. IN LOCATIONS WHERE VOLUME DAMPERS ARE LOCATED ABOVE HARD CEILING OR OTHERWISE INACCESSIBLE, PROVIDE CABLE DRIVEN DAMPER. TERMINATE CABLE END AT FACE OF DIFFUSER.
4. COORDINATE EXACT MOUNTING LOCATIONS FOR THERMOSTATS AND ALL OTHER WALL MOUNTED SENSOR AND CONTROL DEVICES WITH ARCHITECTURAL.
5. ALL DUCTS SIZES SHOWN ARE INTERIOR CLEAR DIMENSIONS. IF DUCT LINER IS USED , DUCTWORK MUST BE SIZED TO ACCOUNT FOR LINING MATERIAL.

M100 KEY NOTES

KEY	NOTE
1	WALL MOUNTED THERMOSTAT FOR GAS FIRED UNIT HEATER.
2	WALL MOUNTED CO DETECTOR. CO DETECTOR SHALL ACTIVATE GARAGE EXHAUST SYSTEM, EF-2.
3	MOTOR OPERATED DAMPER. INTERLOCK TO OPEN WITH ACTIVATION OF EF-2.
4	MOTOR OPERATED DAMPER. INTERLOCK TO OPEN WITH ACTIVATION OF EF-1.
5	INSULATED 72"X24" INSULATED EXHAUST PLENUM CONNECTED TO LOUVER L-1. BOTTOM OF PLENUM SHALL BE 11'- 6" A.F.F.
6	1-1/2" GAS THRU EXTERIOR WALL ABOVE GRADE. COORDINATE EXACT LOCATION WITH ARCHITECTURAL.
7	NEW INCOMING GAS SERVICE WITH GAS METER. COORDINATE EXACT LOCATION WITH GAS UTILITY COMPANY. 576 MBH TOTAL CONNECTED LOAD. MINIMUM PRESSURE REQUIRED AT APPLIANCES IS 7" W.C.
8	4"Ø STAINLESS STEEL FLUE AND COMBUSTION AIR INTAKE UP THRU ROOM. TERMINATE FLUE WITH VENT CAP. TERMINATE COMBUSTION AIR INTAKE WITH GOOSENECK DOWN TOWARDS ROOF WITH 1/4" ALUMINUM MESH BIRD SCREEN.
9	1" NATURAL GAS CONNECTION TO GAS FIRED UNIT HEATER. PROVIDE DIRT LEG AND ISOALTION VALVE. INSTALL GAS PRESSURE REGULATOR PER MANUFACTURER'S RECOMMENDATIONS.
10	NATURAL GAS LINE TO BE ROUTED TIGHT TO STUCTURE ABOVE.
11	1" NATURAL GAS CONNECTION TO RTU-1. PROVIDE DIRT LEG AND ISOALTION VALVE. INSTALL GAS PRESSURE REGULATOR PER MANUFACTURER'S RECOMMENDATIONS.
12	RTU-1 SHALL BE MOUNTED ON 24" INSUALTED PLENUM CURB. PROVIDE CONCRETE PAD ON GRADE. UNIT LOCATION SHALL MAINTAIN FACTORY RECOMMENDED CLEARANCE DISTANCES.
13	22"X12" RETURN CONNECTION TO INSUALTED PLENUM CURB.
14	18"x14" SUPPLY DUCT CONNECTION TO INSULATED PLENUM CURB.
15	DUCTWORK PENITRATION THRU EXTERIOR WALL. COORDIANTE EXACT LOCATION ARCHITECTURAL.
16	2"Ø CPVC FLUE AND COMBUSTION AIR INTAKE FROM GAS FIRED WATER HEATER UP THRU ROOF. TERMINATE FLUE WITH VENT CAP. TERMINATE COMBUSTION AIR INTAKE WITH GOOSENECK DOWN TOWARDS ROOF WITH 1/4" ALUMINUM MESH BIRD SCREEN.
17	3/4" NATURAL GAS CONNECTION TO GAS FIRED WATER HEATER. PROVIDE DIRT LEG AND ISOALTION VALVE. INSTALL GAS PRESSURE REGULATOR PER MANUFACTURER'S RECOMMENDATIONS.
18	EXHAUST DUCTWORK SHALL BE ROUTED IN PLENUM CEILING SPACE.
19	3/4" UNDERCUT DOOR. COORDINATE WITH ARCHITECTURAL.
20	SUPPLY DUCTWORK SHALL BE ROUTED IN PLENUM CEILING SPACE.
21	WALL MONTED RTU CONTROLLER. COORDIANTE EXACT LOCATION WITH ARCHITECTURAL.
22	LINED PLENUM RETURN BOOT TO BE PROVIDED AT CEILING MOUNTED RETURN GRILLE.
23	22"X12" RETURN AIR OPENING TO PLENUM CEILING SPACE WITH 90° UPTURNED MITERED ELBOW. PROVIDE 1/4" ALUMINUM MESH BIRD SCREAN OVER OPENING.
24	INTAKE OUVER TO BE INSTALLED INLINE WITH CLEAR STORY WINDOWS. COORDINATE WITH ARCHITECTURAL.
25	DUCTWORK SHALL NOT BE ROUTED OVER ELCTRICAL PANELS OR GEAR REQUIRING OVERHEAD CLEARANCE. COORDINATE WITH ELECTRICAL.

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Revisions

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Drawn: **Author**
Check: **Checker**
North

MAIN LEVEL HVAC PLAN

Scale: **As indicated**

M100

M

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GAS/DX ROOF TOP UNIT SCHEDULE

NOTES:
1.UNIT TO BE MOUNTED ON 24" INSULATED PLENUM CURB WITH FACTORY HORIZONTAL DUCT OPENINGS.
2.FACTORY PROGRAMMED SINGLE ZONE VARIABLE AIR VOLUME SEQUENCE OF OPERATION.
3.1" INJECTED FOAM WALL CONSTRUCTION, R-7.
4.PROVIDE WITH COMPARATIVE ENTHALPY ECONOMIZER, BAROMETRIC RELIEF, COMBINATION SPACE TEMPERATURE AND HUMIDITY SENSOR, STAND ALONE CONTROLS WITH ADJUSTABLE SET POINTS AND TENANT OVERRIDE , MERV 8 FILTERS, STAINLESS STEEL GAS HEAT EXCHANGER, DIRECT DRIVE ECM FAN MOTOR, ONE INVERTER SCROLL COMPRESSOR WITH ONE FIXED SPEED SCROLL COMPRESSOR, HOT GAS RE-HEAT, NON-FUSED DISCONNECT SWITCH, FIELD POWERED 115V GFI OUTLET, AND PHASE FAILURE MONITOR.

				SUMMER DESIGN		WINTER DESIGN	SUPPLY FAN						GAS HEATING						DX COOLING																			
																								COIL			COMPRESSOR(S)				ELECTRICAL							
MARK	SUPPLY AIR	RETURN AIR	OUTDOOR AIR	DB °F	WB °F	DB °F	QUANTITY	TYPE	T.S.P.	E.S.P.	BHP EACH	MOTOR HP EACH	INPUT	CAPACITY	STAGES	EAT	LAT	THERMAL EFF.	TOTAL CAPACITY	SENSIBLE CAPACITY	EAT DB	EAT WB	LAT DB	LAT WB	ROWS	FPI	REFRIGERANT	TYPE	QUANTITY	EER RATED	IEER RATED	VOLTAGE	Ø	MCA	MOCP	MANUFACTURER	MODEL	WEIGHT	NOTES
RTU 1	2125 CFM	1540 CFM	670 CFM	92 °F	74 °F	-2 °F	1	AIR FOIL - DIRECT DRIVE	2.30 in-wg	1.50 in-wg	1.25 hp	2.3 hp	200000 Btu/h	160000.0 Btu/h	MODULATING	46 °F	115 °F	80%	91111 Btu/h	65323 Btu/h	80.8 °F	66.8 °F	52.7 °F	52.7 °F	3	15	R-410A	SCROLL	2	11.7	19.3	208 V	3	33.9 A	45 A	DAIKIN APPLIED	DPS-007	2210 lbf	1,2,3,4

EXHAUST FAN SCHEDULE

NOTES:
1.PROVIDE NON-FUSED DISCONNECT SWITCH. COORDINATE WITH ELECTRICAL.
2.PROVIDED MOTORIZED BACKDRAFT DAMPER. ACTUATOR VOLTAGE SHALL BE LINE VOLTAGE.
3.FAN TO BE INTERLOCKED TO RUN WITH CO DETECTOR STATUS SIGNAL.
4.UNIT TO BE SUSPENDED FOR STRUCTURE ABOVE.
5.PROVIDE FAN SPEED CONTROLLER.

MARK	DESCRIPTION	AIR FLOW	STATIC PRESSURE	FAN RPM	SONES	FAN BHP	MOTOR RPM	MOTOR	VOLTAGE	Ø	MANUFACTURER	MODEL	WEIGHT	NOTES
EF 1	SQUARE INLINE - DIRECT DRIVE	635 CFM	0.75 in-wg	1105	7.5	0.16 hp	1800	0.25 hp	115 V	1	TWIN CITY FAN & BLOWER	DSI 135AN	132 lbf	1,2,4,5
EF 2	PROPELLER WALL FAN – DIRECT DRIVE	1200 CFM	0.40 in-wg	1748	13.9	0.18 hp	3600	0.25 hp	115 V	1	TWIN CITY FAN & BLOWER	WPD 14	42 lbf	1,2,3

ELECTRIC CABINET UNIT HEATER SCHEDULE

NOTES:
1.PROVIDE INTEGRAL THERMOSTAT.
2.PROVIDE UNIT MOUNTED DISCONNECT SWITCH
3.UNIT TO BE RECESSED IN WALL.

MARK	ROOM NAME	ROOM NUMBER	DESCRIPTION	AIR FLOW	CAPACITY	ELECTRICAL VOLTAGE	Ø	AMPS	MANUFACTURER	MODEL	NOTES
CUH 1	TOILET	10	FAN FORCED ELECTRIC WALL HEATER	100 CFM	1500 W	120 V	1	13 A	MARLEY ENGINEERED PRODUCTS	LFK151F	1,2,3
CUH 2	TOILET	17	FAN FORCED ELECTRIC WALL HEATER	100 CFM	1500 W	120 V	1	13 A	MARLEY ENGINEERED PRODUCTS	LFK151F	1,2,3
CUH 3	VESTIBULE	1	FAN FORCED ELECTRIC WALL HEATER	100 CFM	3000 W	208 V	3	14 A	MARLEY ENGINEERED PRODUCTS	AWH4404-3000W	1,2,3

LOUVER SCHEDULE

NOTES:
1.PROVIDE ALUMINUM MESH BIRD SCREEN.
2.COLOR AND FINISH TO BE COORDINATED WITH ARCHITECTURAL.

MARK	DESCRIPTION	HEIGHT	WIDTH	AIRFLOW	FREE AREA	VELOCITY	SERVICE	MANUFACTURER	MODEL	NOTES
L1	EXTRUDED ALUMINUM NON-DRAINABLE STATIONARY LOUVER	24"	72"	1835 CFM	6.12 SF	300 FPM	GE	RUSKIN	ELF375X	1,2
L2	EXTRUDED ALUMINUM NON-DRAINABLE STATIONARY LOUVER	24"	24"	1250 CFM	1.92 SF	650 FPM	OA	RUSKIN	ELF375X	1,2

DIFFUSER, GRILLE, AND REGISTER SCHEDULE

NOTES:
1.SEE PLANS FOR NECK SIZE.
2.COORDINATE SURFACE MOUNTING REQUIREMENTS WITH ARCHITECTURAL.

TYPE	DESCRIPTION	FACE SIZE	MOUNTING	CONSTRUCTION MATERIAL	FINISH	SERVICE	MANUFACTURER	MODEL	NOTES
E1	GRILLE WITH 1/2" BLADE SPACING, 35°DEFLECTION	SEE PLANS	SURFACE	ALUMINUM	#26 WHITE	GENERAL EXHAUST AIR	TITUS	355FL	1,2
E2	CEILING GRILLE 1/2" BLADE SPACING, 35° DEFLECTION	24 x 12	LAY IN	STEEL	#26 WHITE	GENERAL EXHAUST AIR	TITUS	355RL	1
R1	CEILING GRILLE 1/2" BLADE SPACING, 35° DEFLECTION	24 x 12	LAY IN	STEEL	#26 WHITE	RETURN AIR	TITUS	355RS	1
R2	GRILLE WITH 1/2" BLADE SPACING, 35°DEFLECTION	SEE PLANS	SURFACE	STEEL	#26 WHITE	RETURN AIR	TITUS	355RL	1,2
S2	SQUARE PLAQUE DIFFUSER	24 x 24	LAY IN	STEEL	#26 WHITE	SUPPLY AIR	TITUS	OMNI	1
S3	GRILLE WITH ¾" BLADE SPACING, SINGLE DEFLECTION, INDEPENDENTLY ADJUSTABLE BLADES	SEE PLANS	SURFACE	STEEL	#26 WHITE	SUPPLY AIR	TITUS	301RL	1,2

SLOT DIFFUSER SCHEDULE

NOTES:
1.SEE PLANS FOR NECK SIZE.

TYPE	DESCRIPTION	MOUNTING	NUMER OF SLOTS	SLOT WIDTH	SLOT LENGTH	CONSTRUCTION MATERIAL	FINISH	SERVICE	MANUFACTURER	MODEL	NOTES
S1	HIGH CAPACITY ADJUSTABLE INSULATED PLENUM SLOT DIFFUSER	LAY-IN	2	3/4"	48"	STEEL	#26 WHITE	SUPPLY AIR	TITUS	TBDI-30	

GAS FIRED UNIT HEATER

NOTES:
1.UNIT TO BE MOUNTED FROM STRUCTURE ABOVE. PROVIDE ALL REQUIRED HARDWARE FOR INSTALLATION PER MANUFACTURES RECOMMENDATIONS.
2.PROVIDE 30° DEFLECTOR HOOD, SINGLE STAGE WALL MOUNTED AND THERMOSTAT WITH GUARD COVER.
3.PROVIDE TYPE B FLUE VENT WITH VENT CAP TERMINATION AND COMBUSTION AIR INTAKE WITH GOOSENECK TERMINATION WITH ½" MESH BIRD SCREEN OR CONCENTRIC VENT KIT INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.

MARK	MANUFACTURER	MODEL	GAS HEATING INPUT	CAPACITY	THERMAL EFF	BURNER STAGES	EAT	LAT	CFM	FAN HP	ELECTRICAL VOLTAGE	Ø	FLA	NOTES:
GUH 1	MODINE	PTS150SS01	150000.0 Btu/h	123000.0 Btu/h	82%	1	50 °F	103 °F	2140 CFM	0 hp	115 V	1	5 A	1,2,3
GUH 2	MODINE	PTS150SS01	150000.0 Btu/h	123000.0 Btu/h	82%	1	50 °F	103 °F	2140 CFM	0 hp	115 V	1	5 A	1,2,3

IMC VENTILATION SCHEDULE

ROOM NUMBER	ROOM NAME	SPACE TYPE	AREA	VOLUME	OCCUPANTS	FIXTURES	CODE REQUIRED OUTDOOR AIR CFM / S.F.	CFM / PERSON	REQUIRED O.A.	EXHAUST CFM PER FIXTURE	EX CFM PER SF	REQUIRED EXHAUST	DESIGN SUPPLY	OUTDOOR AIR	RETURN	EXHAUST	NOTES
1	VESTIBULE	CORRIDOR	109 SF	977 CF	0	0	0.05 CFM/SF	0	5 CFM	0 CFM	0.00 CFM/SF	0 CFM	155 CFM	5 CFM	155 CFM	0 CFM	
2	CIRCULATION	CORRIDOR	310 SF	2792 CF	0	0	0.05 CFM/SF	0	16 CFM	0 CFM	0.00 CFM/SF	0 CFM	190 CFM	20 CFM	335 CFM	0 CFM	
3	KITCHENETTE	BREAKROOM	161 SF	1447 CF	0	0	0.00 CFM/SF	15	0 CFM	0 CFM	0.00 CFM/SF	0 CFM	0 CFM	0 CFM	0 CFM	0 CFM	
4	TRAINING ROOM	CLASSROOM	1160 SF	10438 CF	37	0	0.00 CFM/SF	15	555 CFM	0 CFM	0.00 CFM/SF	0 CFM	1230 CFM	555 CFM	680 CFM	0 CFM	
5	OFFICE	OFFICE	104 SF	936 CF	1	0	0.00 CFM/SF	20	20 CFM	0 CFM	0.00 CFM/SF	0 CFM	95 CFM	20 CFM	100 CFM	0 CFM	
6	STORAGE	STORAGE	121 SF	1089 CF	0	0	0.15 CFM/SF	0	18 CFM	0 CFM	0.00 CFM/SF	0 CFM	70 CFM	20 CFM	70 CFM	0 CFM	
7	OFFICE	OFFICE	104 SF	936 CF	1	0	0.00 CFM/SF	20	20 CFM	0 CFM	0.00 CFM/SF	0 CFM	95 CFM	20 CFM	95 CFM	0 CFM	
9	OFFICE	OFFICE	104 SF	939 CF	1	0	0.00 CFM/SF	20	20 CFM	0 CFM	0.00 CFM/SF	0 CFM	100 CFM	20 CFM	100 CFM	0 CFM	
10	TOILET	TOILET ROOM	45 SF	402 CF	0	1	0.00 CFM/SF	0	0 CFM	75 CFM	0.00 CFM/SF	75 CFM	0 CFM	0 CFM	0 CFM	75 CFM	
11	MECH/ELEC.	MECHANICAL	189 SF	2080 CF	0	0	0.05 CFM/SF	0	9 CFM	0 CFM	1.00 CFM/SF	189 CFM	190 CFM	10 CFM	0 CFM	190 CFM	
12	APPARATUS BAY	GARAGE	788 SF	10099 CF	0	0	1.50 CFM/SF	0	1182 CFM	0 CFM	1.50 CFM/SF	1182 CFM	1250 CFM	1250 CFM	0 CFM	1250 CFM	
13	SHOWER	SHOWER	47 SF	425 CF	0	1	0.00 CFM/SF	0	0 CFM	50 CFM	0.00 CFM/SF	50 CFM	0 CFM	0 CFM	0 CFM	50 CFM	
14	SHOWER	SHOWER	48 SF	435 CF	0	1	0.00 CFM/SF	0	0 CFM	50 CFM	0.00 CFM/SF	50 CFM	0 CFM	0 CFM	0 CFM	50 CFM	
15	TOILET	TOILET ROOM	42 SF	377 CF	0	1	0.00 CFM/SF	0	0 CFM	75 CFM	0.00 CFM/SF	75 CFM	0 CFM	0 CFM	0 CFM	75 CFM	
17	TOILET	TOILET ROOM	42 SF	378 CF	0	1	0.00 CFM/SF	0	0 CFM	75 CFM	0.00 CFM/SF	75 CFM	0 CFM	0 CFM	0 CFM	75 CFM	
18	TOILET	TOILET ROOM	41 SF	366 CF	0	1	0.00 CFM/SF	0	0 CFM	75 CFM	0.00 CFM/SF	75 CFM	0 CFM	0 CFM	0 CFM	75 CFM	
			3414 SF						1845 CFM			1771 CFM	3375 CFM	1920 CFM	1535 CFM	1840 CFM	

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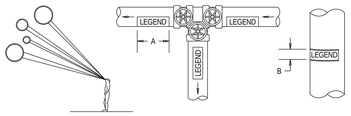
Revisions		
Description	Date	Num

Comm: **173013**
Date: **July 7, 2017**
Drawn: **Author**
Check: **Checker**
North

MECHANICAL SCHEDULES

Scale:

M200



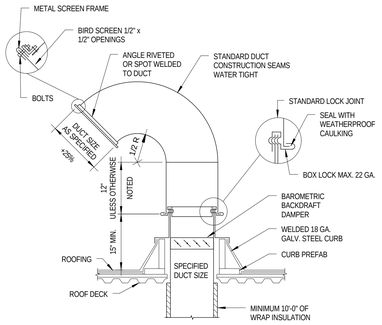
NOTE:
IDENTIFICATION MARKERS OR STRIPS TO BE PLACED ON ALL EXPOSED, COVERED AND UNCOVERED PIPES AT 50'-0" INTERVALS AND AT ALL VALVES AND BRANCHES AND ON BOTH SIDES OF WALLS WHERE PIPES PASS THROUGH SAME. ARROWS OF SAME COLOR AS IDENTIFICATION MARKERS SHALL ALSO BE PLACED ON PIPES POINTING AWAY FROM MARKER INDICATING DIRECTION OF FLOW.

SIZE OF LEGEND LETTERS

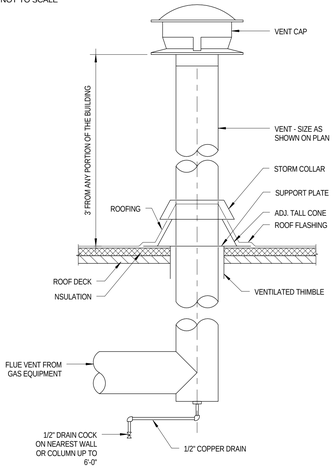
OUTSIDE DIAMETER OF PIPE OR COVERING	LENGTH OF COLOR FIELD A	SIZE OF LETTERS B
3/4" TO 1-1/4"	8"	1/2"
1-1/2" TO 2"	8"	3/4"
2"-1/2" TO 6"	12"	1-1/4"
8" TO 10"	24"	2-1/2"
OVER 10"	32"	3-1/2"

SERVICE	BACKGROUND OR COLOR BAND	IDENTIFICATION MARKER
CITY WATER	GREEN	WHITE ON GREEN
DOMESTIC COLD WATER	GREEN	WHITE ON GREEN
DOMESTIC HOT WATER	GREEN	WHITE ON GREEN
FIRE PROTECTION (SPRINKLER)	RED	WHITE ON RED
NATURAL GAS	YELLOW	BLACK ON YELLOW
SANITARY DRAIN	GREEN	WHITE ON GREEN

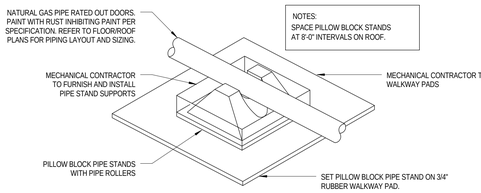
14 TYPICAL PIPE IDENTIFICATION MARKERS
NOT TO SCALE



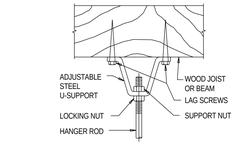
1 GOOSENECK AND COUNTER FLASHING DETAIL
NOT TO SCALE



16 GAS FLUE ROOF PENITRATION
NOT TO SCALE



10 PILLOW BLOCK GAS PIPE SUPPORT DETAIL
NOT TO SCALE



WOOD JOIST OR BEAM

SUPPORT HORIZONTAL STEEL AND COPPER PIPING AS FOLLOWS:

NOMINAL PIPE SIZE	DISTANCE BETWEEN SUPPORTS	HANGER ROD DIAMETERS
1/2"	6'	3/8"
3/4 TO 1-1/2"	6'	1/2"
2" TO 2-1/2"	10'	1/2"
3" AND 4"	10'	5/8"
6" TO 12"	14'	7/8"
14" TO 18"	20'	1"

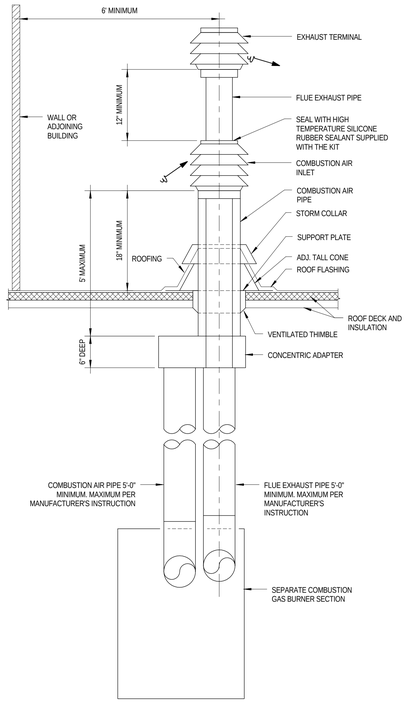
PLACE HANGER WITHIN 1 FOOT OF EACH HORIZ. ELBOW. SUPPORT HORIZ. SOIL WASTE AND STORM PIPE NEAR EACH HUB, WITH 5 FEET MAXIMUM SPACING BETWEEN HANGERS.

VERTICAL PIPING:
1. SUPPORT VERTICAL WATER PIPING AT EVERY FLOOR.
2. SUPPORT VERTICAL SOIL PIPE AT EACH FLOOR AT HUB.

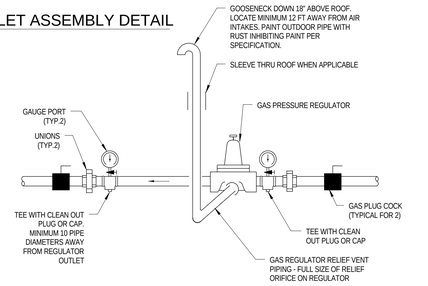
WHERE SEVERAL PIPES CAN BE INSTALLED IN PARALLEL AND AT SAME ELEVATION PROVIDE MULTIPLE OR TRAPEZE HANGERS.

WHERE PRACTICAL, SUPPORT RISER PIPING INDEPENDENTLY OF CONNECTED HORIZ. PIPING.

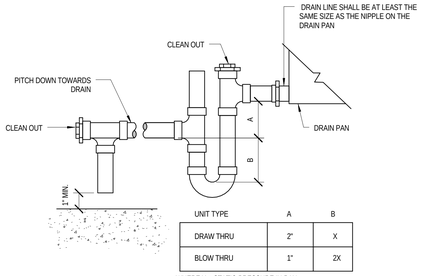
12 PIPE HANGER DETAILS
NOT TO SCALE



15 GAS VENT TERMINAL/COMBUSTION AIR INLET ASSEMBLY DETAIL
NOT TO SCALE



9 NATURAL GAS PRV STATION DETAIL
NOT TO SCALE

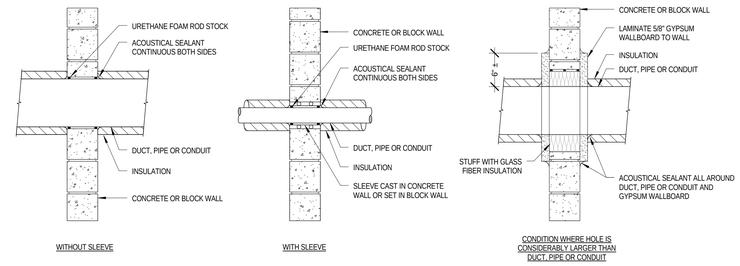


UNIT TYPE	A	B
DRAW THRU	2"	X
BLOW THRU	1"	2X

WHERE X = STATIC PRESSURE IN PAN

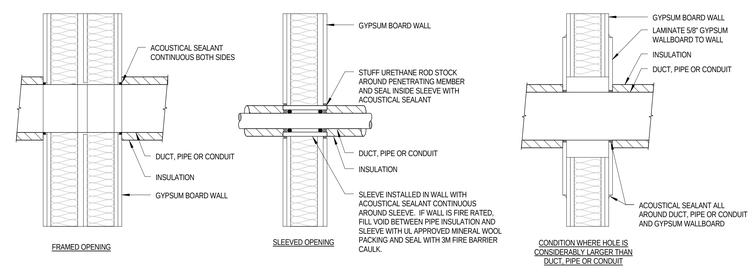
NOTES:
1. COIL MUST BE MOUNTED HIGH ENOUGH TO PERMIT TRAP TO BE INSTALLED.
2. PROVIDE SHIMS OR STRUCTURAL PLATFORMS REQUIRED TO ELEVATE FACTORY PACKAGED AIR HANDLING UNITS TO OBTAIN REQUIRED TRAP HEIGHT.

11 CONDENSATE DRAIN TRAP DETAIL
NOT TO SCALE



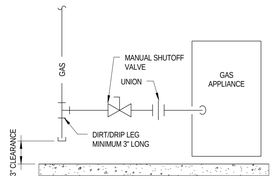
NOTE: WHERE DUCTS, PIPES OR CONDUITS ARE EXTERNALLY INSULATED, DO NOT EXTEND INSULATION THRU WALL.

6 WALL PENITRATION DETAIL - BLOCK OR CONCRETE CONSTRUCTION
NOT TO SCALE

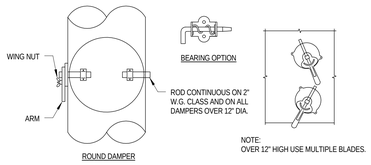


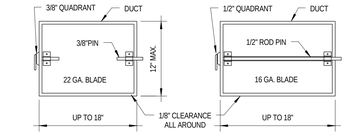
NOTE: WHERE DUCTS, PIPES OR CONDUITS ARE EXTERNALLY INSULATED, DO NOT EXTEND INSULATION THRU WALL.

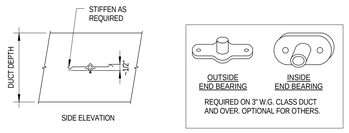
7 WALL PENITRATION DETAIL - STUD CONSTUCTION
NOT TO SCALE



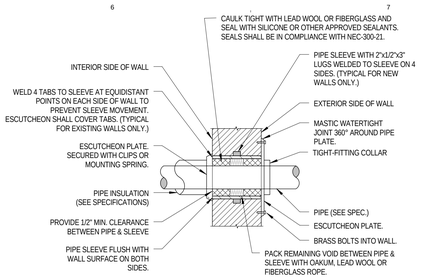
8 NATURAL GAS CONNECTION DETAIL
NOT TO SCALE







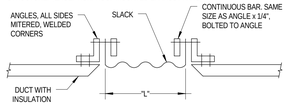
5 VOLUME DAMPER DETAIL
NOT TO SCALE



DETAIL NOTES:
1. CONTRACTOR SHALL ISOLATE ALL PIPES FROM CONSTRUCTION WHICH VIBRATE IN ORDER TO AVOID TRANSMISSION TO STRUCTURE.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR THE COORDINATION OF THEIR SLEEVES WITH OTHER TRADES AND/OR CONTRACTORS.
3. PIPE SLEEVES THRU SMOKE OR FIRE WALLS SHALL BE IN COMPLIANCE WITH NFPA-90A.

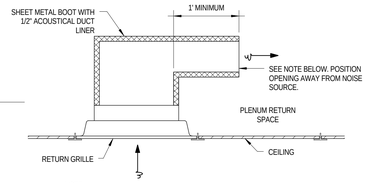
13 PIPE SLEEVE THRU EXTERIOR WALL DETAIL
NOT TO SCALE

NOTE:
FLEXIBLE CONNECTION TO ISOLATE ALL DUCTS FROM ALL FANS AND FAN ENCLOSURES TO PREVENT TRANSMISSION OF VIBRATION TO DUCTWORK AND STRUCTURE. (EXCEPTION: ROOF MOUNTED EXHAUST FANS)



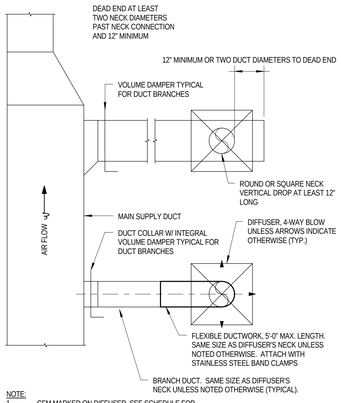
SP OF FAN	MIN. SLACK	MIN. "L"
UP TO 2"	1 1/4"	4"
2 1/8" TO 4"	2"	6"

2 FLEXIBLE DUCT CONNECTION DETAIL
NOT TO SCALE



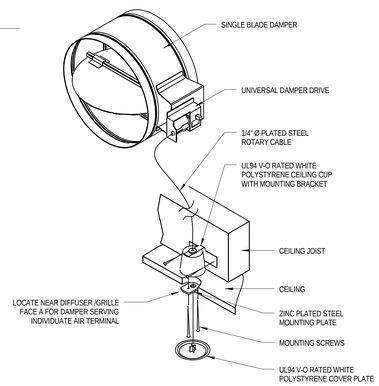
NOTE:
BOOT OUTLET SHALL BE MINUMUM 12" IN HEIGHT BY THE WITDH OF THE GRILLE. SEE PLANS FOR GRILLE DIMENSIONS

3 RETURN AIR GRILLE BOOT DETAIL
NOT TO SCALE



NOTE:
1. CFM MARKED ON DIFFUSER. SEE SCHEDULE FOR SIZING.
2. DETAIL APPLIES TO ALL SITUATIONS WHETHER SHOWN ON PLANS OR NOT

4 TYPICAL DIFFUSER BRANCH DETAIL
NOT TO SCALE



17 CONCEALED CABLE DRIVEN VOLUME DAMPER DETAIL
NOT TO SCALE

C.A.F.T. Building

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

WOLD | RUCK PATE
110 North Brockway, Suite 220
Palatine, Illinois 60067
woldac.com | 847 241 6100

GAGE CONSULTING ENGINEERS INCORPORATED
1301 WEST 22ND STREET Suite 210
Oak Brook, IL 60523
630·472·0918 Fax 630·472·1006

GAGE CONSULTING ENGINEERS, INC.
PROFESSIONAL DESIGN FIRM LICENSE NO. 184.001566, EXPIRES ON 04/30/2019

LICENSED PROFESSIONAL ENGINEER
DAVID R. MCVEY
062-048431
STATE OF ILLINOIS
Exp. 11/30/17

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **PROFESSIONAL ENGINEER** under the laws of the State of

License Number: Date **07-07-2017**

Revisions		
Description	Date	Num

Comm: **173013**
Date: **July 7, 2017**
Drawn: **Author**
Check: **Checker**
North

MECHANICAL DETAILS

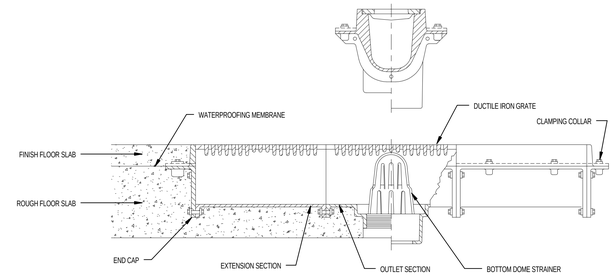
Scale: **As indicated**

M300

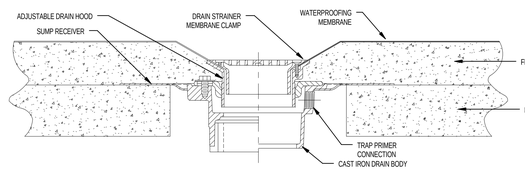
MN

M

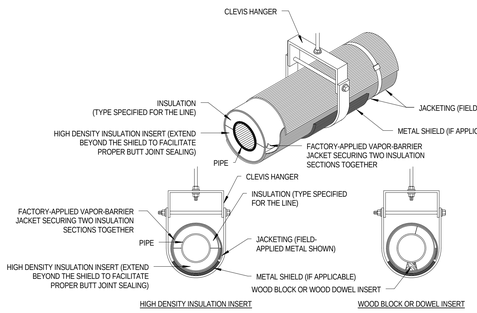
MN



6 EXTRA HEAVY DUTY MODULAR TRENCH DRAIN
NOT TO SCALE



4 SHOWER DRAIN
NOT TO SCALE



8 PIPING INSULATION WITH CLEVIS HANGAR
NOT TO SCALE

PLUMBING GENERAL NOTES

1 THE CONTRACTOR SHALL FURNISH AND INSTALL THE PLUMBING SYSTEMS COMPLETE WITH ALL EQUIPMENT, PIPING, VALVES, INSULATION, CONTROLS, HANGERS, TRIM, ACCESSORIES AND ASSOCIATED WORK, IN ACCORDANCE WITH THE 2014 ILLINOIS PLUMBING CODE, ALL AUTHORITIES HAVING JURISDICTION, AND THE PROJECT SPECIFICATIONS.THE WORK SHALL INCLUDE ALL LABOR, MATERIALS, EQUIPMENT, HOISTING AND RIGGING, SCAFFOLDING, LOADING AND UNLOADING, CLEAN-UP OF DEBRIS AND OTHER SERVICES, TO PROVIDE THE OWNER WITH FULLY OPERATIONAL SYSTEMS.

2 ALL WORK SHALL BE PROPERLY COORDINATED WITH THE WORK OF OTHER TRADES TO AVOID CONFLICTS. REFER TO THE ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR INFORMATION REGARDING CEILING ELEVATIONS, SPACE CLEARANCES, WALL AND PARTITION LOCATIONS ETC., USED TO PREPARE COORDINATED DRAWINGS.

3 ALL NECESSARY CUTTING AND PATCHING OF THE WORK OF GENERAL TRADES FOR THE INSTALLATION OF PLUMBING WORK SHALL BE PERFORMED BY THIS CONTRACTOR. RESTORE SURFACES TO MATCH EXISTING CONDITIONS.

4 ALL MATERIALS AND WORKMANSHIP SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR FROM DATE OF FINAL ACCEPTANCE OF THIS WORK. ENGAGE THE SERVICES OF VARIOUS MANUFACTURERS' SUPPLYING THE EQUIPMENT FOR THE PROPER START-UP ADJUSTMENT AND OPERATION OF THE EQUIPMENT, AND INSTRUCT THE OWNER'S PERSONNEL IN THE PROPER OPERATION AND MAINTENANCE OF THE PLUMBING SYSTEMS.

5 THIS CONTRACTOR SHALL SECURE ALL REQUIRED PERMITS AND APPROVALS AND TRANSMIT ORIGINALS TO THE OWNER FOR RECORD. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL FEES.

6 AN APPROVED REDUCED PRESSURE ZONE (RPZ) BACKFLOW PREVENTER DEVICE SHALL BE INSTALLED IN THE POTABLE WATER SUPPLY TO EACH LOCATION WHERE SANITIZING CHEMICALS OR DETERGENTS WILL BE ASPIRATED OR PUSHED BY WATER PRESSURE INTO CLEANSING/SANITIZING OPERATION. SPILL PROOF OR PRESSURE VACUUM BREAKERS ARE PROHIBITED.

7 DEAD ENDS SHALL BE AVOIDED IN DRAINAGE SYSTEM, EXCEPT WHERE NECESSARY TO EXTEND THE SYSTEM TO INSTALL A CLEANOUT IN AN ACCESSIBLE LOCATION. THE DEAD ENDS INTENDED FOR FUTURE CONNECTION OR CREATED BY REMOVAL OR ABANDONMENT OF PIPE, WHICH IS MORE THAN TWO (2'-0") FEET ABOVE A FLOOR OR MORE THAN TEN (10'-0") FEET HORIZONTALLY FROM THE NEAREST VENTED CONNECTION MUST HAVE A VENTED CONNECTION TO THE OUTSIDE ATMOSPHERE

8 WATER DISTRIBUTION PIPE THAT HAS BEEN TERMINATED OR IS AN UNUSED SEGMENT SHALL HAVE NO DEAD ENDS. NO UNUSED SEGMENT OF PIPE WITH A DEVELOPED LENGTH OF MORE THAN TWO (2'-0") FEET SHALL BE PERMITTED.

9 A STACK TEST IS REQUIRED ON ALL ROUGH AND UNDERGROUND PLUMBING.

10 ALL PVC PIPING LOCATED INSIDE THE RETURN AIR PLENUM CEILING TO BE INSULATED WITH 1/2" THICK FIRE BARRIER PLENUM WRAP INSULATION. THIS INCLUDES ALL PVC PIPING LOCATED INSIDE CHASES AND WALLS THAT ARE NOT COMPLETELY SEALED OFF FROM THE RETURN AIR CEILING PLENUM. REFER TO MECHANICAL DRAWINGS FOR THE EXTENT OF RETURN AIR PLENUM CEILINGS.

11 HOT AND HOT WATER RETURN PIPING TO BE INSULATED IN ACCORDANCE WITH THE SPECIFICATIONS AND IN COMPLIANCE WITH THE 2015 IECC CODE.

12 COLD WATER PIPING TO BE INSULATED IN ACCORDANCE WITH THE PROJECT SPECIFICATION AS TO AVOID CONDENSATION ON THE PIPE OR PIPE INSULATION.

13 INSTALL ALL WATER PIPING ON WARM SIDE OF BUILDING INSULATION. ALL DOMESTIC WATER AND SANITARY PIPING LOCATED IN AREAS SUBJECT TO FREEZING SHALL BE INSULATED AND PROVIDED WITH HEAT TRACE AS REQUIRED TO PREVENT PIPES FROM FREEZING. PLUMBING CONTRACTOR SHALL COORDINATE HEAT TRACE REQUIREMENTS WITH APPLICABLE TRADES.

14 PROVIDE SEISMIC RESTRAINTS FOR ALL PLUMBING EQUIPMENT PER ILLINOIS PLUMBING CODE, 2012 INTERNATIONAL BUILDING CODE, AND LOCAL REQUIREMENTS.

15 PROVIDE AND INSTALL GREASE, OIL, AND LINT INTERCEPTORS PER CURRENT LOCAL CODES.

16 PROVIDE CLEANOUTS PER LOCAL PLUMBING CODES. CONTRACTOR SHALL COORDINATE ACCESSIBLE LOCATIONS FOR ALL FLOOR AND WALL CLEANOUTS WITH ARCHITECTURAL.

17 REPORT WATER PRESSURE AT SITE TO ENGINEER. VERIFY LOCATION OF PRESSURE REDUCING VALVE WITH WATER DEPARTMENT IF REQUIRED.

18 EACH BATHROOM GROUP SHALL HAVE HOT AND COLD LINE ISOLATION VALVES ON THE WATER SUPPLY PIPING. ALL VALVES SHALL BE LOCATED IN ACCESSIBLE LOCATIONS.

19 PIPING SHOWN IS DIAGRAMMATIC IN NATURE AND INDICATE GENERAL LOCATION AND LAYOUT OF PIPING AND EQUIPMENT USED FOR CALCULATIONS AND SIZING. DRAWINGS ARE NOT INTENDED TO BE SCALED FOR EXACT DIMENSIONS. CONTRACTOR IS RESPONSIBLE FOR ALL COORDINATION WITH OTHER TRADES, INCLUDING PROVIDING ALL OFFSETS AS REQUIRED TO AVOID CONFLICTS. DEVIATIONS FROM GENERAL LAYOUT AS SHOWN SHALL REQUIRE APPROVAL FROM ARCHITECT AND ENGINEER PRIOR TO INSTALLATION.

20 BIDDERS, PRIOR TO SUBMITTING PROPOSALS, SHALL VISIT THE SITE AND FULLY EXAMINE THE AREAS INVOLVED WITH THIS WORK, TO FAMILIARIZE THEMSELVES WITH THE EXACT CONDITIONS AND DIFFICULTIES THAT MAY ATTEND THE EXECUTION OF THIS WORK. SUBMISSION OF A PROPOSAL WILL BE CONSTRUED AS EVIDENCE THAT SUCH AN EXAMINATION HAS BEEN MADE, AND LATER CLAIMS WILL NOT BE RECOGNIZED, FOR EXTRA LABOR, MATERIALS AND EQUIPMENT, REQUIRED BECAUSE OF ADDITIONAL DIFFICULTIES ENCOUNTERED, WHICH COULD HAVE BEEN FORESEEN HAD SUCH AN EXAMINATION BEEN MADE.

21 SUBMIT PDFS OF THE PLUMBING INSTALLATION SHOP DRAWINGS, CERTIFIED BY ALL TRADES THAT COORDINATION HAS BEEN ESTABLISHED. SUBMIT PLUMBING FIXTURE CUTS WITH TRIM, INSULATION, PIPE MATERIALS, FITTINGS, VALVES AND CERTIFIED EQUIPMENT CUTS WITH CONSTRUCTION WIRING DIAGRAMS. SUBMIT PDFS OF OPERATING AND SERVICE MANUALS WHICH SHALL INCLUDE COPIES OF ALL SHOP DRAWINGS, FIXTURE AND EQUIPMENT CUTS, SERVICE INSTRUCTIONS.

22 THE POTABLE WATER SYSTEM SHALL BE DISINFECTED BY FILLING WITH A SOLUTION CONTAINING 200 PPM OF AVAILABLE CHLORINE AND ALLOWING IT TO STAND 3 HOURS. THEN FLUSH THE SYSTEM WITH CLEAN, POTABLE WATER UNTIL CHLORINE LEVELS ARE WITHIN ACCEPTABLE LIMITS. ALL TESTING SHALL BE IN ACCORDANCE WITH LOCAL PLUMBING CODES.

23 DRAINAGE AND VENTING SYSTEMS SHALL BE TESTED BY WATER OR AIR TO PROVE WATERTIGHT. TESTING SHALL BE IN ACCORDANCE WITH LOCAL PLUMBING CODES.

24 ALL FIXTURE TRAPS SUBJECT TO LOSS OF A TRAP SEAL BY EVAPORATION MUST HAVE A TRAP PRIMER INSTALLED IN COMPLIANCE WITH ASSE 1018.

25 ANY HOSE BIBB FIXTURES MUST BE PROVIDED WITH BACKFLOW PREVENTION AND BE IN COMPLIANCE WITH LOCAL PLUMBING CODES.

26 ALL PLUMBING FIXTURES SHALL BE PROVIDED AS PER THE FIXTURE SCHEDULE OR APPROVED EQUAL AS LISTED IN PROJECT SPECIFICATIONS.

27 THE OUTLET TEMPERATURE OF THE RESTROOM LAVATORIES SHALL BE LIMITED TO 110°F. PROVIDE THERMOSTATIC MIXING VALVES AS REQUIRED.

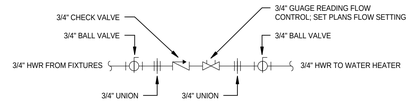
28 PROVIDE A POSITIVE SLOPE TO ALL FLOOR DRAINS. COORDINATE REQUIREMENTS WITH ARCHITECTURAL.

29 ALL PENETRATIONS THROUGH ANY FIRE-RESISTANT RATED ASSEMBLIES MUST BE PROTECTED IN ACCORDANCE WITH THE LOCAL BUILDING CODE.

30 HANGERS, ANCHORS & SUPPORTS SHALL BE IN ACCORDANCE WITH LOCAL PLUMBING CODES.

31 ALL IN-SLAB PIPING SHALL BE PROTECTED FROM BREAKAGE CAUSED BY STRESS OR STRAIN BY A PROTECTIVE SLEEVE OR WRAP-ON MATERIAL.

32 ANY HOSE BIBB FIXTURES MUST BE PROVIDED WITH BACKFLOW PREVENTION AND BE IN COMPLIANCE WITH LOCAL PLUMBING CODES.



12 HOT WATER RETURN BALANCING STATION
NOT TO SCALE

PLUMBING SYMBOLS

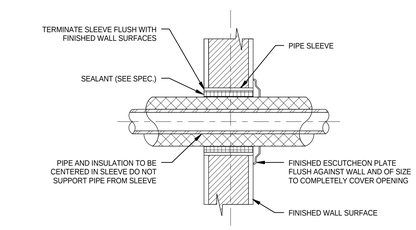
(NOTE: NOT ALL SYMBOLS MAY BE REQUIRED OF THIS PROJECT.)

- BALANCING VALVE
- BALL VALVE
- BUTTERFLY VALVE
- CHECK VALVE / BACKWATER VALVE
- CONTROL POINT — POINT TYPE
- MOTOR OPERATED / CONTROL VALVE
- FLEX CONNECTION
- GATE VALVE - OS&Y
- GATE VALVE - NRS
- GLOBE VALVE
- HOSE END DRAIN VALVE
- INCREASER/REDUCER
- MIXING VALVE
- NEW CONNECTION
- PIPE CAP
- PIPE CUT SYMBOL
- PRESSURE GUAGE
- PRESSURE REGULATING VALVE
- PUMP
- P-1 — PUMP TAG; T&P — VALVE TYPE
- SAFETY RELIEF VALVE
- SHUT OFF VALVE
- STRINER
- STRAINER WITH BLOW DOWN VALVE
- THERMOMETER
- THREE WAY MOTOR OPERATED / CONTROL VALVE
- UNION
- NEW CONNECTION
- DEMOLITION LIMIT
- KEY NOTE TAG — KEY NUMBER; PLUMBING NOTE TAG
- EQP-X — FIXTURE DESIGNATION; EQUIPMENT TYPE
- TYP MRK — EQUIPMENT NUMBER; RISER NUMBER
- XX PXXX — PLUMBING NOTE TAG; REFERANCE SHEET
- 1" XXX — PIPE TAG; SYSTEM ABBREVIATION
- PIPE SIZE
- PIPE RISE
- PIPE DROP
- WALL HYDRANT / HOSE BIBB
- CLEANOUT
- DOMESTIC COLD WATER
- DOMESTIC HOT WATER
- DOMESTIC HOT WATER RETURN
- VENT
- SANITARY
- STORM

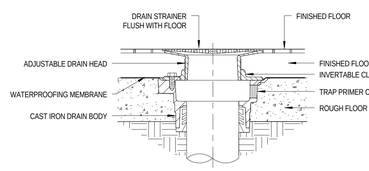
PLUMBING ABBREVIATIONS

(NOTE: NOT ALL ABBREVIATIONS MAY BE REQUIRED OF THIS PROJECT.)

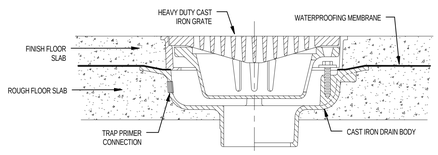
A	AMP
AD	ACCESS DOOR
ADA	AMERICANS WITH DISABILITIES ACT
AFF	ABOVE FINISH FLOOR
AHJ	AUTHORITY HAVING JUSTIDICTION
AI	ANALOG INPUT
APX	APROXIMATE
AO	ANALOG OUTPUT
ARCH	ARCHITECT
AW	ACID WASTE
B	BOILER
BAS	BUILDING AUTOMATION SYSTEM
BFP	BACK FLOW PREVENTER
BFV	BUTTERFLY VALVE
BFT	BUFFER TANK
BHP	BREAK HORSE POWER
BI	BINARY INPUT
BMS	BUILDING MANAGEMENT SYSTEM
BP	BOILER PUMP
BO	BINARY OUTPUT
BT	BATHING/BATH TUB
BTU	BRITISH THERMAL UNIT
BV	BALL VALVE
CA	COMPRESSED AIR
CD	CONDENSATE PRIPING
CI	CAST IRON
CLG	CEILING
CO	CLEAN OUT
COP	COEFFICIENT OF PERFORMANCE
CO(TG)	CLEANOUT TO GRADE
COV	CHAIN OPERATED VALVE
CP	CONDENSATE PUMP
CPVC	CHLORINATED POLYVINYL CHLORIDE
CSS	CLINICAL SERVICE SINK
CU IN	CUBIC INCH
CU FT	CUBIC FOOT
CW	COLD WATER
D	DRAIN
DCBP	DOUBLE CHECK VALVE
DCV	DUAL CHECK VALVE
DCDA	DOUBLE CHECK VALVE DETECTOR ASSEMBLY
DDC	DIRECT DIGITAL CONTROL
DI	DE-IONIZED WATER
DIA	DIAMETER
DN	DOWN
DS	DISHSPOUT
DWG	DRAWING
DX	DIRECT EXPANSION
EFF	EFFICIENCY
EL	ELEVATION
EPP	ELEVATOR PIT PUMP
EX. (E)	EXITISTING
ET	EXPANSION TANK
ETR	EXISTING TO REMAIN
EWC	ELECTRIC WATER COOLER
EW	EYE WASH
EWT	ENTERING WATER TEMPERATURE
°F	DEGREE FAHRENHEIT
FCO	FLOOR CLEAN OUT
FD	FLOOR DRAIN
FLA	FULL LOAD AMPS
FP	FIRE PROTECTION
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FPT	FEMALE PIPE THREAD
FS	FLOOR SINK
FT	FOOT / FEET
F&T	FLOAT AND THEMOSTATIC
G	GAS (NATURAL)
GA	GAUGE
GAL	GALLON
GD	GARAGE DRAIN
GE	GROOVED END
GI	GREASE INTERCEPTOR
GPM	GALLONS PER MINUTE
GPH	GALLON PER HOUR
GW	GREASE WASTE
H	HUMIDIFIER
HB	HOSE BIBB
HD	HUB DRAIN
HG	MERCURY
HP	HORSE POWER
HW	HOT WATER
HWR	HOT WATER RETURN
HVAC	HEATING VENTILATING AND AIR CONDITIONING
HX	HEAT EXCHANGER
I/O	INPUT OUTPUT
ID	INSIDE DIAMETER
IM	ICE MAKER
IN	INCH, INCHES
IP	IRON PIPE
IPS	IRON PIPE SIZE
KW	KILOWATT
KO	KNOCK OUT
L	LAVATORY
LBS	POIUNDS
LF	LINEAR FEET
LI	LINT INTERCEPTOR
LP	LIQUIFIED PETROLEUM
LRA	LOCKED ROTOR AMPS
MAX	MAXIMUM
MB	MOP BASIN
MBH	THOUSAND BTU
MIN	MINIMUM
MOCP	MAXIMUM OVER-CURRENT PROTECTION
MOP	MAXIMUM OPERATING PRESSURE
MPT	MALE PIPE THREAD
N/A	NOT APPLICABLE
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NRS	NON-RISING STEM
NTS	NOT TO SCALE
OB	OUTLET BOX
OC	ON CENTER
ODP	OPEN DRIP PROOF
OI	OIL INTERCEPTOR
OS&Y	OUTSIDE STEM AND YOKE
OSD	OPEN SITE DRAIN
OST	OVERFLOW STORM
ORD	ORVERFLOW ROOF DRAIN
Ø	PHASE
P	PRESSURE / PUMP
PD	PRESSURE DROP
PE	POLYETHYLENE
P&ID	PIPING AND INSTRUMENTATION DRAWING
PPM	PARTS PER MILLION
PRV	PRESSURE REDUCING VALVE
PSI	POUND PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
R	RETURN
RD	ROOF DRAIN
RLA	RUNNING LOAD AMPS
RM	ROOM
RP	RECIRCULATING PUMP
RPBP	REDUCED PRESSURE BACKFLOW PREVENTER
RPDA	REDUCED PRESSURE DETECTOR ASSEMBLY
RPM	REVOLUTIONS PER MINUTE
RPZ	REDUCED PRESSURE ZONE (VALVE)
S	SUPPLY
SAN	SANITARY
SB	SETTLING BASIN
SD	SHOWER DRAIN
SE	SEWAGE EJECTOR
SF	SERVICE FACTOR
SHV	SHOWER VALVE
SK	SINK
SP	SUMP PUMP
SOV	SHUT OFF VALVE
SQ FT	SQUARE FEET
ST	STORM
STM	STEAM
SV	SOLINOID VALVE
SW	SWITCH
T	TEMPRATURE
TMV	THERMOSTATIC MIXING VALVE
TS	TEMPRATURE SWITCH
TYP	TYPICAL
UL	UNDERWRITERS LABORATORY
UR	URINAL
V	VENT / VOLT
VB	VACUUM BREAKER
VEL	VELOCITY
VFD	VARIABLE FREQUERNCY DRIVE
VTR	VENT THRU ROOF.
W	WASTE / WATTS
W/	WITH
W/O	WITHOUT
WC	WATER CLOSET
WCO	WALL CLEAN OUT
WH	WATER HEATER
WT	WEIGHT



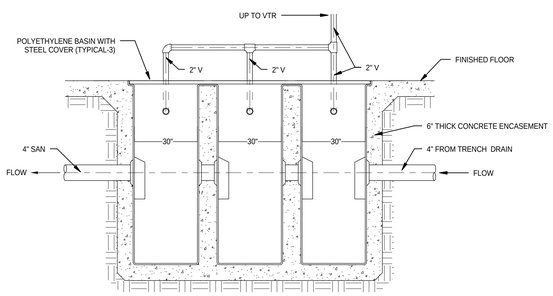
7 PIPE SLEEVE THRU INTERIOR WALL
NOT TO SCALE



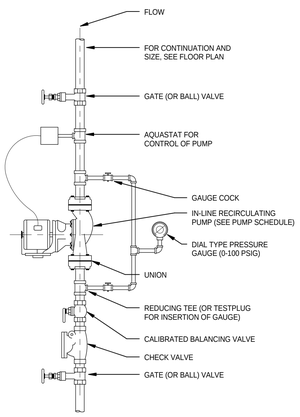
5 TYPICAL FLOOR DRAIN WITH ADJUSTABLE TOP
NOT TO SCALE



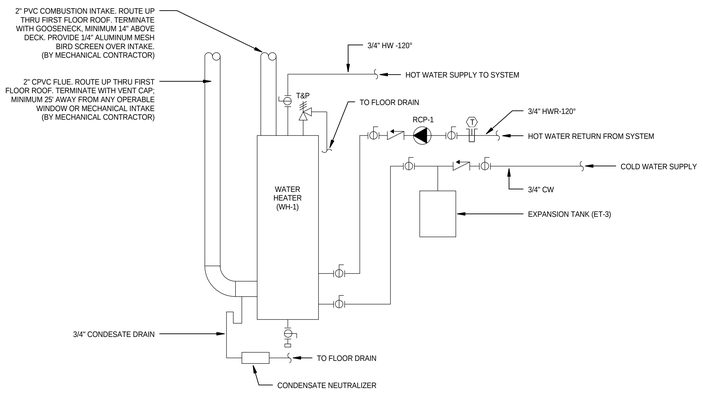
3 12" DIAMETER HEAVY-DUTY DRAIN
NOT TO SCALE



9 TRIPLE BASIN DETAIL
NOT TO SCALE



10 DOMESTIC WATER RECIRCULATING PUMP
NOT TO SCALE



11 WH-1 HIGH EFFICIENCY GAS WATER HEATER
NOT TO SCALE

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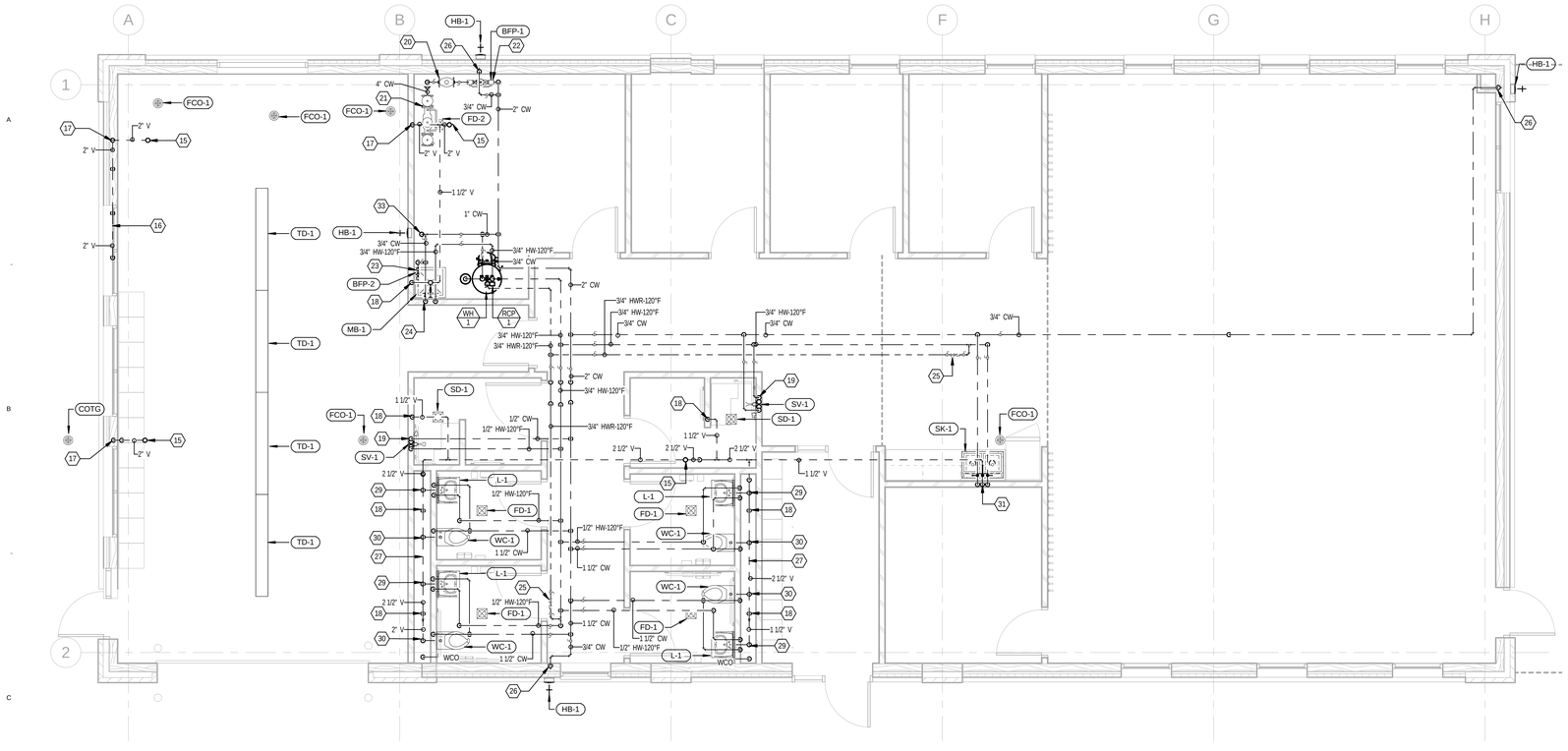
PLUMBING GENERAL NOTES, SYMBOLS, AND DETAILS

Scale: **As indicated**

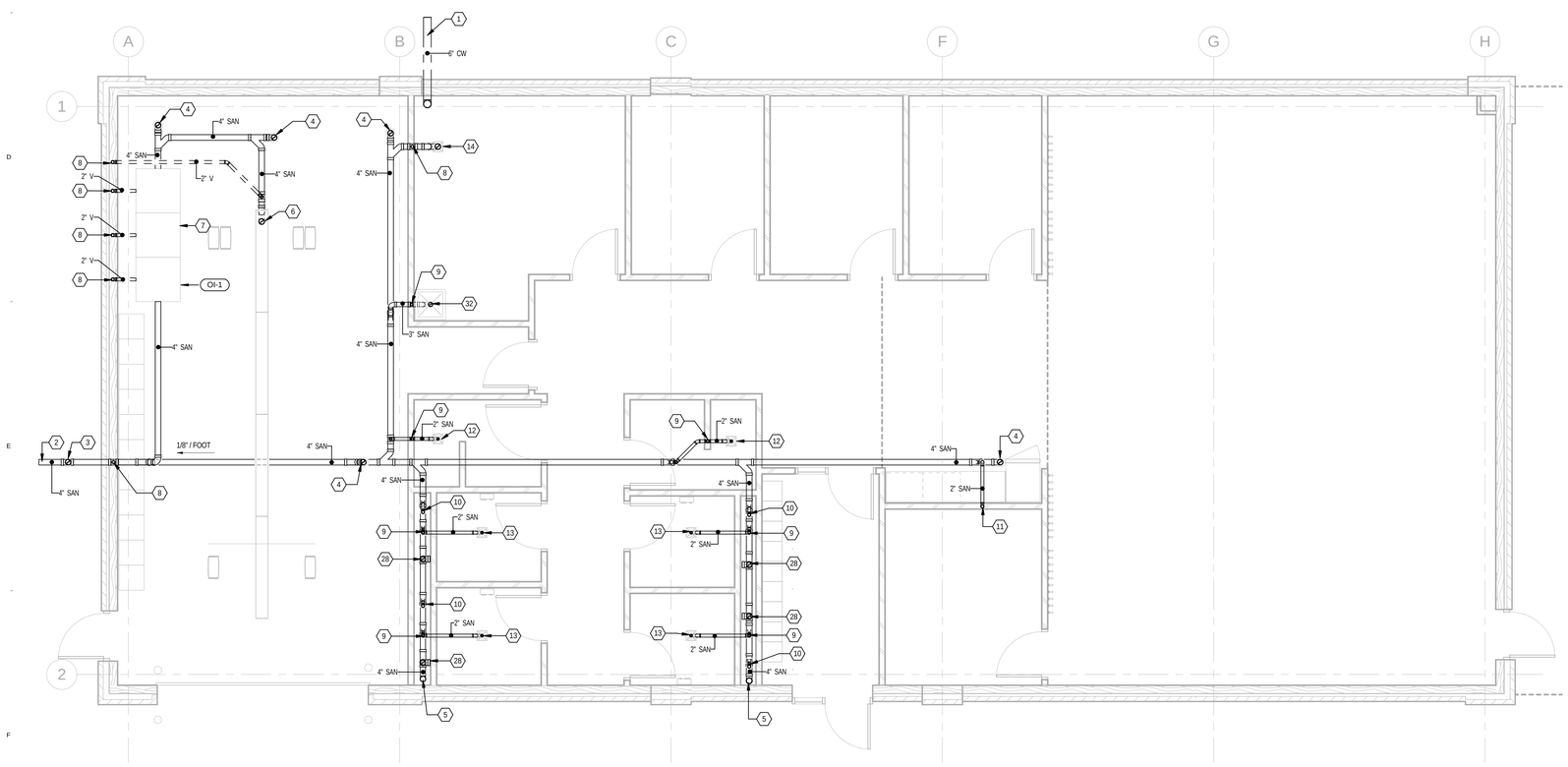
P001

MN



1 PLUMBING PLAN
1/4" = 1'-0"

M



2 UNDERGROUND PLUMBING PLAN
1/4" = 1'-0"

PLUMBING PLAN NOTES

1. ALL DOMESTIC WATER PIPING SHALL BE INSTALLED COMPLETELY ON THE INTERIOR SIDE OF THE BUILDING THERMAL INSULATION. COORDINATE WITH ARCHITECTURAL ON INSULATION LOCATION.
2. ALL PVC PIPING LOCATED IN A AREAS DESIGNATED AS A MECHANICAL PLENUM SHALL BE PROVIDED WITH FIRE WRAP TO A MAINTAIN 25/50 FLAME SPREAD AND SMOKE DEVELOPED RATING.
3. ALL DOMESTIC WATER PIPING SHALL BE INSULATED WITH MINIMUM 1" PIPE INSULATION WITH VAPOR BARRIER JACKET.
4. ALL HOT WATER SUPPLY AND RETURN PIPING SHALL BE INSTATED TO ECC 2015 REQUIREMENTS OR BETTER.
5. ALL HORIZONTAL STORM AND STORM OVERFLOW PIPING SHALL BE PROVIDED WITH MINIMUM 1" PIPE INSULATION WITH VAPOR BARRIER JACKET.
6. ALL EXPOSED INSULATED PIPING BELOW 8' A.F.F. SHALL BE PROVIDED WITH WHITE PVC PROTECTIVE JACKET.
7. ALL ISOLATION AND CONTROL VALVES SHALL BE LOCATED IN AN ACCESSIBLE LOCATION. COORDINATE ACCESS PANEL LOCATIONS WITH ARCHITECTURAL.
8. ROUTE ALL DOMESTIC WATER PIPING SERVING ROOMS ADJACENT TO THE CORRIDOR BELOW THE TRUSS GIRDER. SEE STRUCTURAL AND ARCHITECTURAL DETAILS.
9. ALL DOMESTIC WATER CONNECTING WITH OWNER PROVIDED EQUIPMENT SHALL BE PROVIDED WITH QUARTER TURN BALL VALVE(S) AND WATER HAMMER ARRESTER(S).
10. ALL ISOLATION VALVES SHALL BE PROVIDED WITH INDENTIFICATION OF ROOM OR SPECIFIC FIXTURE OR EQUIPMENT SERVED.
11. MOUNTING HEIGHT OF ALL FIXTURES SHALL BE COORDINATED WITH ARCHITECTURAL PRIOR TO ROUGH IN.

UNDERGROUND PLUMBING PLAN NOTES

1. ALL UNDERGROUND STORM PIPING SHALL BE INSTALLED AT A MINIMUM 1% GRADE DOWN. COORDINATE REQUIRED PIPE INVERT ELEVATION LEAVING THE BUILDING WITH CIVIL ENGINEERING DOCUMENTS.
2. ALL UNDERGROUND SANITARY PIPING LARGER THAN 2" NPS SHALL BE INSTALLED AT A MINIMUM 1% GRADE DOWN. ALL UNDERGROUND SANITARY PIPING 3" NPS AND SMALLER SHALL BE INSTALLED AT A MINIMUM 2% GRADE DOWN. COORDINATE REQUIRED INVERT ELEVATION LEAVING THE BUILDING WITH CIVIL ENGINEERING DOCUMENTS.
3. ALL UNDERGROUND DOMESTIC WATER PIPING OUTSIDE OF THE BUILDING FOOTPRINT SHALL BE INSTALLED AT A MINIMUM 5' BELOW GRADE. COORDINATE EXACT LOCATION WITH CIVIL ENGINEERING DOCUMENTS.
4. ALL UNDERGROUND GREASE WASTE PIPING SHALL BE EXTRA HEAVY WEIGHT CAST IRON, MINIMUM 4" NPS.
5. UNDERGROUND PIPE PENETRATIONS OF STRUCTURAL FOUNDATION WALL SHALL BE PROVIDED WITH PIPE SLEEVES. COORDINATE ALL LOCATIONS WITH STRUCTURAL ENGINEER.
6. ALL FLOOR CLEANOUTS SHALL BE INSTALLED WITH MINIMUM 18" SERVICE CLEARANCE.

P100 KEY NOTES

KEY	NOTE
1	6" INCOMING COMBINED DOMESTIC WATER AND FIRE PROTECTION SERVICE. SEE CIVIL DRAWINGS FOR CONTINUATION AND INVERT REQUIREMENTS.
2	4" BUILDING DRAIN. SEE CIVIL DRAWINGS FOR CONTINUATION AND INVERT REQUIREMENTS.
3	4" UP TO COTG.
4	4" UP TO FCO.
5	4" UP TO WCO.
6	4" UP TO TRENCH DRAIN BOTTOM OUTLET.
7	EXACT LOCATION OF OIL INTERCEPTOR SHALL BE COORDINATED WITH ARCHITECTURAL. INLET AND OUTLET INVERT ELEVATIONS SHALL BE COORDINATED BY CONTRACTOR PRIOR TO PURCHASE OF INTERCEPTOR.
8	2" VENT UP.
9	1-1/2" VENT UP.
10	2" UP TO LAVATORY.
11	2" UP TO SINK.
12	2" UP TO SHOWER DRAIN.
13	2" UP TO FLOOR DRAIN
14	4" UP TO FLOOR DRAIN.
15	4" VTR.
16	MANIFOLD OIL INTERCEPTOR VENTS TOGETHER IN WALL; MINIMUM 6" A.F.F.
17	2" VENT DOWN IN WALL TO UNDERGROUND.
18	1-1/2" VENT DOWN IN WALL TO UNDERGROUND.
19	1/2" DOMESTIC HOT AND COLD WATER DOWN TO SHOWER VALVE.
20	2" DOMESTIC WATER SERVICE. COORDINATE METER REQUIREMENT WITH MUNICIPALITY.
21	4" FIRE PROTECTION SERVICE AND BACKFLOW PREVENTER. SEE FIRE PROTECTION DRAWINGS.
22	ROUTE RPZ DRAIN TO FLOOR DRAIN, DISCHARGE WITH AIR GAP.
23	RPZ FOR CONNECTION TO CHEMICAL SANITIZING STATION. ROUTE RPZ DRAIN TO MOP BASIN, DISCHARGE WITH AIR GAP.
24	3/4" DOMESTIC HOT AND COLD DOWN TO MOP BASIN FAUCET.
25	HOT WATER RETURN BALANCING STATION, SET TO 0.5 GPM. SEE DETAIL ON P001.
26	3/4" DOMESTIC COLD WATER DOWN IN WALL TO HOSE BIBB.
27	MANIFOLD TOILET ROOM FIXTURE VENTS IN PLUMBING CHASE, MINIMUM 6" ABOVE FLOOD RIM OF LAVATORY.
28	4" SANITARY UP TO WALL MOUNTED WATER CLOSET.
29	1/2" DOMESTIC HOT AND COLD, 1-1/2" VENT DOWN TO LAVATORY. 2" WASTE DOWN TO UNDERGROUND.
30	1-1/2" DOMESTIC COLD, 2" VENT DOWN TO WALL MOUNTED WATER CLOSET. 4" SANITARY DOWN TO UNDERGROUND.
31	1/2" DOMESTIC HOT AND COLD, 1-1/2" VENT DOWN TO SINK. 2" WASTE DOWN TO UNDERGROUND.
32	3" SANITARY UP TO MOP BASIN.
33	3/4" DOMESTIC COLD WATER DOWN TO HOSE BIBB.

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184.001566, EXPIRES ON 04/30/2019

LICENSED PROFESSIONAL ENGINEER
DAVID R. MCVEY
062-048431
STATE OF ILLINOIS
Exp. 11/30/17

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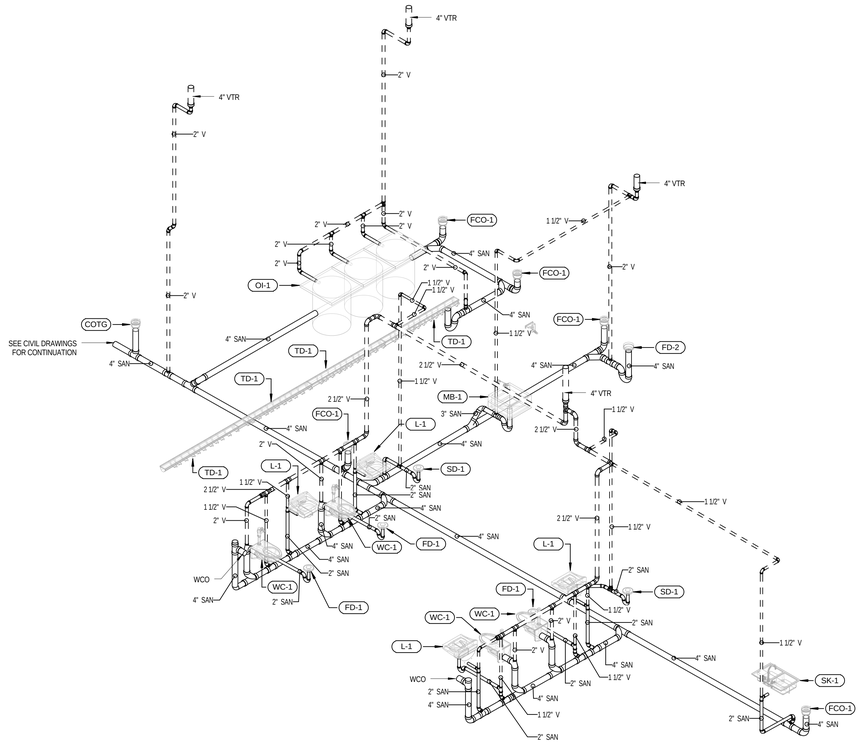
MAIN LEVEL PLUMBING PLANS

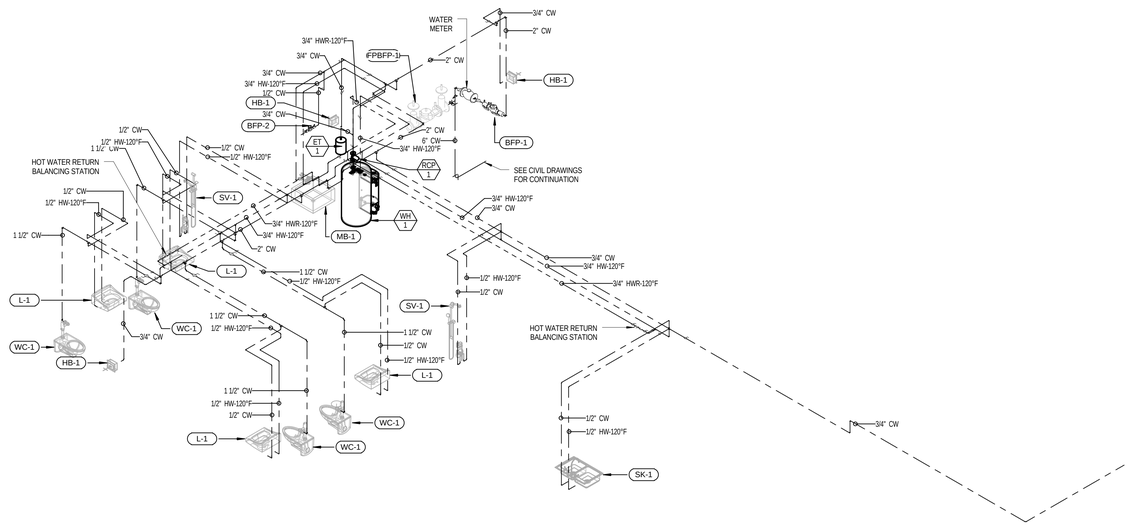
Scale: **As indicated**

P100

MN



1 SANITARY / VENT RISER DIAGRAM



2 DOMESTIC WATER RISER DIAGRAM

M

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PLUMBING RISER DIAGRAMS

Scale:

P200

FLOOR DRAIN SCHEDULE

TAG	QTY.	MANUFACTURER	MODEL	STRAINER	STRAINER DIM.	DRAIN BODY	WASTE	SERVICE	DESCRIPTION
FD-1	4	ZURN	Z415S	SQUARE - POLISHED NICKEL BRONZE	6" X 6"	CAST IRON	2"	FINISHED AREAS	DURA-COATED BODY, ADJUSTABLE COLLAR WITH SEEPAGE SLOTS. PROVIDE WITH HEEL PROOF STRAINER, VANDAL PROOF SECURED TOP, DEEP SEAL P-TRAP AND ZURN MODEL Z1022-XL TRAP PRIMER.
FD-2	1	ZURN	Z541	CAST IRON	12"Ø	CAST IRON	4"	MECHANICAL	DURA-COATED BODY AND GRATE. SEEPAGE PAN AND COMBINATION MEMBRANE FLASHING CLAMP AND FRAME, POLYPROPYLENE SEDIMENT BUCKET. PROVIDE WITH, VANDAL PROOF SECURED TOP, DEEP SEAL P-TRAP AND ZURN MODEL Z1022-XL TRAP PRIMER

SHOWER DRAIN SCHEDULE

TAG	QTY.	MANUFACTURER	MODEL	STRAINER	STRAINER DIM.	DRAIN BODY	WASTE	DESCRIPTION
SD-1	2	ZURN	Z415S	SQUARE - NICKEL BRONZE	6" X 6"	CAST IRON	2"	DURA-COATED BODY, ADJUSTABLE COLLAR WITH SEEPAGE SLOTS. LIGHT DUTY SQUARE LEVELING STRAINER, VANDAL PROOF SECURED TOP. PROVIDE DEEP SEAL P-TRAP.

CLEANOUT SCHEDULE

TAG	QTY.	MANUFACTURER	MODEL	TOP	BODY	PIPE SIZE	SERVICE	DESCRIPTION
FCO-1	5	ZURN	Z1400	ROUND - POLISHED NICKEL BRONZE	CAST IRON	4"	ALL AREAS	DURA-COATED BODY WITH GAS AND WATER TIGHT ABS TAPERED THREAD PLUG AND ROUND EXTRA SECURED TOP ADJUSTABLE TO FINISHED FLOOR. PROVIDE WITH VANDAL-PROOF SCREWS.

FLUSH VALVE WATER CLOSET SCHEDULE

			TOILET		FLUSH VALVE						
TAG	QTY.	SERVICE	MANUFACTURER	MODEL	MANUFACTUERER	MODEL	GPF	SANITARY	CW	DESCRIPTION
WC-1	4	PUBLIC TOILET	AMERICAN STANDARD	2257.001	SLOAN	ECOS 115-1.28 HW	1.3 gal	4"	1"	WALL MOUNTED ELONGATED FLUSHOMETER TOILET, VITREOUS CHINA, WHITE FINISH, 16-1/2" BOWL HEIGHT. PROVIDE CARRIER AND BEMIS MODEL 3155SSCT ANTI-MICROBIAL OPEN FRONT SEAT LESS COVER. HARD WIRED SENSOR ACTIVATED FLUSH VALVE. PROVIDE WALL CARRIER AND ESCUTCHEON PLATE. ADA COMIPLIANT FIXTURE.

MOP BASIN SCHEDULE

		BASIN		FAUCET					
TAG	QTY.	MANUFACTURER	MODEL	MANUFACTURER	MODEL	WASTE	CW	HW	DESCRIPTION
MB-1	1	FIAT	TSB-100	CHICAGO FAUCET	814-VBCP	3"	1/2"	1/2"	12" TERRAZZO MOP BASIN WITH STAINLESS STEEL CAPS ON ALL CURBS. PROVIDE WITH STAINLESS STEEL STRAINER. FAUCET SHALL BE WALL MOUNTED WITH INTEGRAL PAIL HOOK AND VACUUM BREAKER.

LAVATORY SCHEDULE

		BASIN		FAUCET					
TAG	QTY.	MANUFACTURER	MODEL	MANUFACTURER	MODEL	WASTE	CW	HW	DESCRIPTION
L-1	4	AMERICAN STANDARD	0356.421	SLOAN	EAF200-ISM	1 1/2"	1/2"	1/2"	ADA COMPLIANT FIXTURE - WALL HUNG VITREOUS CHINA, SINGLE FAUCET HOLE, D-SHAPED BOWL WITH FRONT OVERFLOW. HARD WIRED POLISHED CHROME IR SENSOR FAUCET. 0.5 GPM FLOW RATE. PROVIDE POINT OF USE THERMOSTATIC MIXING VALVE, LOOSE KEY STOPS, STAINLESS STEEL GRID STRAINER, TAILPIECE, P-TRAP, AND CARRIER. INSULATE EXPOSED DOMESTIC WATER AND WASTE LINES PER ADA REQUIREMENTS.

HOSE BIBB SCHEDULE

TAG	QTY.	MANUFACTURER	MODEL	CW	DESCRIPTION
HB-1	4	WOODFORD MANUFACTURING COMPANY	B65C-6	1/2"	ANTI-SIPHON FREEZELESS WALL HYDRANT – ¾" MALE HOSE THREAD VACUUM BREAKER. CHROME PLATED CONCEALED RECTANGULAR WALL BOX, AND LOOSE KEY OPERATION. COORDINATE WALL THICKNESS WITH ARCHITECTURAL.

BACKFLOW PREVENTOR SCHEDULE

						RATED CONDITIONS	
TAG	QTY	SIZE	MANUFACTURER	MODEL	DISCRIPTION	FLOW	PRESSURE
BFP-1	1	2"	WATTS	LF009-M2-QT	REDUCED PRESSURE ZONE BACKFLOW PREVENTER ASSEMBLY	80 GPM	13.00 psi
BFP-2	1	1/2"	WATTS	LF009-QT	REDUCED PRESSURE ZONE BACKFLOW PREVENTER ASSEMBLY	5 GPM	17.00 psi

SINK SCHEDULE

		BASIN		FAUCET					
TAG	QTY.	MANUFACTURER	MODEL	MANUFACTURER	MODEL	WASTE	CW	HW	DESCRIPTION
SK-1	1	ELKAY	LRAD332265PD	CHICAGO FAUCET	201-AGN8AE29-317AB	1 1/2"	1/2"	1/2"	TOP MOUNT DOUBLE BOWL SINK WITH TWO PERFECT DRAIN STRAINER ASSEMBLIES, 6.5" BOWL DEPTH, 18 GAUGE STAINLESS STEEL WITH LUSTERTONE FINISH. WITH REAR CENTER DRAIN PLACEMENT. 8" RIDGED/SWING GOOSENECK SPOUT, 4" VANDAL PROOF WRIST BLADE HANDLE, CHROME FINISH, QUARTER TURN COMPRESSION CARTRIDGES, AND 2.2 GPM LAMINAR FLOW NON AERATING OUTLET. PROVIDE P- TRAP FOR EACH BOWL, LOOSE KEY STOPS, AND ESCUTCHEON PLATES.

SHOWER VALVE SCHEDULE

TAG	QTY.	MANUFACTURER	MODEL	CW	HW	DESCRIPTION
SV-1	2	DELTA	T13H152	1/2"	1/2"	SHOWER VALVE – POLISHED CHROME PLATED FINISH. PRESSURE BALANCED 1.2 GPM CARTRIDGE WITH FIELD ADJUSTABLE LIMIT, INTEGRAL CHECKS ON HOT AND COLD SUPPLIES. METAL LEVER HANDLE. HAND SHOWER WITH TWO CHECK VALVES AND NON-POSITIVE SHUT OFF, 24" STAINLESS STEEL SLIDE BAR. PROVIDE DELTA MODEL R10000-UNWS ROUGH-IN. ADA COIMPLIANT FIXTURE.

OIL INTERCEPTOR SCHEDULE

TAG	QTY.	MANUFACTURER	MODEL	BODY	WASTE	BASIN DEPTH	HOLDING CAPACITY	DESCRIPTION
OI-1	1	ZURN	Z885	POLYETHYLENE	4"	3' - 0"	216 gal	TRIPPLE BASIN OIL SEPARATOR. 1/4" THICK BODY, MEDIUM DUTY 1/4" THICK STEEL DIAMOND PLATE COVERS.

GAS WATER HEATER SCHEDULE

NOTES:
1.COPPER NICKEL HEAT EXCHANGER, STAINLESS STEEL 316L TANK.
2.UNIT TO BE MOUNTED ON 4" CONCRETE HOUSEKEEPING PAD.
3.PROVIDE ACID NOTARIZATION KIT. ROUTE DRAIN TO OVER FLOOR DRAIN.
4.PROVIDE T&P RELIEF VALVE ROUTE TO FLOOR DRAIN.
5.PROVIDE EXPANSION TANK (ET-1). MINIMUM 4.4 GALLON ACCEPTANCE.
6.PROVIDE NON-FUSED DISCONNECT SWITCH. COORDINATE WITH ELECTRICAL.

						GPH RECOVERY	SUPPLY	ELECTRICAL			
MARK	MANUFACTURER	MODEL	STORAGE	INPUT	THERMAL EFF.	@ 100°F RISE	TEMPERATURE	VOLTAGE	Ø	WEIGHT	NOTES
WH 1	HTP	PH76-50	45 gal	76000 Btu/h	97%	97 gal	140 °F	120 V	1	155 lb	1,2,3,4,5,6

RECIRCULATION PUMP SCHEDULE

NOTES:
1.PROVIDE NON-FUSED DISCONNECT SWITCH. COORDINATE WITH ELECTRICAL.
2.PROVIDE AQUASTAT FOR ON/OF CONTROL.

								ELECTRICAL			
MARK	MANUFACTURER	MODEL	DESCRIPTION	FLOW	HEAD	INLET SIZE	DISCHARGE SIZE	MOTOR HP	VOLTAGE	Ø	NOTES
RCP 1	TACO	009-SF5	CARTRIDGE CIRCULATOR. DIRECT DRIVE, REPLACEABLE CARTRIDGE, SELF LUBRICATING, STAINLESS STEEL CONSTRUCTION FOR DOMESTIC WATER SERVICE, NON-METALLIC IMPELLER.	8 GPM	12.00 psi	3/4"	3/4"	0.13 hp	115 V	1	1,2

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630˙472˙0918 Fax 630˙472˙1006

GAGE CONSULTING ENGINEERS, INC.
PROFESSIONAL DESIGN FIRM LICENSE NO.
184.001566, EXPIRES ON 04/30/2019

LICENSED PROFESSIONAL ENGINEER
DAVID P. MCVEY
062-048431
STATE OF ILLINOIS
Exp. 11/30/17

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed
PROFESSIONAL ENGINEER
under the laws of the State of

License Number: Date **07-07-2017**

Revisions		
Description	Date	Num

Comm: **173013**
Date: **July 7, 2017**
Drawn: **Author**
Check: **Checker**
North

PLUMBING SCHEDULES

Scale:

P300

LUMINAIRES

LT-1 / A1a — LUMINAIRE CONNECTED TO NORMAL POWER SOURCE

LUMINAIRE CONNECTED TO ESSENTIAL ELECTRICAL SYSTEM CRITICAL BRANCH

LUMINAIRE CONNECTED TO ESSENTIAL ELECTRICAL SYSTEM LIFE SAFETY BRANCH

EXIT SIGN

EMERGENCY LIGHT

ADJACENT LETTERS INDICATED ON SYMBOLS ABOVE INDICATE THE FOLLOWING:

LT-1: LUMINAIRE TYPE PER LUMINAIRE SCHEDULE
A: POWER SOURCE PANEL
1: CIRCUIT NUMBER
a: SWITCH CONTROL
R1: RELAY DESIGNATION FOR LIGHTING FIXTURES CONTROLED VIA A RELAY LIGHTING CONTROL PANEL

LIGHTING CONTROLS

OS — OVERRIDE SWITCH, +44" A.F.F. IN WALL

MS — MOTION SENSOR

PCS — PHOTOCELL / COMBINATION PHOTOCELL AND MOTION SENSOR

PP — POWER / RELAY PACK

SINGLE POLE WALL SWITCH, +44" A.F.F IN WALL

ADJACENT LETTERS INDICATED WITHIN SYMBOLS ABOVE INDICATE THE FOLLOWING LIGHTING CONTROL REQUIREMENTS:

V: VACANCY MODE, MANUAL ON / AUTO OFF CONTROLS
O: OCCUPANCY MODE, AUTO ON / AUTO OFF CONTROLS

NOTE:
1. REFER TO LIGHTING CONTROL DEVICE SCHEDULE FOR SPECIFIC DEVICE DESCRIPTION.

WIRING DEVICES

DUPLEX RECEPTACLE - 20A, 125V, 2P, 3W (NEMA5-20R) -18" A.F.F. IN WALL OR AS NOTED

QUADRAPLEX RECEPTACLE - 20A, 125V, 2P, 3W (NEMA5-20R) -18" A.F.F. IN WALL OR AS NOTED

DUPLEX RECEPTACLE - 20A, 125V, 2P, 3W (NEMA 5-20R) -6" IN WALL ABOVE COUNTER TOP OR AS NOTED

QUADRAPLEX RECEPTACLE-20A, 125V, 2P, 3W (NEMA 5-20R) -6" IN WALL ABOVE COUNTER TOP OR AS NOTED

J — JUNCTION BOX IN WALL

J — JUNCTION BOX IN CEILING

A1 / GF — ADJACENT LETTERS INDICATED ON PLANS FOR THE SYMBOLS ABOVE INDICATE THE FOLLOWING:

A: INDICATES POWER SOURCE PANEL
1: INDICATES CIRCUIT NUMBER
GF: INDICATES GROUND FAULT CIRCUIT INTERRUPTER
TR: INDICATES TAMPER-RESISTANT
WP: INDICATES WEATHER PROOF IN-USE RECEPTACLE

LOW VOLTAGE SYSTEM DEVICES

TELEPHONE/DATA OUTLET -18" A.F.F. IN WALL OR AS NOTED

TELEPHONE/DATA OUTLET -6" IN WALL ABOVE COUNTER TOP OR AS NOTED

TV — TELEVISION OUTLET IN WALL

ACCESS CONTROL SYSTEM DEVICES

CR — CARD READER - JUNCTION BOX AT 42"

DC — DOOR CONTACT IN DOOR FRAME

DS — DOOR STRIKE IN DOOR FRAME

RE — REQUEST-TO-EXIT SENSOR

ED — ELECTRIC DOOR POWER CONNECTION IN DOOR FRAME

ELECTRICAL EQUIPMENT

PANELBOARD

NON-FUSED DISCONNECT SWITCH

VFD — VARIABLE FREQUENCY DRIVE

AHU 1 — MECHANICAL EQUIPMENT TAG

39.1 — KITCHEN EQUIPMENT TAG

CONDUIT, RACEWAYS AND WIRING

EXPOSED CONDUIT OR SURFACE RACEWAY 'R' INDICATES RACEWAY

CONDUIT CONCEALED IN WALL OR CEILING CONSTRUCTION

CONDUIT CONCEALED IN FLOOR CONSTRUCTION OR UNDERGROUND

FIRE ALARM SYSTEM DEVICES

FACP — FIRE ALARM CONTROL PANEL

FAA — FIRE ALARM ANNUNCIATOR

S — MANUAL PULL STATION 44" ABOVE FLOOR

AV — AUDIBLE DEVICE WITH VISUAL ALARM LIGHT 80" ABOVE FLOOR OR 6" BELOW CEILING, WHICHEVER IS LOWER

V — VISUAL ALARM LIGHT 80" ABOVE FLOOR OR 6" BELOW CEILING, WHICHEVER IS LOWER

SD — SMOKE DETECTOR

WF — SPRINKLER FLOW SWITCH

Z M — ZONE ADDRESSABLE MODULE FOR FIRE ALARM MONITOR

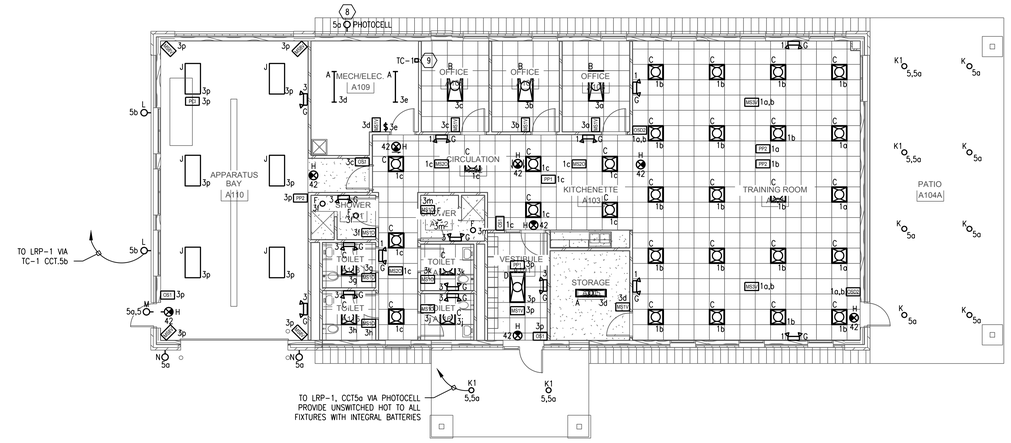
VSS — TAMPER PROOF SPRINKLER VALVE SWITCH

GENERAL NOTES (FOR ALL DRAWINGS):

1. SEE ARCHITECTURAL DRAWINGS AND ELEVATIONS FOR EXACT MOUNTING HEIGHTS AND LOCATIONS OF ALL ELECTRICAL DEVICES, PRIOR TO ROUGH-IN.
2. ALL CIRCUITS SHALL BE RUN WITH DEDICATED NEUTRALS. SHARED NEUTRALS ARE NOT ALLOWED. THE NEUTRAL IS CONSIDERED A CURRENT CARRYING CONDUCTOR AND THE MAXIMUM NUMBER OF CURRENT CARRYING CONDUCTORS ALLOWED IN A RACEWAY IS EIGHT (8).
3. ALL 120V HOMERUNS OVER 75 FEET SHALL BE RUN WITH A MINIMUM OF #10 WIRE AND ALL 120V HOMERUNS OVER 100 FEET SHALL BE RUN WITH A MINIMUM OF #8 WIRE.
4. LABEL ALL RECEPTACLES WITH THE PANEL AND CIRCUIT NAME SERVING THEM.
5. BACK BOXES SHALL NOT BE MOUNTED BACK TO BACK IN ACOUSTICAL PARTITIONS OR PARTITIONS CONTAINING SOUND BATTING.

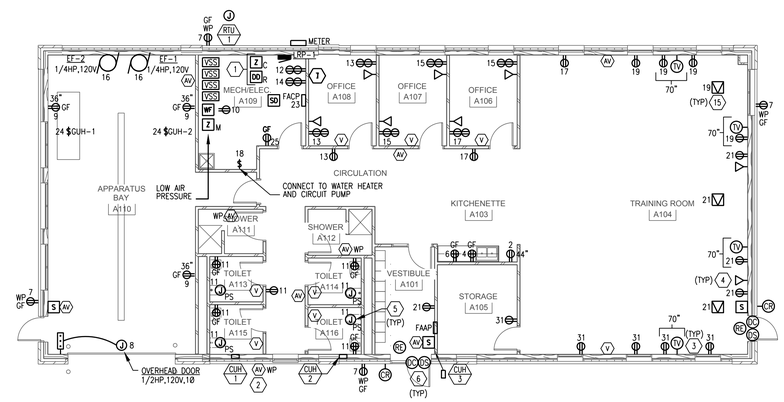
KEY NOTES:

1. PROVIDE A RETURN AIR DUCT MOUNTED SMOKE DETECTOR AND FAN SHUTDOWN MODULE FOR CONNECTION TO RTU-1
2. PROVIDE A FIRE ALARM AUDIO/VISUAL DEVICE, AS REQUIRED BY THE AHJ, FOR THE WATER FLOW INDICATION.
3. RUN A 3/4" EMPTY CONDUIT FROM EACH TELEVISION OUTLET UP TO THE NEAREST ACCESSIBLE CEILING SPACE, WITH GROMMETTED ENDS. PROVIDE RG6U JACK AND CABLE TO THE MAIN IT LOCATION SPLITTER/AMPLIFIER
4. RUN A 1" EMPTY CONDUIT FROM EACH TELEPHONE/DATA OUTLET UP TO THE NEAREST ACCESSIBLE CEILING SPACE, WITH GROMMETTED ENDS. PROVIDE (2) CAT6 JACKS AND CABLING TO THE WALL MOUNTED PATCH PANEL AT THE MAIN IT LOCATION.
5. PROVIDE A POWER CONNECTION TO THE CEILING MOUNTED PLUMBING FIXTURE POWER SUPPLY. PROVIDE ALL RACEWAYS AND WIRING REQUIRED TO EACH POWERED PLUMBING FIXTURE. COORDINATE ALL REQUIREMENTS WITH THE PLUMBING CONTRACTOR.
6. TERMINATE THE COMED PRIMARY CONDUITS TO WHERE DIRECTED BY COMED.
7. PROVIDE THE FOLLOWING AT THE MAIN IT LOCATION:
   - 48" X 96" X 1" FIRE RATED PLYWOOD TELEPHONE BOARD
   - GROUND BAR WITH #6 GROUND RUN TO THE SERVICE GROUND BAR
   - WALL MOUNTED CATV DISTRIBUTION
   - WALL MOUNTED PATCH PANEL FOR TELEPHONE/DATA
   - EMPTY CONDUITS FOR TELEPHONE/DATA/CABLE SERVICES STUBBED UP 6" ABOVE FLOOR. SEE SITE PLAN FOR CONTINUATION.
8. PROVIDE A 120 VOLT ADJUSTABLE FOOTCANDLE LEVEL PHOTOCELL FOR CONTROL OF EXTERIOR LIGHTING CIRCUIT 5a.
9. PROVIDE AN ASTRONOMIC TIMECLOCK FOR CONTROL OF EXTERIOR LIGHTING CIRCUIT 5b. SET THE TIMECLOCK TO OPERATED FROM DUSK TO 10PM.
10. AFTER THE EXISTING ELECTRICAL SERVICES HAVE BEEN DISCONNECTED AND REMOVED, COORDINATE WITH COMED TO REMOVE THE EXISTING PAD MOUNTED TRANSFORMER. DEMOLISH THE EXISTING CONCRETE PAD AND GROUNDING AND RESTORE THE LANDSCAPING.
11. DISCONNECT AND REMOVE THE EXISTING ELECTRICAL SERVICE AND METER SOCKET SERVING THE PEDESTAL MOUNTED ELECTRICAL PANEL (100A,120/240V,1ø,3W). RE-FEED THE PEDESTAL PANEL AS INDICATED ON THE ELECTRICAL SITE PLAN AND ONE LINE DIAGRAM.
12. REMOVE THE EXISTING POLE MOUNTED LIGHTING FIXTURE AND REPLACE WITH NEW TWIN LIGHTING FIXTURE TYPE "XA". MODIFY THE EXISTING POLE AND TENON AS REQUIRED TO INSTALL THE NEW FIXTURES. CONNECT TO THE EXISTING CIRCUITING.
13. DISCONNECT AND REMOVE THE ABANDONED ELECTRICAL METER FITTING, STRUCTURE AND TELEPHONE SERVICE.
14. TERMINATE THE TELEPHONE/DATA/CABLE CONDUITS WHERE DIRECTED BY THE UTILITY COMPANIES.
15. PROVIDE A CAST IRON, 2 GANG FLOOR BOX WITH ONE DUPLEX RECEPTACLE AND ONE DATA JACK LOCATION (PROVIDE 2 DATA JACKS) WITH BLACK COVER. RUN A 1" CONDUIT FROM THE DATA SECTION UP TO THE CEILING SPACE, WITH GROMMETTED ENDS.



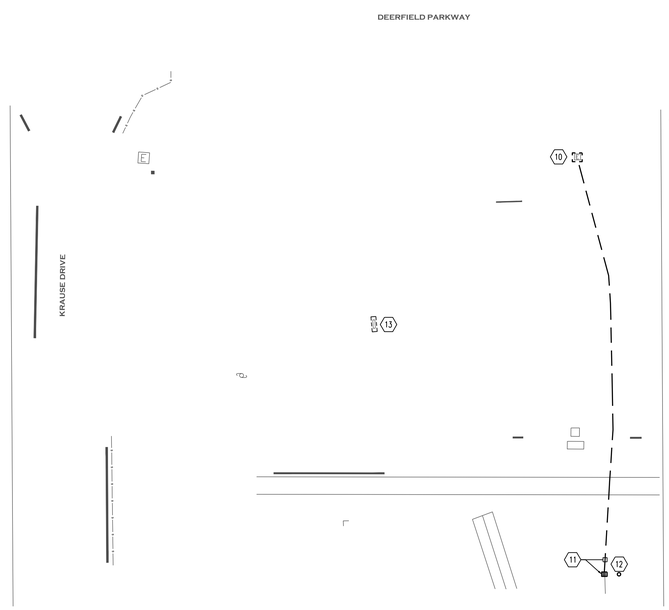
MAIN LEVEL LIGHTING PLAN

SCALE: 1/8" = 1' - 0"



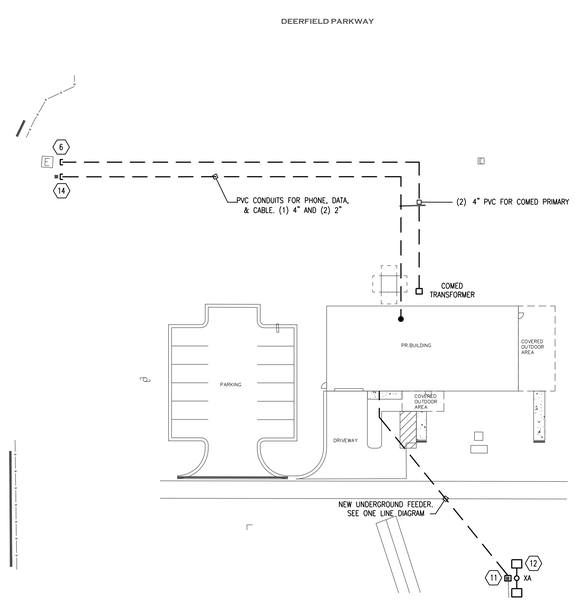
MAIN LEVEL POWER PLAN

SCALE: 1/8" = 1' - 0"



SITE DEMOLITION PLAN

SCALE: 1" = 30' - 0"



SITE ELECTRICAL PLAN

SCALE: 1" = 30' - 0"

C.A.F.T. Building

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Buffalo Grove, IL 60089

Village of Buffalo Grove
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LICENSED PROFESSIONAL ENGINEER DAVID R. MCVEY 062-048431 STATE OF ILLINOIS
Exp. 11/30/17

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License Number: Date **07-07-2017**

Revisions		

Comm: **173013 / 17036**
Date: **July 7, 2017**
Drawn: **RS**
Check: **DM**

North

ELECTRICAL PLANS

Scale:

E101

IL

A

17036E101

LIGHTING CONTROL DEVICE SCHEDULE

TYPE	DESCRIPTION	MANUFACTUERER	MODEL	MOUNTING	NOTES
OS1	OVERRIDE SWITCH THAT PROVIDES LOCAL CONTROL OF ONE (1) LIGHTING ZONE	ACUITY - nLIGHT LEVITON LUTRON	#nPODM EQUIVALENT EQUIVALENT	WALL RECESSED	
OSD2	OVERRIDE RAISE/LOWER DIMMING SWITCH THAT PROVIDES LOCAL CONTROL OF TWO (2) LIGHTING ZONES	ACUITY - nLIGHT LEVITON LUTRON	#nPODM-DX-2P EQUIVALENT EQUIVALENT	WALL RECESSED	
MS1	WALL SENSOR W/ PIR/MICROPHONICS DETECTION THAT PROVIDES CONTROL OF ONE (1) LIGHTING ZONE. PROVIDES 180° COVERAGE BY 20' FOR SMALL AND 36' AWAY FOR LARGE MOTION	ACUITY - SENSOR SWITCH LEVITON LUTRON	#WSX PDT EQUIVALENT EQUIVALENT	WALL RECESSED	1
MS2	CEILING SENSOR W/ DUAL DETECTION (PIR/MICROPHONICS). PROVIDES 360° 500 SQ FT COVERAGE DESIGNED FOR SMALL MOTION DETECTION	ACUITY - nLIGHT LEVITON LUTRON	#nCM-PDT-9-RJB EQUIVALENT EQUIVALENT	CEILING SURFACE	1
MS3	CEILING SENSOR W/ DUAL DETECTION (PIR/MICROPHONICS). PROVIDES 360° 2000 SQ FT COVERAGE DESIGNED FOR LARGE MOTION DETECTION	ACUITY - nLIGHT LEVITON LUTRON	#nCM-PDT-10-RJB EQUIVALENT EQUIVALENT	CEILING SURFACE	1
MS8	CORNER WIDE VIEW SENSOR WITH DUAL DETECTION (PIR/MICROPHONICS). PROVIDES 120° BY 40' COVERAGE FOR SMALL MOTION AND 70' AWAY FOR LARGE MOTION DETECTION.	ACUITY - nLIGHT LEVITON LUTRON	#nWV PDT16 EQUIVALENT EQUIVALENT	WALL SURFACE	
PP1	POWER / RELAY PACK CAPABLE OF SWITCHING LOADS UP TO 16A	LEVITON	#nPP16 EQUIVALENT EQUIVALENT	ACCESSIBLE CEILING SPACE	2
PP2	POWER / RELAY PACK CAPABLE OF 0-10V DIMMING LOADS UP TO 16A	LUTRON	#nPP16-D EQUIVALENT EQUIVALENT	ACCESSIBLE CEILING SPACE	2
PC1	CEILING DAYLIGHT HARVESTING PHOTOCELL CAPABALE OF AUTOMATIC DIMMING CONTROL	ACUITY - nLIGHT LEVITON LUTRON	#nCM ADCX-RJB EQUIVALENT EQUIVALENT	CEILING SURFACE	

NOTES:
1. THE ADJACENT LETTER THAT FOLLOWS THE MOTION (MS1X) AND COMBINATION PHOTOCELL/MOTION (PCX)SENSORS WITHIN THE SYMBOL INDICATES LIGHTING CONTROL REQUIREMENTS. 'V' INDICATES VACANCY MODE (MANUAL ON/ AUTO OFF). 'O' INDICATES OCCUPANCY MODE (AUTO ON/ AUTO OFF).
2. POWER PACK SHALL RUN IN CONJUNCTION WITH THE LOCAL OVERRIDE SWITCH . MOUNT THE POWER PACK IN THE NEAREST ACCESSIBLE CEILING SPACE. EC SHALL VERIFY EXACT QUANTITY WITH THE MANUFACTURER, PRIOR TO BIDDING.
3. FOR THE LOCAL LIGHTING CONTROL SYSTEM, CONTRACTOR SHALL REFER TO THE LIGHTING CONTROL DEVICE SCHEDULE FOR FURTHER REQUIREMENTS. THE ELECTRICAL CONTRACTOR SHALL COORDINATE THE EXACT QUANTITY OF LIGHTING CONTROL DEVICES REQUIRED WITH THE MANUFACTURER'S SUBMITTED SHOP DRAWINGS FOR A COMPLETE AND FUNCTIONING SYSTEM, PRIOR TO BIDDING. THIS INCLUDES ALL OVERRIDE SWITCHES (OS), SENSORS (MS), POWER PACKS (PP), ETC. ANY CONFLICT, DISCREPANCY OR INCONSISTENCY THAT OCCURS WITHIN OR BETWEEN THE CONTRACT DOCUMENTS AND THE LIGHTING CONTROL SHOP DRAWINGS SHALL BE INCLUDED IN THE SCOPE WORK AT NO ADDITIONAL COST TO OWNER.

LRP-1 — 42 CIRCUITS

DISTRIBUTION SYSTEM: 208/120V 3Ø 4W

MAIN DEVICE: 200a,3P MAIN BREAKER
AIC RATING: 35 KAIC
MOUNTING: SURFACE
FED FROM:

CONNECTED LOAD	DEMAND LOAD
43.21 KVA	35.66 KVA
120.03 AMPS	99.06 AMPS

NOTES:
1 = PROVIDE LOCKOUT

CKT #	TRIP/ POLE	NOTE	LOAD TYPE	LOAD DESCRIPTION	CONNECTED LOAD (KVA) AØ		BØ		CØ		LOAD DESCRIPTION	LOAD TYPE	NOTE	TRIP/ POLE	CKT #
1	20/1	1	L	L	1.12	1.20					R - REFRIG.	A		20/1	2
3	20/1	1	L	L			1.18	1.20			R - MICROWAVE	A		20/1	4
5	20/1	1	L	L - EXTERIOR					0.61	1.20	R - COFFEE	A		20/1	6
7	20/1		R	R - EXTERIOR.	0.72	1.00					DOOR	A		20/1	8
9	20/1		R	R - APPARATUS BAY			0.54	1.20			SPRINKLER AIR	M		20/1	10
11	20/1		R	R					0.90	1.08	R - IT	R		20/1	12
13	20/1		R	R	0.90	1.08					R - IT	R		20/1	14
15	20/1		R	R			1.08	1.40			EF-1 AND EF-2	M		20/1	16
17	20/1		R	R					0.72	0.40	H.W. HEATER & PUMP	M		20/1	18
19	20/1		R	R	0.90	1.50					CUH-1	H		20/1	20
21	20/1		R	R			0.90	1.50			CUH-2	H		20/1	22
23	20/1	1	M	FACP					0.20	0.40	GH-1,2	H		20/1	24
25	20/1		R	R	0.18						SPARE	R		20/1	26
27	20/2		H	CUH-3			1.50				SPARE	R		20/1	28
29			H						1.50		SPARE	R		20/1	30
31	20/1		R	R	0.90						SPARE	R		20/1	32
33	100/2		M	SITE PEDESTAL PANEL			2.50				SPARE	R		20/1	34
35			M						2.50						36
37	45/3		C	RTU-1	3.70						SPD			60/3	38
39			C				3.70								40
41			C						3.70	0.10	L - EXITS	L	1	20/1	42
					8.42	4.78	11.40	5.30	10.13	3.18					
					13.20		16.70		13.31						

LOAD TYPE	CONNECTED LOAD (KVA)	DEMAND FACTOR (%)	DEMAND LOAD (KVA)
L - LIGHTING	3.01	1.00	3.01
R - RECEPTACLES	9.90	NEC TABLE 220.44	9.90
M - MOTORS	8.20	1.00	8.20
H - HEATING (NONCOINCIDENT)	6.40	1.00	6.40
C - COOLING (NONCOINCIDENT)	11.10	1.00	11.10
EH - ELECTRIC REHEAT	0.00	0.60	0.00
A - APPLIANCE	4.60	0.75	3.45
KE - KITCHEN EQUIPMENT	0.00	1.00	0.00

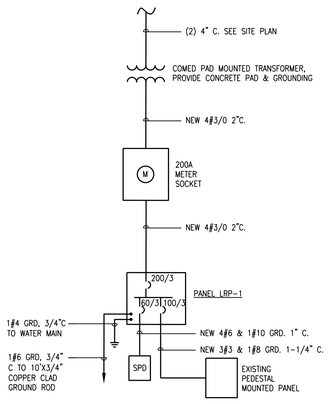
MECHANICAL EQUIPMENT SCHEDULE

TAG	EQUIPMENT	LOAD HP	LOAD KVA	LOAD FLA	SOURCE OF POWER	VOLTAGE/ PHASE	OCPD	CIRCUIT #	WIRE	CONDUIT	NOTES
RTU-1	CONDENSING UNIT		11.13		PANEL LRP-1	208/3	45A,3P	(37,39,41)	3#8 & 1#10 GRD	3/4"	UNIT HAS INTEGRAL DISCONNECT SWITCH
CUH-1	ELECTRIC CABINET UNIT HEATER		1.5		PANEL LRP-1	120/1	20A,1P	20	2#12 & 1#12 GRD	3/4"	UNIT HAS INTEGRAL DISCONNECT SWITCH
CUH-2	ELECTRIC CABINET UNIT HEATER		1.5		PANEL LRP-1	120/1	20A,1P	22	2#12 & 1#12 GRD	3/4"	UNIT HAS INTEGRAL DISCONNECT SWITCH
CUH-3	ELECTRIC CABINET UNIT HEATER		3		PANEL LRP-1	208/1	20A,2P	(27,29)	2#12 & 1#12 GRD	3/4"	UNIT HAS INTEGRAL DISCONNECT SWITCH

LUMINAIRE SCHEDULE

TYPE	DESCRIPTION	MANUFACTURER	MODEL NUMBER	VOLTS	LAMPS	MOUNTING	NOTES
A	4' LED WRAPAROUND WITH 0-10V DIMMING DRIVER	COLUMBIA LIGHTING	LAW-4-35-ML-ED-U	UNV	4700 LUMENS 3500K 48 WATTS	SUSPENDED AT 8'-0" AFF	SEE NOTE 1
B	2' X 4' LED ARCHITECTURAL TROFFER WITH 0-10V DIMMING DRIVER	COLUMBIA LIGHTING	LCAT-24-35-HL-G-ED-L	UNV	5600 LUMENS 3500K 44 WATTS	RECESSED IN GRID	SEE NOTES 1 AND 2
C	2' X 2' LED ARCHITECTURAL TROFFER WITH 0-10V DIMMING DRIVER	COLUMBIA LIGHTING	LCAT-22-35-HL-G-ED-L	UNV	3700 LUMENS 3500K 32 WATTS	RECESSED IN GRID	SEE NOTES 1 AND 2
D	2' X 4' LED ARCHITECTURAL TROFFER WITH 0-10V DIMMING DRIVER	COLUMBIA LIGHTING	LCAT-24-35-HL-G-ED-L	UNV	3460 LUMENS 3500K 30 WATTS	RECESSED IN GRID	SEE NOTES 1 AND 2
F	6" LED DOWNLIGHT WITH WET LOCATION RATING AND 0-10V DIMMING DRIVER	PRESCOLITE	LF6LEDG4-6LFLED5G4-35-WT	UNV	1100 LUMENS 3500K 15 WATTS	SUSPENDED AT 8'-0" AFF	SEE NOTE 1
G	LED EMERGENCY BATTERY LIGHT	DUALLITES	LZ-2-03L	UNV	LED	SURFACE WALL AT 8'-0" AFF	SEE NOTE 1
H	LED POLYCARBONATE EXIT SIGN. SEE PLANS FOR ARROW/FACE REQUIREMENTS	DUALLITES	EVE-J-R-W-E	UNV	LED	SURFACE WALL OR CEILING	SEE NOTE 2. SURFACE WALL UNITS SHALL BE MOUNTED 6" ABOVE THE DOOR FRAME
J	LED LOW BAY FIXTURE	COLUMBIA LIGHTING	MPL4-35-ML-W-ED-U	UNV	8600 LUMENS 3500K 71 WATTS	SUSPENDED AT 12'-0" AFF	SEE NOTE 1
K	6" LED DOWNLIGHT WITH DAMP LOCATION RATING AND 0-10V DIMMING DRIVER	PRESCOLITE	LF6LEDG4-6LFLED6G4-35-WT	UNV	1500 LUMENS 3500K 19 WATTS	RECESSED IN DRYWALL	SEE NOTE 1
K1	6" LED DOWNLIGHT WITH DAMP LOCATION RATING AND 0-10V DIMMING DRIVER AND EMERGENCY BATTERY PACK	PRESCOLITE	LF6LEDG4-EM-6LFLED6G4-35-WT	UNV	1500 LUMENS 3500K 19 WATTS	RECESSED IN DRYWALL	SEE NOTE 1
L	LED FLOODLIGHT WALL MOUNTED ON BUILDING. PROVIDE KNUCKLE AND ASSOCIATED WALL BRACKET	HUBBELL	FXL-S6L-190-4K-W-U-K-DB	UNV	20700 LUMENS 4000K 187 WATTS	SURFACE WALL AT 16'-0" AFF	SEE NOTE 1
M	LED WALLPACK WITH INTEGRAL BATTERY PACK	HUBBELL	LNC2-12L-120-4K-3-1-BBU	120	2800 LUMENS 4000K 28 WATTS	SURFACE WALL 12' ABOVE DOOR	SEE NOTE 1
N	LED EXTERIOR SCONCE			120	LED 20 WATTS	SURFACE WALL. SEE ARCH ELEVATION	PROVIDE $500 ALLOWANCE
XA	TWIN LED SHOEBOX WITH PHOTOCELL, INTEGRAL MOTION SENSOR (TAKE LIGHT LEVEL DOWN TO 60%) AND BRONZE FINISH	HUBBELL	ASL-A-24L-4K-210-4-U-DB-7PR-RPA-SCP_F-RETA2-DB-PTL-8	120	21000 LUMENS 4000K 169 WATTS	SURFACE WALL 12' ABOVE DOOR	SEE NOTE 1. COORDINATE TENON AND MOUNTING BRACKET REQUIREMENTS ON THE EXISTING POLE

LUMINAIRE SCHEDULE NOTES:
1. EQUIVALENT MANUFACTURERS FOR THE PRODUCT SPECIFIED IS: HE WILLIAMS, LITHONIA, EATON, PHILIPS
2. PROVIDE TWO INDIVIDUAL SUPPORT WIRES FOR EACH FIXTURE INDICATED, CONNECTED TO STRUCTURE



ONE LINE DIAGRAM

C.A.F.T. Building

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

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Drawn: RS
Check: DM
North

ELECTRICAL SCHEDULES

Scale:

E201

IL

A

17036E101

Project Name: **Village of Buffalo Grove CAFT**

BID TABULATION

Commission No.: 173013
Date: 25-Jan-18
Time: 9:30 AM

Wold Architects and Engineers
110 N. Brockway St. - Suite 220
Palatine, Illinois 60067
847.241.6100 Fax: 847.241.6105

Bidders Name	Addendum Numbers	Bid Security	Base Bid	ALT # 1 Canopy	ALT# 2 Skylights	Alt #3 Tornado Siren	Remarks
Intergral Construction Inc 320 Rocbarr Dr. Romeoville, IL 60446 844-317-7403 844-317-7402	1,2,3	Yes	$1,145,320	Add $92,000	Add $5,800	Add $6,600	
Kandu Construction Inc. 3756 W. Devon Lincolnwood, IL 60712 847-436-4014	1,2,3	Yes	$1,165,189	Add $47,700	Add $6,800	Add $4,600	
MAG Construction 629 Homewood Ave Highland Park, IL 60035 847-973-0600 847-432-4847	1,2,3	Yes	$1,220,739	Add $69,281	Add $4,134	Add $3,230	
R L Sohol General Contractor 14150 S. RT. 30 Ste 201 Plainfield, IL 60544 815-436-1177	1,2,3	Yes	$1,281,700	Add $105,000	Add $8,000	Add $7,000	
RoMAAS Inc. 67 S. Main Street Glen Ellyn, IL 60137 630-432-7368	1,2,3	Yes	$1,059,900	Add $80,000	Add $4,000	Add $5,500	
Schaefges Brothers 851 Seton Court Wheeling, IL 60090 847-537-3330 847-537-7439	1,2,3	Yes	$1,425,000	Add $131,000	Add $8,500	Add $18,300	

Bidders Name	Addendum Numbers	Bid Security	Base Bid	ALT # 1	ALT# 2	Alt #3	Unit Price
Structures Construction LLC 2300 W Diversey Ave Chicago, IL 60647 773-598-8698 773-598-4780	1,2,3	Yes	$1,149,795	Add #131,000	Add $8,500	Add $18,300	
Troop Contracting Inc. 648 Executive Drive Willowbrook, IL 60527 630-568-5252	1,2,3	Yes	$1,109,000	Add $106,000	Add $8,000	Add $6,000	
Kroeschell Engineering 3222 N. Kennicott Ave. Arlington Heights, IL 60004 312-649-7980	None	Yes	$137,000	$2,000	blank	blank	Electrical Sub-Contractor bid

Wold Architects and Engineers
110 North Brockway Street, Suite 220
Palatine, IL 60067
woldae.com | 847 241 6100

Project Manual

Divisions 00 - 33

Combined Area Fire Training Facility

Village of Buffalo Grove

Buffalo Grove, IL
December 7, 2017

Set No: _____

Book 1 of 1

Comm No: 173013

SECTION 00 01 01

PROJECT IDENTIFICATION PAGE

P R O J E C T M A N U A L

PROJECT IDENTIFICATION

BIDDING REQUIREMENTS

CONDITIONS OF THE CONTRACT

GENERAL REQUIREMENTS

AND SPECIFICATIONS FOR:

COMBINED AREA FIRE TRAINING FACILITY RE-BID

851 KRAUS DRIVE
BUFFALO GROVE, ILLINOIS 60089

VILLAGE OF BUFFALO GROVE
BUFFALO GROVE, ILLINOIS 60089

Bid Time: 9:30 AM

Bid Date: Wednesday, January 25, 2017

Bid Place: Buffalo Grove Village Hall
50 Raupp Boulevard
Buffalo Grove, Illinois 60089

SECTION 00 01 03

TITLE PAGE

PROJECT TITLE AND LOCATION:	COMBINED AREA FIRE TRAINING FACILITY RE-BID 851 KRAUSE DRIVE BUFFALO GROVE, ILLINOIS 60089
OWNER:	VILLAGE OF BUFFALO GROVE
ARCHITECTS:	Wold | Ruck Pate 110 North Brockway, Suite 220 Palatine, Illinois 60067 Tel. (847) 241-6100
CIVIL ENGINEER:	Meritcorp Group 50 North Brockway, Suite 3-9 Palatine, Illinois 60067 Tel. (847) 496-4170
STRUCTURAL ENGINEER:	Johnson Wilbur Adams 175 North Washington Street Wheaton, Illinois 60187 Tel. (630) 653-9060
MECHANICAL ENGINEER:	Gage Consulting Engineers 1301 West 22nd Street, Suite 220 Oak Brook, Illinois 60523 Tel. (630) 472-0910
ELECTRICAL ENGINEER:	Gage Consulting Engineers 1301 West 22nd Street, Suite 220 Oak Brook, Illinois 60523 Tel. (630) 472-0910
DATE:	December 6, 2017

SECTION 00 01 05

PROFESSIONAL CERTIFICATIONS

COMBINED AREA FIRE TRAINING FACILITY

VILLAGE OF BUFFALO GROVE

Wold | Ruck Pate

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Architect under the laws of the State of Illinois.

December 6, 2017 001-020883

Signature Date Registration

Matthew J Bickel

Typed Name

Meritcorp Group
Civil Engineer

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Illinois.

December 6, 2017

Signature Date Registration

James P. Meier

Typed Name

Johnson Wilbur Adams
Structural Engineer

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Illinois.

December 6, 2017

Signature Date Registration

Kent L. Adams

Typed Name

Gage Consulting Engineers
Mechanical Engineer

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Illinois.

December 6, 2017

Signature Date Registration

David P. McVey

Typed Name

Gage Consulting Engineers
Electrical Engineer

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Illinois.

December 6, 2017

Signature Date Registration

Eric Carlson

Typed Name

SECTION 00 01 10

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BID AND CONTRACT DOCUMENTS

The Owner's Bid and Contract Documents are attached hereto.

Village of Buffalo Grove

Combined Area Fire Training Facility Re-Bid

Bid and Contract Documents

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INVITATION TO BID

Exterior Masonry Improvements (Fire Stations No. 25 and No. 26)

The Village of Buffalo Grove (the "Village" or "Owner") herein invites you to submit a bid for a new Combined Area Fire Training (CAFT) facility at 851 Krause Dr., Buffalo Grove Illinois, 60089. This project includes a new pre-engineered wood building, exterior aluminum windows and doors, hollow metal door frames, wood doors, decorative quartz floor coating, plastic laminate millwork, site utilities, grading, excavation, paving, electrical power systems, lighting, plumbing, HVAC, etc.

PREVAILING WAGE ACT - The Village is an Illinois unit of local government and the Work hereunder is subject to the Illinois Prevailing Wage Act, 820 ILCS 130/0.01, et seq.

For information on how to receive a copy of the Bid Package and any addenda contact the Office of the Village Clerk at 847-459-2500 or visit the Village of Buffalo Grove procurement website at www.vbg.org/bids

Bidding documents, including the Proposal Form, Drawings and Specifications, will be on file at the McGraw Hill Construction Dodge Plan Room (St. Louis, MO) 314-781-2504; Reed Construction Market Data (Oak Brook, IL) (800) 699-8640; Illowa Builders Exchange (Rock Island) (309) 788-9260; Northern Illinois Building Contractor's Association (Rockford) (815) 229-5636; Greater Peoria Contractor's & Suppliers Association (Peoria) (309) 692-5710; Construction Resource Technology (888) 506-7613 and Master Builders of Iowa (DesMoines, IA) 1-800-362-2578.

American Reprographics Company, 640 North LaSalle Street, Suite 240, Chicago, Illinois 60654, phone (312) 372-8600 and fax (312) 337-2810, will provide complete sets of the Bidding Documents to prospective bidders and subcontractors. A non-refundable check in the amount of $50 made out to "Village of Buffalo Grove" for each set ordered are required. The following information must accompany the deposit: Company name, mailing address, street address, phone and email address and type of bidder (i.e. General, Mechanical or Electrical Subcontractor to General, or other).

TIMELINE

Monday, December 18, 2017	Pre-Bid Meeting at Village Hall at 9:30 AM ("Pre-Bid Meeting")
Friday, January 12, 2018	Due date for all questions regarding the Work ("Question Due Date")
Wednesday, January 25, 2018	Bid Proposals due to the Village ("Bid Due Date")

INSTRUCTIONS TO BIDDERS

QUESTIONS ON THE WORK

All comments, concerns and questions regarding the Work and these documents shall be addressed to Ben Bercher, Wold Architects via email at bbercher@woldae.com with the subject line "Combined Area Fire Training Facility". All comments, concerns and questions regarding the Work must be received by the 9:30 AM local time on the Question Due Date (defined above).

BID PROPOSAL DOCUMENTS

Each bidder must submit **three copies** of the following documents (collectively, the "**Bid Proposal**"):

1. Executed and notarized Public Contract Statement set forth on **Exhibit A**;
2. Completed Schedule of Prices set forth on **Exhibit B**;
3. Completed Reference List set forth on **Exhibit C**;
4. A list of the requested changes to the Contract citing the specific Article within the Contract and the specific change requested.

BID SECURITY

Along with the Bid Proposal, each bidder must submit with its Bid Proposal a bank draft, cashier's check, certified check or bid bond equal to at least ten percent (10%) of the Total Contract Price, as set forth in their Schedule of Prices (the "**Bid Security**").

BID SUBMITTAL

Sealed Bid Proposals shall be delivered to the Village at the Office of the Village Clerk at 50 Raupp Boulevard, Buffalo Grove, Illinois 60089 on or before 9:30 AM local time on the Bid Due Date. Each bidder shall deliver their Bid Proposal along with their Bid Security in a sealed envelope or box. The envelope or box shall be marked or endorsed:

VoBG-2018-01 Bid for Village of Buffalo Grove, Illinois

COMBINED AREA FIRE TRAINING FACILITY RE-BID

NO WITHDRAWAL OF BIDS

No Bid Proposal shall be withdrawn after the Bid Due Date without the consent of the Village for a period of sixty (60) calendar days after the Bid Due Date.

QUALIFICATION OF BIDDERS

It is the intention of the Village to award the Work only to a bidder who furnishes satisfactory evidence that they have the requisite qualifications, capital, experience, facilities and ability to complete the Work successfully, promptly, and within the time frame set forth in these documents.

The Village reserves the right to make such investigations as it deems necessary to determine the qualifications and ability of any bidder. To that extent, all bidders agree to furnish to the Village any information and data requested by the Village in its investigation. Failure of a bidder to provide any information or data requested by the Village in its investigation will be grounds to reject that bidder from consideration for the Work.

INSTRUCTIONS TO BIDDERS

1. Bidders must inform themselves of all the conditions under which the Work is to be performed including, but not limited to, and where applicable, the structural integrity of the building, the conditions of the ground, building codes. No extra compensation will be given to any bidder who fails to apprise themselves of the conditions under which the Work is to be performed.
2. All changes requested by a bidder to the Contract must be submitted with their Bid Proposal.
3. Bidders shall be responsible, at their own expense, for all permits, business licenses and other licenses which may be required to complete the Work and required by local, county, state or federal government.

RESERVATION OF RIGHTS

The Village reserves the following rights regarding the bidding process:

1. The right to accept the Bid Proposal that is, in the Village's sole judgment, the best and most favorable to the interests of the Village and the public.
2. To reject the lowest bidder.
3. To accept any item or any portion in any Bid Proposal from any bidder.
4. To accept and incorporate corrections, clarifications or modifications following the Bid Due Date when doing so would not, in the Village's opinion, prejudice the procurement process or create any improper advantage to any bidder.
5. To waive irregularities and informalities in the procurement process or in any Bid Proposal; provided, however, that the waiver of any prior defect or informality shall not be considered a waiver of any future or similar defects or informalities, and bidders shall not rely upon, or anticipate, such waivers in submitting their Bid Proposal.
6. To disqualify any bidder that is found to have contacted the Village's personnel in any manner with regard to the Work.
7. The right to approve or disapprove of any or all subcontractors, or insist on no subcontractors, in connection with any Bid Proposal.
8. Reject any subcontractor from working on the Work if they are not listed in the Bid Proposal.
9. The Village shall hold the Bid Security from the two (2) lowest bidders until the Contract is signed for the Work.
10. Disqualify any bidder who requests changes to the Contract when such changes were not submitted with their Bid Proposal.

EXHIBIT A - PUBLIC CONTRACT STATEMENT

This Public Contract Statement (the "**Contract Statement**") has been executed by the below supplier, contractor or vendor (collectively the "**Contractor**") in order for the Village of Buffalo Grove to obtain certain information necessary prior to awarding a public contract. The Contract Statement shall be executed and notarized and submitted as part of the Bid Proposal.

CERTIFICATION OF CONTRACTOR/BIDDER

In order to comply with 720 Illinois Compiled Statutes 5/33 E-1 et seq., the Village of Buffalo Grove requires the following certification be acknowledged:

> The Contractor certifies that it is not barred from bidding or supplying any goods, services or construction let by the Village of Buffalo Grove with or without bid, due to any violation of either Section 5/33 E-3 or 5/33 E-4 of Article 33E, Public Contracts, of the Chapter 720 of the Illinois Compiled Statutes, as amended. This act relates to interference with public contracting, bid rigging and rotating, kickbacks, and bidding.

CERTIFICATION RELATIVE TO 65 ILCS 5/11-42.1.1

In order to comply with 65 Illinois Complied Statutes 5/11-42.1.1, the Village of Buffalo Grove requires the following certification:

> The Contractor does hereby swear and affirm that it is not delinquent in the payment of any tax administered by the Illinois Department of Revenue unless it is contesting such tax in accordance with the procedures established by the appropriate revenue act, its liability for the tax or the amount of the tax. The undersigned further understands that making a false statement herein: (1) is a Class A misdemeanor, and (2) voids the contract and allows the Village to recover all amounts paid to it under the contract.

CONFLICT OF INTEREST

The Village of Buffalo Grove Municipal Code requires the following verification relative to conflict of interest and compliance with general ethics requirements of the Village:

> The Contractor represents and warrants to the Village of Buffalo Grove as a term and condition of acceptance of their Bid Proposal that none of the following Village officials is either an officer or director of Contractor nor owns five percent (5%) or more of the Contractor: the Village President, the members of the Village Board of Trustees, the Village Clerk, the Village Treasurer, the members of the Zoning Board of Appeals and the Plan Commission, the Village Manager and his/her Assistant, or the heads of the various departments within the Village.

If the foregoing representation and warranty is inaccurate, state the name of the Village official who either is an officer or director of your business entity or owns five percent (5%) or more thereof:
_____.

IN WITNESS WHEREOF, the below Contractor has signed and sealed this Contract Statement as of this ____ day of _____, 20___.

_____
Print Name of Contractor

_____
Signature

_____
Print Title

Given under my hand and official seal, this _____ day of _____, 20___.

_____
Notary Public

EXHIBIT B - SCHEDULE OF PRICES

Name of Bidder:

_____

Address of Bidder:

_____

City _____ State _____ Zip _____ Telephone

_____

Email Address: _____

The Bidder declares, represents and warrants that it has read and agrees to abide by the terms, conditions and obligations set forth in the Invitation to Bid. In particular, the Bidder declares, represents and warrants that it has informed itself of all the conditions under which the Work is to be performed including, but not limited to, and where applicable, the conditions of the ground, building codes. Bidder waives any right to additional compensation for failure to make itself aware of the afore-mentioned conditions.

Bidder further declares that if their Bid Proposal is accepted, that Bidder will enter into the Contract in the same form as set forth in the Bid and Contract Documents. However, Bidder may request changes to the Contract by submitting with this Schedule of Price a list of requested changes to the Contract.

If this bid is accepted, and the undersigned fails to (**i**) contract as aforesaid, (**ii**) provide the Performance Bond required by the Contract, and (**iii**) provide all insurance required under the Contract within fifteen (15) calendar days after the date of the award of the Contract then the Village, at its option, may determine that the bidder has abandoned this Bid, and thereupon this Bid and the acceptance thereof shall be null and void, and such security accompanying this Bid shall be forfeited and shall be the property of the Village of Buffalo Grove not as penalty, but as liquidated damages.

BID SECURITY

Accompanying this Bid is a _____

in the amount of _____ Dollars

($_____).

Note: (a) Insert the words "Bank Draft", "Cashier's Check", "Certified Check" or "Bid Bond", as the case may be.

(b) Amount must be equal to at least five percent (5%) of the Total Base Bid.

EXHIBIT B - SCHEDULE OF PRICES (cont.)

A. BASE BID

_____

_____Dollars ($_____).

B. ALTERNATE NO. 1 – BUILDING CANOPY

Add / Deduct _____

_____Dollars ($_____).

C. ALTERNATE NO. 2 – SKYLIGHTS

Add / Deduct _____

_____Dollars ($_____).

D. ALTERNATE NO. 3 – TORNADO SIREN RELOCATION

Add / Deduct _____

_____Dollars ($_____).

Each Bidder shall attach a Schedule of Values showing bid breakdown and estimated itemized costs of base bid total costs. An example of which is shown on the following page

EXHIBIT B - SCHEDULE OF PRICES (cont.)

SCHEDULE OF VALUES

Scope					Base Price
Site Grading / Earthwork					
Site Utilities					
Site Concrete					
Site Paving					
Fencing					
Building Concrete					
Carpentry					
Pre-Engineered Wood Building					
Masonry Veneer					
Exterior Doors					
Interior Walls and Framing					
Interior Doors and Hardware					
Acoustic Ceilings					
Decorative Quartz Flooring					
Painting					
Tile					
Resilient Flooring					
Millwork and Countertops					
Toilet Room Accessories					
Plumbing					
HVAC					
Fire Protection					
Electrical					
General Conditions					
Overhead and Profit					
Insurance					
Bonds					
A. BASE BID					

EXHIBIT B - SCHEDULE OF PRICES (cont.)

SUBCONTRACTOR LISTING

Bidder, to employ the following listed subcontractors for the following enumerated classes of work and is not to alter or add to such list without the written consent of the Village.

	SUBCONTRACTOR	CLASS OF WORK
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____

ACKNOWLEDGEMENT OF ADDENDA

Acknowledgement of receipt of Addenda(s)_____(list each addendum number)

Attach each signed addendum, if any, to the bid packet as part of your submittal.

CONTRACTOR SIGNATURE and CONTACT INFORMATION

_____ _____
Date Phone

_____ _____
Legal Entity E-mail

_____
(Sign here)

_____
(Print Name)

EXHIBIT C – REFERENCE LIST

Contact Name: _____

Municipality/Business: _____

Dates Employed: _____ to _____

Phone Number or E-mail address: _____

Contact Name: _____

Municipality/Business: _____

Dates Employed: _____ to _____

Phone Number or E-mail address: _____

Contact Name: _____

Municipality/Business: _____

Dates Employed: _____ to _____

Phone Number or E-mail address: _____

Contact Name: _____

Municipality/Business: _____

Dates Employed: _____ to _____

Phone Number or E-mail address: _____

DESCRIPTION OF THE WORK

The services, equipment, labor and/or materials below shall be collectively referred to as the "**Work**":

All work described in "Project Manual Combined Area Fire Training Facility Re-Bid " Book 1 of 1

All work described in Plan set "Combined Area Fire Training Facility Re-Bid" as listed on the Cover Sheet.

COMBINED AREA FIRE TRAINING FACILITY RE-BID CONTRACT

EXTERIOR MASONRY IMPROVEMENTS CONTRACT (the "**Contract**") is entered between the Village of Buffalo Grove (hereinafter the "**Village**" or "**Owner**"), an Illinois home-rule unit of government, and _____ an [_____] (hereinafter the "**Contractor**") on this _____ day of _____, 2018 (the "**Effective Date**"). The Village and the Contractor are hereinafter sometimes collectively referred to as the "**Parties**" and individually as a "**Party**".

RECITALS

WHEREAS, the Village has solicited bids for the Work (defined below), Contractor has submitted a bid for the Work and Village has selected Contractor for the Work based on their bid; and

WHEREAS, the Contractor wishes to enter into this Contract with the Village and the Village wishes to enter into this Contract with the Contractor for the Work;

NOW THEREFORE, for and in consideration of the mutual covenants and promises herein contained, the adequacy and sufficiency of which are hereby acknowledged by the Parties, it is agreed as follows:

ARTICLE I - WORK TO BE DONE BY THE CONTRACTOR

The Village does hereby hire and contract with the Contractor to provide all the labor, equipment, materials and/or services described more thoroughly on Contract **Exhibit A** (the "**Work**") which is incorporated into the Contract by this reference.

ARTICLE II - CONTRACT DOCUMENTS

The following exhibits are attached hereto and incorporated herein by this reference:

Contract Exhibit A – Description of the Work
Contract Exhibit B – Schedule of Prices
Contract Exhibit C – Payment and Performance Bonds
Contract Exhibit D – Partial Lien Waiver
Contract Exhibit E – Final Lien Waiver

If any term or provision of this Contract shall conflict with any term or provision of the exhibits referenced above, the terms and provisions of the exhibit shall control.

ARTICLE III - CONTRACT AMOUNT

The Village agrees to pay the Contractor for the proper and timely performance of the Work in strict accordance with this Contract as detailed in **Contract Exhibit B** (the **"Schedule of Prices")** Unless explicitly provided otherwise in this Contract, the detailed sums shall be the full and exclusive compensation owed to the Contractor for the Work; and Contractor may not seek additional payments from the Village.

ARTICLE IV – APPLICATION FOR PAYMENT

The Contractor shall be paid at most once a month and only after providing the Village the following:

1. An executed and notarized Contractor's Sworn Statement in a form similar to AIA G702 or AIA G703;
2. Either a partial or final lien waiver from every subcontractor, sub-subcontractor, or materialman in substantially the same form as attached here as **Contract Exhibit D** and **Contract Exhibit E**;
3. Certified payroll necessary for the Prevailing Wage Act; and

All payments under this Contract must be approved by the Village's Board at regularly scheduled meetings. The Village reserves the right to request any receipts, invoices, proof of payments as the Village, in its sole discretion, may deem necessary to justify the payment requested *prior* to paying the requested payment. The Contractor shall furnish with his final application for payment a Final Lien Waiver from itself and, if not already provided, from every subcontractor and materialman of the Work.

The Contractor acknowledges that the Village is a unit of local government and that all payments under the Contract are subject to the Local Government Prompt Payment Act, 50 ILCS 505 et seq. To that extent, the Village shall have forty-five calendar (45) days from receipt of a bill or invoice to pay the same before it is considered late under the Contract. Interest, if any, charged for any late payments will be subject to the interest rate caps specified in the Prompt Payment Act.

ARTICLE V – CONTRACT TIME

The Contractor shall fully, and not substantially, complete all the Work and the Work shall be accepted by the Director of Public Works, provided that acceptance by the Director of Public Works shall not be unreasonably delayed, on or before Friday, October 12, 2018.

If the Contractor shall fail to complete the work within the Contract Time which shall include any proper extension granted by the Village, the Contractor shall pay to the Village an amount equal to Seven Hundred Fifty dollars ($750) per calendar day for each day past the Contract Time until final acceptance by the Village.

Unless otherwise provided in this Contract, any reference in this Contract to "day" or "days" shall mean calendar days and not business days. If the date for giving of any notice required to be given, or the performance of any obligation, under this Contract falls on a Saturday, Sunday or federal holiday, then the notice or obligation may be given or performed on the next business day after that Saturday, Sunday or federal holiday.

ARTICLE VI – PERFORMANCE and PAYMENT BOND

The Contractor shall provide the Village with a performance and payment bond in substantially the same form as on **Contract Exhibit C** (the "**Performance and Payment Bond**") prior to Contractor beginning any Work and within 10 calendar days of the Notice of Award sent to the Contractor.

ARTICLE VII – ACCIDENT PREVENTION

The Contractor shall exercise every precaution at all times to protect itself, the property of the Village and the property of others. The safety provision of all applicable laws and ordinances shall be strictly observed by the Contractor at all times. Any practice deemed hazardous or dangerous by the Director of Public Works or his authorized representatives shall be immediately discontinued by the Contractor upon receipt of instructions from the Director of Public Works or his authorized representatives. To the fullest extent permitted by law, the Contractor shall be solely responsible for all safety-related matters.

ARTICLE VIII – INDEMNIFICATION

To the fullest extent permitted by law, the Contractor agrees to defend, pay on behalf of, indemnify, and hold harmless the Village, its elected and appointed officials, agents, employees and volunteers and others working on behalf of the Village against any and all claims, demands, suits or loss, including all costs connected therewith, and for any damages which may be asserted, claimed or recovered against or from the Village, its elected and appointed officials, agents, employees and volunteers and others working on behalf of the Village, by reason of personal injury, including bodily injury and death, and/or property damage, whether damage to property of the Village or of a third party, including loss of use thereof, which arises out of or is in any way connected or associated with the Contract and the Work.

ARTICLE IX – INSURANCE

A. LIMITS OF INSURANCE – For the entire duration of this Contract, Contractor shall maintain insurance against claims for injuries to persons or damages to property which may arise in connection with the performance of the Work as follows:

1. **Commercial General Liability Insurance –** The Contractor shall maintain commercial general liability insurance on an "occurrence basis" with limits of liability not less than $3,000,000 per occurrence and/or aggregate combined single limit, personal injury, bodily injury and property damage. Coverage shall include the followings: (A) Contractual Liability; (B) Products and Completed Operations; (C) Independent Contractors Coverage; (D) Board Form General Liability Extensions or Equivalent; (E) Deletion of all Explosion, Collapse, and Underground (XCU) Exclusions; and (F) Per contract aggregate. All general liability coverage shall be provided on an occurrence policy form, claims-made general liability policies will not be accepted.
2. **Motor Vehicle Liability Insurance –** The Contractor shall maintain motor vehicle liability insurance with limits of liability of not less than $3,000,000 per accident combined single limit Bodily Injury and Property Damage. Coverage shall include all owned vehicles, all non-owned vehicles and all hired vehicles.
3. **Workers Compensation –** The Contractor shall maintain workers compensation insurance as required by the Labor Code up to the statutory limits and employer's liability limits of $500,000 per accident.
4. **Builders Risk Property Coverage –** The Contractor shall maintain builders risk property coverage insurance in an amount equal to the sum of payments under Article III owed to the Contractor.

ARTICLE IX – INSURANCE (cont.)

B. REQUIREMENTS FOR ALL INSURANCE – All insurance required under this Article IX shall be placed with an insurance carrier licensed and admitted to do business in the State of Illinois with an A.M. Best Ratings of at least A- and size of VII. Further, all insurance required under this Article IX shall name the Village, its elected and appointed officials, agents, employees and volunteers as an additional insured and shall contain a Severability of Interests/Cross Liability clause stating that the Contractor's insurance shall apply separately to each insured against whom a claim is made or suit is brought, except with respect to the limits of the insurer's liability.

C. SELF INSURANCE DEDUCTIBLES - Any deductibles or self-insured retentions must be declared to and approved by the Village. At the option of the Village, either: the insurer shall reduce or eliminate such deductibles or self-insured retentions as it respects the Village, its officials, agents, employees and volunteers; or the Contractor shall procure a bond guaranteeing payment of losses and related investigation, claim administration and defense expenses.

D. PRIMARY COVERAGE AND NO CONTRIBUTION – All insurance provided by the Contractor under this Article IX shall be primary insurance with respect to any other insurance or self-insurance afforded to the Village. Any insurance or self-insurance maintained by the Village, its officials, agents, employees and volunteers shall be excess of Contractor's insurance and shall not contribute with it. This primary, non-contributory additional insured coverage shall be confirmed through the following required policy endorsements: ISO Additional Insured Endorsement CG 20 10 or CG 20 26 and CG 20 01 04 13.

E. INDEMNIFICATION AND KOTECKI CAP WAIVER – To the fullest extent permitted by law the Contractor shall indemnify, defend and hold the Village, and its elected and appointed officers, directors, members, employees, agents, and representatives, harmless from all claims and suits for damages arising from personal injuries, including death to persons or damage to property and from all expenses for defending such claim or suit, including court costs and reasonable attorney's fees, arising out of the acts, omission or negligence of the Contractor, a subcontractor, anyone directly or indirectly employed by them or anyone whose acts they may be liable. The Contractor shall have no duty to indemnify the Village hereunder against claims arising as a result of the Village's sole negligence. To the maximum extent permitted by law, in claims against any person or entity indemnified under this section by an employee of the Contractor, a subcontractor, anyone directly or indirectly employed by them or anyone whose acts they may be liable, the indemnification obligations under this section shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a subcontractor under any workers' compensation acts, disability benefit acts or other employee benefit acts.

F. INSURANCE OF SUBCONTRACTORS – The Village reserves the right to require all major subcontractors, as determined by the Village in its sole discretion, to carry the same insurance outlined in this Article IX. All contracts with any subcontractor must include a provision that the subcontractor waive its Kotecki Cap limits.

G. CANCELLATION CLAUSE WITHIN INSURANCE – All insurance required under this Article IX will provide that the Village receive at least thirty (30) calendar days notice prior to any modification, cancellation, suspension or expiration of the policy.

ARTICLE IX – INSURANCE (cont.)

H. CERTIFICATES OF INSURANCE – The Contractor, and any applicable subcontractor, must provide to the Village certificates of insurance providing for all the insurance required by this Article IX *prior* to the Contractor, and any applicable subcontractor, performing any of the Work. Notwithstanding, the Village reserves the right to request fully certified copies of all insurance policies and endorsements. Insurance Services Office Commercial General Liability occurrence form CG 0001 with the Village named as additional insured, on a form at least as broad as the ISO Additional Insured Endorsement CG 2010 or CG 2026.

I. RETENTION OF PAYMENTS – The Contractor and the Village agree that the Village may withhold payments due to the Contractor by virtue of this Contract if, in the Village's sole discretion, such amounts are necessary to protect the Village from any loss from any claim, suit, loss, or judgment until such claim, suit, loss, or judgment has been settled or discharged to the satisfaction of the Village.

ARTICLE X – CERTIFICATE OF AUTHORITY AND SURETY CERTIFICATE

The Contractor shall furnish the Village with a current Certificate of Authority or Surety Certificate issued by the Illinois Department of Insurance for the bonding company and insurance company they are using. In lieu of a Certificate of Authority of Surety Certificate, the Contractor may provide certificate of good standing from the Illinois Department of Insurance's website.

ARTICLE XI – COPYRIGHTS AND LICENSES

The Contractor agrees that all documents of any kind whatsoever, and in whatever medium expressed, prepared by the Contractor and the Contractor's consultants in connection with the Work (collectively, the "**Documents**") or otherwise pursuant to this Contract and all rights therein (including trademarks, trade names, rights or use, copyrights and/or other proprietary rights) shall be and remain the sole property of the Village (regardless of whether the Village or the Contractor terminates this Contract for any reason whatsoever). The Contractor hereby agrees that the Documents are or shall be deemed to be "Works for Hire" within the meaning of Section 101 of the Copyright Act, and the Contractor hereby assigns to the Village all right, title and interest therein. Notwithstanding, the Contractor shall indemnify and hold harmless the Village, its appointed and elected officials, employees, agents and volunteers from and against all claims, damages, losses, and expenses (including attorneys' fees and court and arbitration costs) arising out of any infringement of patent rights or copyrights incident to the Documents and the Work.

ARTICLE XII – NOTICE

All notices, demands, requests, consents, approvals and other communications required or permitted to be given hereunder (a "**Notice**") shall be in writing and shall be deemed effective three (3) business days after mailing if mailed by certified mail with return receipt requested and immediately if served personally, and shall be addressed to the following:

IF TO THE VILLAGE: Village of Buffalo Grove
51 Raupp Blvd
Buffalo Grove, IL 60089
ATTN: Director of Public Works

IF TO THE CONTRACTOR: _____
_____
_____
ATTN: _____

ARTICLE XIII – CHANGE ORDERS

If the Village requests any change to the Work the Village shall do so by delivering Notice of the same to the Contractor and the change requested by the Village shall be effective upon receipt of the Notice by the Contractor. The Contractor may propose a change to the Work by delivering Notice of the proposed change along with a description of the changes full effect on the Work to the Village; provided, such requested change shall not be deemed accepted until the Village has delivered to the Contractor Notice of the same. Prior to approving a proposed change to the Work by the Contractor, the Village may request such additional documentation as it deems necessary to investigate the proposed change. The Contractor shall be responsible for informing all its employees and subcontractors of any changes to the Work, whether such change is requested by the Contractor or the Village.

ARTICLE XIV – NOTICE OF STARTING WORK

The Contractor shall provide Notice to the Village prior to the Contractor, or its employees or subcontractors, starting the Work or any phase of the Work.

ARTICLE XV – SEQUENCE OF THE WORK

The Director of Public Works shall have the power to direct the order and sequence of the Work. On any major portion of the Work, all accessories shall be set coincident with the main construction. Payment for major portions of the Work may be withheld until proper completion of accessories.

ARTICLE XVI – SUPERVISION

The Director of Public Works shall have override power to superintend and direct the Work, and the Contractor shall perform all of the Work herein specified to the satisfaction, approval and acceptance of the Director of Public Works. The Contractor shall have at all times a competent foreman or superintendent at the Work's site, who shall have full authority to act for the Contractor and to receive and execute orders from the Director of Public Works, and any instructions given to such superintendant or person, executing work for the Contractor, shall be binding on the Contractor as though it was personally given to the Contractor.

ARTICLE XVII – STANDARD OF WORK AND WORKERS

The Contractor shall employ competent staff and shall discharge, at the request of the Director of Public Works, any incompetent, unfaithful, abusive or disorderly workers in its employ. Where experts or skilled workers must be employed, only expert or skilled workers shall be employed.

ARTICLE XVIII – CONDITIONS OF THE WORK SITE

The Contractor shall provide and maintain such sanitary accommodations for the use of its employees as may be necessary to comply with the State and local Board of Health requirements. Public nuisances will not be permitted. The Contractor shall leave said Work's site(s) in the best possible condition to the complete satisfaction of the Director of Public Works. No vehicles of any kind shall be placed, parked, or operated upon any grass areas at any time except as authorized by the Director of Public Works or his authorized representative. Further, the Contractor shall exercise every precaution for the protection of all persons and all property. The safety provisions of all-applicable laws and ordinances shall be strictly observed. Any practice hazardous in the opinion of the Director of Public Works or his authorized representatives shall be immediately discontinued by the Contractor upon his receipt of instructions from the Director of Public Works or his authorized representative. To the maximum extent permitted by law, the Contractor shall be responsible for all safety-related matters.

ARTICLE XIX – WARRANTY PERIOD

All material and workmanship shall be warranted and guaranteed according to manufacturer's recommendation after inspection and approval by the Director of Public Works or his designated representative. All work performed by the Contractor shall be warranted by the Contractor following completion and final acceptance of the Work for a period of twelve (12) months from the date of final, and not substantial, completion.

ARTICLE XX – ACCIDENTS

In the event of any accident of any kind that involves the general public or property of the Village or a third party, the Contractor shall immediately notify the Director of Public Works by phone as well as provide Notice of the same. The Notice shall include a full accounting of all details of the accident. The Contractor shall furnish the Village with copies of all reports of such accidents at the same time that the reports are forwarded to any other interested parties.

ARTICLE XXI – NO ASSIGNMENT

If the Contractor sublets or assigns any part of the Work then the Contractor shall not under any circumstances be relieved of its liabilities hereunder. All transactions of the Village shall be with the Contractor. Subcontractors shall be recognized only in the capacity of employees or workmen and shall be subject to the same requirements as to character and competence. The Contractor shall not assign, transfer, convey, sell or otherwise dispose of the whole or any part of this Contract to any person, firm or corporation without written consent of the Director of Public Works or his authorized representative.

ARTICLE XXII – DEFAULT

The following shall constitute a default an "**Event of Default**" by the Contractor under this Contract:

A. If the Contractor shall fail to strictly observe or perform one or more of the terms, conditions, covenants and agreements of this Contract;

B. If there shall be placed on any property owned by the Village any mechanics', materialmens' or suppliers' lien;

C. If there shall be instituted any proceeding against the Contractor seeking liquidation, dissolution or similar relief and the same shall not be dismissed within forty-five (45) calendar days;

D. If there shall be appointed any trustee, receiver or liquidator of the Contractor and such appointment shall not have been vacated within forty-five (45) calendar days; and

E. If the Contractor fails to maintain or obtain any and all permits, licenses and the like, if any, required by the Village, State or Federal governments for the Work.

Upon any Event of Default the Village shall have the option of (**i**) terminating the Contract; (**ii**) pursuing any remedy available to it at law or in equity; or (**iii**) pursuing both simultaneously. In addition, upon an Event of Default, the Village may withhold payments due to the Contractor until it has hired a replacement of the Contractor and deducted all costs of hiring a replacement.

ARTICLE XXIII – DELAYS

The Contractor shall not be liable in damages for delays in performance when such delay is the result of fire, flood, strike, acts of God, or by any other circumstances which are beyond the control of the Contractor; provided, however, under such circumstances the Village may, at its option, cancel the Contract.

ARTICLE XXIV – COMPLIANCE WITH LAWS

The Contractor shall comply with all applicable laws, regulations and rules promulgated by any federal, state, local, or other governmental authority or regulatory body pertaining to all aspects of the Work, now in effect, or which may become in effect during the performance of the Work. The scope of the laws, regulations, and rules referred to in this paragraph includes, but is in no way limited to, the Illinois Human Rights Act, Illinois Equal Pay Act of 2003, Occupational Safety & Health Act along with the standards and regulations promulgated pursuant thereto (including but not limited to those safety requirements involving work on elevated platforms), all forms of traffic regulations, public utility, Interstate and Intrastate Commerce Commission regulations, Workers' Compensation Laws, Public Construction Bond Act, Public Works Preference Act, Employment of Illinois Workers on Public Works Act, USA Security Act, federal Social Security Act (and any of its titles), and any other law, rule or regulation of the Illinois Department of Labor, Department of Transportation, Illinois Environmental Protection Act, Illinois Department of Natural Resources, Illinois Department of Human Rights, Human Rights Commission, EEOC, and the Village of Buffalo Grove. Notwithstanding the following, the Contractor shall particularly note that:

A. NO DISCRIMINATION – The Contractor shall comply with the provisions of the Illinois Public Works Employment Discrimination Act and the Illinois Human Rights Act/Equal Opportunity Clause which, pursuant to Illinois law, are deemed to be part of this Contract.

B. FREEDOM OF INFORMATION - The Contractor agrees to furnish all documentation related to the Contract, the Work and any documentation related to the Village required under an Illinois Freedom of Information Act (ILCS 140/1 et. seq.) ("**FOIA**") request within five (5) calendar days after the Village issues Notice of such request to the Contractor. The Contractor agrees to defend, indemnify and hold harmless the Village, and agrees to pay all reasonable costs connected therewith (including, but not limited to attorney's and witness fees, filing fees and any other expenses) for the Village to defend any and all causes, actions, causes of action, disputes, prosecutions, or conflicts arising from Contractor's actual or alleged violation of FOIA or the Contractor's failure to furnish all documentation related to a FOIA request within five (5) calendar days after Notice from the Village for the same. Furthermore, should the Contractor request that the Village utilize a lawful exemption under FOIA in relation to any FOIA request thereby denying that request, Contractor agrees to pay all costs connected therewith (such as attorneys' and witness fees, filing fees and any other expenses) to defend the denial of the request. This defense shall include, but not be limited to, any challenged or appealed denials of FOIA requests to either the Illinois Attorney General or a court of competent jurisdiction.

C. ILLINOIS WORKERS ON PUBLIC WORKS ACT - To the extent applicable, the Contractor shall comply with the Illinois Workers on Public Works Act, 30 ILCS 570/1 et seq., and shall provide to the Village any supporting documentation necessary to show such compliance.

D. NOT A BLOCKED PERSON - The Contractor affirms and covenants that neither the Contractor nor any individual employed by the Contractor for this Work or under this Contract is a person forbidden from doing business with a unit of local government under Executive Order No. 13224 (Sept 23, 2001), 66 Fed.Reg. 49,079 (Sept 23, 2001) or is a person registered on the Specially Designated Nationals and Blocked Persons List. The Contractor shall indemnify the Village from all costs associated with failure to comply with this paragraph.

E. SUBSTANCE ABUSE PREVENTION ON PUBLIC WORKS ACT - The Contractor knows, understands and acknowledges its obligations under the Substance Abuse Prevention on Public Works Act (820 ILCS 265/1 et seq.), and shall comply and require all subcontractors and lower tiered contractors to comply with the requirements and provisions thereof.

ARTICLE XXIV – COMPLIANCE WITH LAWS (cont.)

F. PREVAILING WAGE ACT - The Village is an Illinois unit of local government and the Work hereunder is subject to the Illinois Prevailing Wage Act, 820 ILCS 130/0.01, et seq. Consequently, the Contract and each subcontractor shall submit monthly with their application for payment a certified payroll along with a signed statement attesting that: (**i**) such payroll is true and accurate; (**ii**) the hourly rate paid to each worker is at least equal to the prevailing wage for such work; and (**iii**) the Contractor or subcontractor is aware that filing a falsely certified payroll is a Class B Misdemeanor. Any delay in processing the payments due to a lack of certified payroll shall not be an event of default by the Village and shall not excuse any delay by the Contractor who shall proceed with the Work as if no delay in payment has occurred. The Contractor and Village shall agree to take any further steps not outlined above to ensure compliance with the Prevailing Wage Act. Upon two business day's Notice, the Contractor and each subcontractor shall make available to the Village their records to confirm compliance with the Prevailing Wage Act. Finally, to ensure compliance with Prevailing Wage Act, the Contractor and each subcontractor shall keep for a period of not less than 5 years after the Work has been completed records of all laborers, mechanics, and other workers employed by them for the Work; the records shall include each worker's name, address, telephone number, classification or classifications, the hourly wages paid in each period, the number of hours worked each day, the starting and ending times of work each day and, when available, last four digits of the social security number. The Contractor shall provide a list of every name, address, phone number and email of every sub-contractor for the Work.

Current rates can be located on the Illinois Department of Labor website.
https://www.illinois.gov/idol/Laws-Rules/CONMED/Pages/Rates.aspx

ARTICLE XXV – NO WAIVER OF RIGHTS

A waiver by the Village of any Event of Default or any term of provision of this Contract shall not be a waiver of the same Event of Default, another Event of Default or any other term or provision of this Contract.

ARTICLE XXVI – CONTROLLING LAW AND VENUE

This Contract is entered into in the State of Illinois, for work to be performed in the State of Illinois and shall be governed by and construed in accordance with the laws of the State of Illinois. Any legal matters or dispute shall be resolved in the Circuit Court of Cook County and the Parties hereby submit to the jurisdiction of such Circuit Court. This Contract shall be construed without regard to any presumption or other rule requiring construction against the Party causing the Contract to be drafted.

ARTICLE XXVII – MISCELLANEOUS

A. AMENDMENT – This Contract may be amended only in writing executed by both Parties.

B. NO RECORDING – This Contract, or a memorandum thereof, may not be recorded in any form by either Party. If either Party records this Contract, or a memorandum thereof, they shall immediately file a release of the same.

ARTICLE XXVII – MISCELLANEOUS (cont.)

C. **COUNTERPARTS –** This Contract may be executed by the Parties in any any number of counterparts, each of which shall be deemed an original, but all of which together shall constitute an original instrument.

D. **SECTION HEADINGS –** The headings in the Contract are intended for convenience only and shall not be taken into consideration in any construction or interpretation of the Contract.

E. **NO THIRD PARTY BENEFICIARIES –** This Contract does not confer any rights or benefits on any third party.

F. **BINDING EFFECT –** This Contract shall be binding and inure to the benefit of the Parties hereto, their respective legal representatives, heirs and successors-in-interest.

G. **ENTIRE AGREEMENT –** This Contract supersedes all prior agreements and understandings and constitutes the entire understanding between the Parties relating to the subject matter hereof.

H. **SEVERABILITY -** If any term, condition or provision of the Contract is adjudicated invalid or unenforceable, the remainder of the Contract shall not be affected and shall remain in full force and effect, to the fullest extent permitted by law.

I. **TORT IMMUNITY DEFENSES -** Nothing contained in this Contract is intended to constitute nor shall constitute a waiver of the rights, defenses, and immunities provided or available to the Village under the Local Governmental and Governmental Employees Tort Immunity Act, 745 ILCS 10 *et seq*.

IN WITNESS WHEREOF, the Parties hereto have caused the Contract to be executed as of the Effective Date.

Village of Buffalo Grove,	**Company**
an Illinois home-rule unit of government	[An Illinois _____ company]
By:_____	By:_____
Name: Beverly Sussman	Name: _____
Title: Village President	Title: _____

CONTRACT EXHIBIT A

[Description of the Work]

CONTRACT EXHIBIT B

[Schedule of Prices]

CONTRACT EXHIBIT C

FORM OF PERFORMANCE and PAYMENT BONDS

Bond Number: _____

KNOW ALL MEN BY THESE PRESENTS, That _____ (the "**Principal**") and _____ _____ (the "**Surety**"), are held and firmly bound unto the Village of Buffalo Grove, an Illinois home-rule unit of government (the "**Village**"), the full and just sum of _____Dollars ($_____) in lawful money of the UNITED STATES OF AMERICA as herein provided.

THE CONDITION OF THIS OBLIGATION is such that the Principal and Surety agree to bind themselves, their successors, assigns, executors, heirs and administrators, jointly and severally, for the full and faithful performance of the Work as defined in that particular Combined Area Fire Training Facility Re-Bid contract between Principal and the Village dated __ day of _____, 20__, (hereinafter referred to as the "**Contract**"), a copy of which is attached and incorporated by reference as though fully set forth herein.

NOW THE CONDITIONS OF THIS OBLIGATION ARE SUCH that if the said Principal (**i**) shall in all respects keep and perform all the undertakings, covenants, terms, conditions and agreements of the Contract; (**ii**) shall pay all sums of money due or to become due, for any labor, materials, apparatus, fixtures or equipment furnished for the Work provided in said Contract; and (**iii**) shall remove and replace any defects in workmanship or materials which may be apparent or may develop within the ARTICLE XIX – WARRANTY PERIOD of the Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

And the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or the Work thereunder shall in any way affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the Work.

IN WITNESS WHEREOF, we have hereunto set our hands and sea ___ day of _____, 20__.

SURETY	**PRINCIPAL**
By: _____	**By:** _____
Name: _____	**Name:** _____
Title: _____	**Title:** _____
ATTEST	**ATTEST**
By: _____	**By:** _____

NOTE: Date of Bond must not be prior to date of Contract.
If Contractor is Partnership, all partners should execute Bond.
IMPORTANT: Surety companies executing Bonds must appear on the Treasury Departments most current list (Circular 570 as amended) and be authorized to transact business in the state where the Work is located.

CONTRACT EXHIBIT D

PARTIAL LIEN WAIVER

STATE OF ILLINOIS

COUNTY OF _____

TO WHOM IT MAY CONCERN:
WHEREAS the undersigned has been employed by _____
to furnish _____
for the premises known as _____
of which _____ is the owner.
THE undersigned, for and in consideration of _____
($_____
_____
) Dollars, and other good and valuable considerations, the receipt whereof is hereby acknowledged, do(es) hereby waive and release any and all lien or claim of, or right to, lien, under the statutes of the State of Illinois, relating to mechanics' liens, with respect to and on said above-described premises, and the improvements thereon, and on the material, fixtures, apparatus or machinery furnished, and on the moneys, funds or other considerations due or to become due from the owner, on account of all labor, services, material, fixtures, apparatus or machinery, furnished to this date by the undersigned for the above-described premises, INCLUDING EXTRAS.*
DATE _____ COMPANY NAME _____
ADDRESS _____
SIGNATURE AND TITLE _____

*EXTRAS INCLUDE BUT ARE NOT LIMITED TO CHANGE ORDERS, BOTH ORAL AND WRITTEN, TO THE CONTRACT

CONTRACTOR'S AFFIDAVIT

STATE OF ILLINOIS

COUNTY OF _____

TO WHOM IT MAY CONCERN:
THE UNDERSIGNED, (NAME) _____ BEING DULY SWORN, DEPOSES AND SAYS THAT HE OR SHE IS (POSITION) _____ OF (COMPANY NAME) _____ WHO IS THE CONTRACTOR FURNISHING _____ WORK ON THE BUILDING LOCATED AT _____
OWNED BY _____
That the total amount of the contract including extras* is $ _____ on which he or she has received payment of $ _____ prior to this payment. That all waivers are true, correct and genuine and delivered unconditionally and that there is no claim either legal or equitable to defeat the validity of said waivers. That the following are the names and addresses of all parties who have furnished or delivered material or labor, or both, for said work and all parties having contracts or sub contracts for specific portions of said work or for material entering into the construction thereof and the amount due or to become due to each, and that the items mentioned include all labor and material required to complete said work according to plans and specifications:

NAMES AND ADDRESSES	WHAT FOR	CONTRACT PRICE INCLDG EXTRAS*	AMOUNT PAID	THIS PAYMENT	BALANCE DUE
TOTAL LABOR AND MATERIAL INCLUDING EXTRAS* TO COMPLETE.					

That there are no other contracts for said work outstanding, and that there is nothing due or to become due to any person for material, labor or other work of any kind done or to be done upon or in connection with said work other than above stated.

DATE _____ SIGNATURE: _____

SUBSCRIBED AND SWORN TO BEFORE ME THIS _____ DAY OF _____, _____

*EXTRAS INCLUDE BUT ARE NOT LIMITED TO CHANGE ORDERS, BOTH ORAL AND WRITTEN, TO THE CONTRACT.

_____
NOTARY PUBLIC

CONTRACT EXHIBIT E

FINAL WAIVER OF LIEN

STATE OF ILLINOIS

COUNTY OF _____

TO WHOM IT MAY CONCERN:
WHEREAS the undersigned has been employed by _____
to furnish _____
for the premises known as _____
of which _____ is the owner.
THE undersigned, for and in consideration of _____
($_____) Dollars, and other good and valuable considerations, the receipt whereof is hereby acknowledged, do(es) hereby waive and release any and all lien or claim of, or right to, lien, under the statutes of the State of Illinois, relating to mechanics' liens, with respect to and on said above-described premises, and the improvements thereon, and on the material, fixtures, apparatus or machinery furnished, and on the moneys, funds or other considerations due or to become due from the owner, on account of all labor, services, material, fixtures, apparatus or machinery, heretofore furnished, or which may be furnished at any time hereafter, by the undersigned for the above-described premises, INCLUDING EXTRAS.*
DATE _____ COMPANY NAME _____
ADDRESS _____
SIGNATURE AND TITLE _____

*EXTRAS INCLUDE BUT ARE NOT LIMITED TO CHANGE ORDERS, BOTH ORAL AND WRITTEN, TO THE CONTRACT

CONTRACTOR'S AFFIDAVIT

STATE OF ILLINOIS

COUNTY OF _____

TO WHOM IT MAY CONCERN:
THE UNDERSIGNED, (NAME) _____ BEING DULY SWORN, DEPOSES AND SAYS THAT HE OR SHE IS (POSITION) _____ OF (COMPANY NAME) _____ WHO IS THE CONTRACTOR FURNISHING _____ WORK ON THE BUILDING LOCATED AT _____
OWNED BY _____
That the total amount of the contract including extras* is $ _____ on which he or she has received payment of $ _____ prior to this payment. That all waivers are true, correct and genuine and delivered unconditionally and that there is no claim either legal or equitable to defeat the validity of said waivers. That the following are the names and addresses of all parties who have furnished or delivered material or labor, or both, for said work and all parties having contracts or sub contracts for specific portions of said work or for material entering into the construction thereof and the amount due or to become due to each, and that the items mentioned include all labor and material required to complete said work according to plans and specifications:

NAMES AND ADDRESSES	WHAT FOR	CONTRACT PRICE INCLDG	AMOUNT PAID	THIS PAYMENT	BALANCE DUE
TOTAL LABOR AND MATERIAL INCLUDING EXTRAS*					

That there are no other contracts for said work outstanding, and that there is nothing due or to become due to any person for material, labor or other work of any kind done or to be done upon or in connection with said work other than above stated.

DATE _____ SIGNATURE: _____

SUBSCRIBED AND SWORN TO BEFORE ME THIS _____ DAY OF _____, _____

*EXTRAS INCLUDE BUT ARE NOT LIMITED TO CHANGE ORDERS, BOTH ORAL AND WRITTEN, TO THE CONTRACT.

_____
NOTARY PUBLIC

SECTION 00 31 32

GEOTECHNICAL DATA

COMBINED AREA FIRE TRAINING FACILITY RE-BID

PART 1: GENERAL

1.01 SCOPE

A. The information on soil data was obtained primarily for use in preparing the foundation design. However, each Contractor shall draw their own conclusions therefrom. No responsibility is assumed by the Owner or the Architect for subsoil quality or conditions.

1.02 INVESTIGATIONS

A. A subsurface investigation has been made and reports prepared by Rubino Engineering, Inc., Report No. G17.097.

B. A copy of the test boring locations and a log of test borings is attached after this Section.

1.03 CONDITIONS

A. Boring information is provided in good faith solely for the purpose of placing each Bidder in receipt of information available to the Owner, and each Bidder is responsible for any conclusions which he draws therefrom, since the Owner does not guarantee continuity of the conditions indicated at the boring locations.

B. Each Bidder is expected to make their own investigations, to examine the site and record of the Owner's investigations, and then decide for themselves the character of materials to be encountered. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions but such subsurface investigations shall be performed only under arrangements approved in advance by the Architect.

END OF SECTION 00 31 32

REPORT TRANSMITTAL

June 30th, 2017

To: Michael K. Skibbe
Village of Buffalo Grove
51 Raupp Boulevard
Buffalo Grove, IL 60089
Phone: 847.459.2545
Fax: 847.537.1742

Re: **Geotechnical Engineering Services Report**
Proposed CAFT Building and Parking Lot
SEC of Deerfield Parkway and Krause Drive
Buffalo Grove, Illinois

Rubino Report No. G17.097

Via email: MSkibbe@vbg.org

Dear Mr Skibbe,

Rubino Engineering, Inc. (Rubino) is pleased to submit our Geotechnical Engineering Services Report for the Proposed CAFT Building and Parking Lot in Buffalo Grove, Illinois.

Report Description

Enclosed is the Geotechnical Services Report including results of field and laboratory testing, as well as recommendations for foundation design, pavement design, and general site development.

Authorization and Correspondence History

- *Rubino Proposal Q17.230g dated May 16th, 2017; Signed and authorized by Purchase Order 2017-00001536*

Closing

Rubino appreciates the opportunity to provide geotechnical services for this project and we look forward to continued participation during the design and in future construction phases of this project.

If you have questions pertaining to this report, or if Rubino may be of further service, please contact our office at (847) 931-1555.

Respectfully submitted,
RUBINO ENGINEERING, INC.

Michelle A. Lipinski, PE
President

michelle.lipinski@rubinoeng.com

MAL/file/ Enclosures

Geotechnical Engineering Services Report

Drilling
Laboratory Testing
Geotechnical Analysis

PROPOSED CAFT BUILDING AND PARKING LOT

SEC OF DEERFIELD PARKWAY AND KRAUSE DRIVE

BUFFALO GROVE, ILLINOIS

RUBINO PROJECT NO. G17.097

PREPARED BY:

rubino ENGINEERING INC.

Michelle A. Lipinski, PE
President
IL No. 062-061241, Exp. 11/30/17

PREPARED FOR:

VILLAGE OF BUFFALO GROVE

51 RAUPP BOULEVARD

BUFFALO GROVE, IL 60089

JUNE 30TH, 2017

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APPENDIX J – SITE VICINITY MAP & BORING LOCATION PLAN
APPENDIX K – BORING LOGS
APPENDIX L – LABORATORY REPORTS

PROJECT INFORMATION

Rubino understands that The Village of Buffalo Grove is planning to construct a new building and parking lot located at the southeast corner of Deerfield Parkway and Krause Drive in Buffalo Grove, Illinois. The building will be a single story, slab-on-grade structure (no basement), approximately 6,250 square feet in plan area, and is anticipated to be lightly loaded.

Site Grading and Pavement Design Criteria were not received but are based on the following:

- Individual column loads not exceeding 70 kips
- Bearing wall loads not exceeding 4.0 kips per lineal foot (klf)
- Grade-supported slab live loads not exceeding 150 psf.
- Site grading including cuts and fills being less than 2 feet
- Light Duty Pavement 18-kip ESALS: 30,000
- Heavy Duty Pavement 18-kip ESALS: 60,000
- Pavement Life Expectancy: 15 years

Structural Loads: this report is based on the following Email from Kent Adams of JWA Structural Engineering dated June 19th, 2017:

Maximum Wall Loads:	2.5 Kips / Lineal Foot
Maximum concentrated load:	25 Kips (Column)

Documents received:

- "Proposed Borings for CFTA Building and Parking Lot" – prepared by MeritCorp Group, LLC.

Project Correspondence:

- RFP Email from James P. Meier of MeritCorp Group, LLC. on May 15th, 2017.

The geotechnical recommendations presented in this report are based on the available project information and the subsurface materials described in this report. If any of the information on which this report is based is incorrect, please inform Rubino in writing so that we may amend the recommendations presented in this report (if appropriate, and if desired by the client). Rubino will not be responsible for the implementation of our recommendations if we are not notified of changes in the project.

Purpose / Scope of Services

The purpose of this study was to explore the subsurface conditions at the site in order to prepare geotechnical recommendations for shallow foundations, pavement design, and general site development for the proposed construction.

Rubino's scope of services included the following drilling program:

Table 1: Drilling Scope

Boring Number	DEPTH (FEET BEG*)	LOCATION
B-01	15 feet	Proposed CAFT Building
B-02	15 feet	Proposed CAFT Building
B-03	15 feet	Proposed CAFT Building
B-04	15 feet	Proposed CAFT Building
B-05	15 feet	Proposed CAFT Building
P-01	10 feet	Proposed Parking Lot
P-02	10 feet	Proposed Parking Lot

*BEG = below existing grade

Representative soil samples obtained during the field exploration program were transported to the laboratory for additional classification and laboratory testing.

This report briefly outlines the following:

- *Summary of client-provided project information and report basis.*
- *Overview of encountered subsurface conditions.*
- *Overview of field and laboratory tests performed including results.*
- *Geotechnical recommendations pertaining to:*
  - *Subgrade preparation and cut / fill recommendations.*
  - *Foundations, including suitable foundation type(s), allowable bearing pressure(s), and estimated settlement.*
  - *Pavements, including subgrade pavement sections for bituminous and Portland Cement Concrete (PCC) pavements.*
  - *Seismic design site classification parameters.*
- *Construction considerations, including temporary excavation and construction control of water.*

DRILLING, FIELD, AND LABORATORY TEST PROCEDURES

The Village of Buffalo Grove selected the number of borings and the boring depths. Rubino located the borings in the field using a Garmin GPSMap 64s. The borings were advanced utilizing 3 ¼ inch inside-diameter, hollow stem auger drilling methods and soil samples were routinely obtained during the drilling process.

Selected soil samples were tested in the laboratory to determine material properties for this report. Drilling, sampling, and laboratory tests were accomplished in general accordance with ASTM procedures. The following items are further described in the Appendix of this report.

- *Field Penetration Tests and Split-Barrel Sampling of Soils (ASTM D1586)*
- *Laboratory Determination of Water (Moisture) Content of Soil by Mass (ASTM D2216)*
- *Laboratory Determination of Atterberg Limits (ASTM D4318)*
- *Laboratory Organic Content by Loss on Ignition (ASTM D2974)*

The laboratory testing program was conducted in general accordance with applicable ASTM specifications. The results of these tests are to be found on the accompanying boring logs located in the Appendix.

EXECUTIVE SUMMARY OF GEOTECHNICAL CONSIDERATIONS

The main geotechnical design and construction considerations at this site are:

- **Possible Undocumented fill soils** were observed within the borings. The primary risk of supporting structures on undocumented/uncontrolled fill materials is the potential for excessive and/or non-uniform settlement. See *Undocumented Fill Soils Discussion* section for more information.
- **Subgrade soils** generally consisted of brown and gray, silty clay soils. See *Subsurface Conditions* section for more detailed information.
    - Silty clay soils with **lower blow counts and moderate to high moisture contents** were encountered near the existing surface grade. These soils will likely need to be stabilized during construction. See the *Subgrade Stability* section for more recommendations.
- **Intermediate Foundations such as helical piers** are a possible foundation design option at this site as long as the soils at bearing depth are stabilized (undercut). See *Foundation Recommendations* section for more information.
- During subgrade preparation, Rubino recommends that one of our representatives be onsite for typical observations and documentation of foundation excavations, and reworking of the unsuitable fill materials, if applicable.

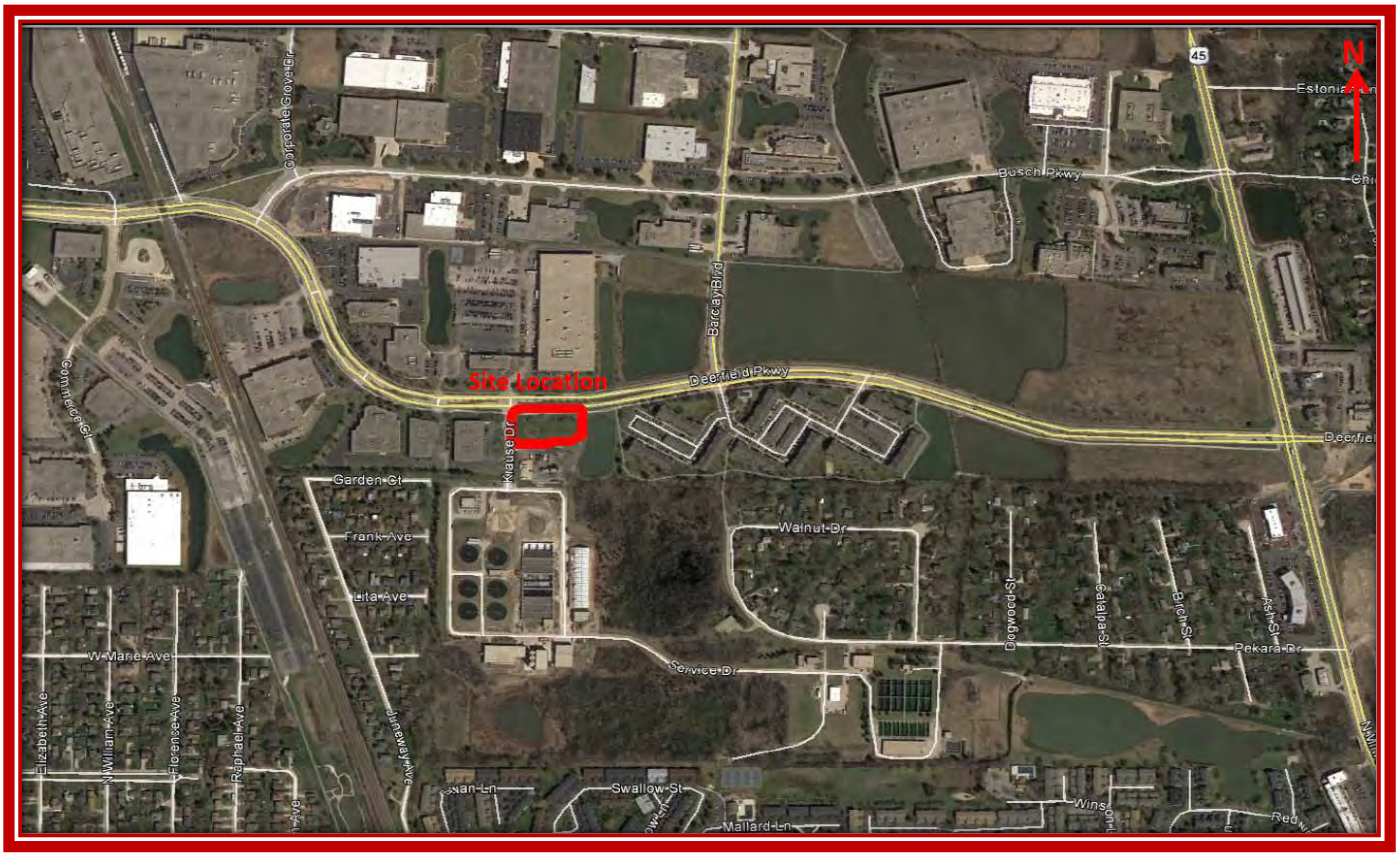
The geotechnical-related recommendations in this report are presented based on the subsurface conditions encountered and Rubino's understanding of the project. Should changes in the project criteria occur, a review must be made by Rubino to determine if modifications to our recommendations will be necessary.

SITE AND SUBSURFACE CONDITIONS

Site Location and Description

The general site location of exploration was the Southeast Corner of Deerfield Parkway and Krause Drive in Buffalo Grove, Illinois. The site has an approximate latitude and longitude of 42°10'4.18" N and 87°56'6.72" W respectively.

The map below shows the general site location of where the soil borings were taken:



Subsurface Conditions

Beneath the existing undocumented fill soils or gravel, subsurface conditions generally consisted of brown, black, and/or gray silty clay soils and brown gravelly sands.

- The **topsoil** thicknesses were approximately 3 to 8 inches.
- The native **silty clay** soils were generally Medium stiff to very stiff in consistency

Table 2: Subsurface Conditions Summary

DEPTH RANGE (FT)	SOIL DESCRIPTION	SPT N-VALUES (BLOWS PER FOOT)	MOISTURE CONTENT (%)	ESTIMATED SHEAR STRENGTH (PSF)
Proposed CAFT Building / Borings B-01 through B-05				
¼ – 15 feet	Medium stiff to very stiff silty CLAY	5 - 15	11 – 33 %	750 – 2,250 psf
Proposed Parking Lot / Borings P-01 & P-02				
0 – 8 ½ ft	UNDOCUMENTED FILL: Silty clay with sand and gravel	7 – 11	14 – 25	N/A
6 - 10	Medium stiff to stiff silty CLAY	8 – 13	18 – 21	1,200 – 1,950 psf

The native soils were visually classified as silty clay (CL) according to the Unified Soil Classification System (USCS). The above table is a general summary of subsurface conditions. Please refer to the boring logs for more detailed information.

Estimated shear strength of clay soils is based on empirical correlations using N-values, moisture content, and unconfined compressive strength.

Groundwater Conditions

Groundwater was encountered in some of the borings during drilling operations. The moisture contents of the soils indicate that the soils are at or near saturation. Based on the saturation of soils, and the color change of the soils from brown to gray, Rubino anticipates that **seasonal high groundwater levels may be encountered at shallower depths than at the time of drilling operations.** The following table summarizes groundwater observations from the field and Rubino's estimates for potential seasonal high groundwater tables:

Table 3: Groundwater Observation Summary

Boring Number	Boring Location	Groundwater Level during drilling (feet*)	Groundwater Level upon auger removal (feet*)	Estimated Seasonal High Groundwater Level (Feet*)
B-01	Proposed CAFT Building	N/A	N/A	≥ 15 ft
B-02		N/A	N/A	≥ 15 ft
B-03		N/A	N/A	≥ 15 ft
B-04		N/A	N/A	≥ 15 ft
B-05		13 ft	12 ft	12 ft
P-01	Proposed Parking Lot	N/A	N/A	6 ft
P-02		N/A	N/A	6 ft

*Depth below existing grade

It should be noted that fluctuations in the groundwater level should be anticipated throughout the year depending on variations in climatological conditions and other factors not apparent at the time the borings were performed. Additionally, discontinuous zones of perched water may exist within the soils. The possibility of groundwater level fluctuation should be considered when developing the design and construction plans for the project.

Evaluation and Recommendations

The geotechnical-related recommendations in this report are presented based on the subsurface conditions encountered and Rubino's understanding of the project. Should changes in the project criteria occur, a review must be made by Rubino to determine if modifications to our recommendations will be necessary.

Undocumented Fill Discussion

Undocumented fill was observed in the borings to depths exceeding 10 feet below existing grade.

Where existing fill is encountered, Rubino recommends that structure foundations extend through the fill materials and be supported on the a stiffer soil stratum. In this case, intermediate foundations are the recommended option due to the depth of fill encountered.

Undocumented fill is defined as fill that has been placed without being documented as to its placed density and moisture content.

Deleterious materials could include, but are not limited to, bricks, asphalt, concrete, metal, wood, or other building debris.

If documentation of fill placement can be produced, Rubino can review the quality of the fill placement and provide alternative recommendations if there is sufficient documentation.

Based on the boring information, it is anticipated that most of these existing undocumented clayey fill soils should be suitable for support of floor slabs and pavements unless otherwise noted in this report. However, undocumented fill materials should be carefully evaluated by proof-rolling and subgrade stability testing (as recommended herein) at the time of construction to document the in-place consistency of these materials.

Deleterious materials were not observed within the undocumented fill materials during the drilling operations. Although deleterious materials were not encountered in all the undocumented fill materials, this does not eliminate the possibility that deleterious materials could be present within the undocumented fill materials at other locations along the project.

Dewatering Recommendations

Groundwater was encountered in the borings. Therefore, dewatering may be necessary during excavation of saturated soils due to presence of sand seams or other conditions not apparent at the time of drilling. Shoring or trench boxes may be required where the soils are saturated. Please reference the groundwater elevations on the attached boring logs and in the *Groundwater Conditions* section of this report.

Subgrade Preparation and Testing

The following comments are considered site-specific. To reference general subgrade preparation recommendations for proofrolling and compaction, **please refer to the Appendix** of this report.

- During construction, the site should be **stripped of existing concrete, abandoned utilities, and pavement sections including asphalt, subbase, and curbs**.
- Prior to paving, the soils should be stabilized as follows:
  - **Parking Area:** Soils must pass a proofroll prior to placing structural fill. This may require stabilization at least 12 inches below bottom of the topsoil elevation in most areas. See *Subgrade Stability Recommendation* for more detailed information.
- During subgrade preparation, Rubino recommends that one of our representatives be onsite for **typical observations and documentation** of proofrolling of the subgrade areas, foundation excavations, and stabilizing the unsuitable soils.
- Construction traffic should be minimized to prevent unnecessary disturbance of the subgrade. Disturbed areas, as documented in the field by Rubino, should be treated as recommended below.

Subgrade Stability Recommendations

Subgrade soils may be **stabilized** by one of the following **options**:

- **Remove and replace** with non-woven filter fabric and 3-inch stone capped with CA-06 stone.
  - The contractor can also attempt to stabilize the existing subgrade in place by "losing" 3-inch stone into the subgrade until the until the voids of the 3-inch stone are filled with the soft soil and the subgrade "locks up," showing minimal deflection under a proofroll.
  - A layer of non-woven filter geotextile should be placed between silty clay soil and an open-graded stone.
  - Please be aware that large amounts of open-graded stone placed on the site will attract groundwater. Please notify the Civil engineer of record if this option is chosen.
- **Geogrid and a stone mat** placed across the building pad per manufacturer's installation specifications could reduce the amount of stone required and provide additional lateral support for foundation loads in service.
- Scarifying and re-compacting the existing subgrade soil to at least 95% compaction per ASTM D698 Standard Proctor (12 inch depth).
- **Lime or other chemical additive** stabilization (12 to 14 inches). This can be done as part of a lift structure. Compaction requirements still apply.

Intermediate Foundation Option (Helical Piers)

Due to the presence of undocumented fill soils, Rubino recommends that the proposed CAFT building may be supported by intermediate foundations such as helical piers. **The helical piers should be planned to be anchored within t stiff silty clay soils underlying possible fill soils. The contractor is able to measure the torque of the helical anchors during installation.**

There are many possibilities for helical pier design. The spacing of the helicals on the shaft and the diameters of the helicals is variable and should be selected based on design loading and suitable soil depth. The helical pier installer or manufacturer should be consulted for design of the helical piers for each specific location on site.

The piles should be designed to support the applied loads without undergoing unacceptable deflection. Because there are softer soils to a depth of approximately 18 ½ feet below existing grade, there is a possibility of shaft buckling in this range which should be considered when designing the helical pier. Factors that determine the buckling load include the pile shaft diameter, length, flexural stiffness and strength, the soil stiffness and strength profile, lateral shear and/or moment applied at the pile head, and pile head fixity conditions.

If the required amount of torque is not encountered at the anticipated depth in the field, the following modifications can be made to increase the capacity:

- Decrease the spacing between the helical piers.
- Increase the number of helicals on the pier.

If the helical piers are planned to be socketed into concrete, the concrete should be placed at frost depth. If the structures will be constructed during winter months or if the concrete will likely

be subjected to freezing temperatures after construction is completed, then the concrete should be protected from freezing.

The connections between the helical piers and structural elements should be designed by the structural engineer and the load transfer characteristics of the existing foundations should be considered in selecting the helical pier spacing. Helical pier design and installation should be performed by qualified personnel.

Shallow Foundation Discussion

Geotechnical Risk

The primary risk of supporting structures on undocumented/uncontrolled fill materials is the potential for excessive and/or non-uniform settlement. The non-uniformity concern is based on the lack of information regarding how the fill was originally placed. Without documentation, Rubino cannot make an assessment as to whether or not the fill materials between the boring are consistent with what was explored. Risk of fill settlement can be reduced if the existing fill is removed and replaced with a controlled and compacted structural fill, or if records documenting the placement and compaction of the fill can be located.

The owner may choose to accept the risk of settlement and select a shallow foundation system with a max net allowable bearing capacity of 1,000 psf.

In this case, Rubino recommends increasing reinforcing steel in concrete foundations and designing construction joints to allow for some movement.

Settlement Estimate

The loads on which this report are based are considered to be relatively light. A settlement analysis modeling the undocumented fill soils using the data obtained only from the soil borings performed for this project resulted in total and differential settlements between 0.5 inch and 1.5 inches.

Although soft or loose fill materials were not encountered in all of the borings, this does not eliminate the possibility that soft or loose pockets or layers are present between and/or beyond the borings.

Floor Slab Recommendations

Based on the site grading information provided by the client and the encountered subsurface conditions, the anticipated floor slab bearing soil is compacted and documented structural fill or undocumented fill soils that pass a proofroll as recommended herein.

Subgrade soils should be proofrolled and documented by the geotechnical engineer of record prior to placing the floor slab, or inspected and approved newly placed, properly compacted and documented structural fill which extends to original soils as described herein.

Provided that the subgrade and/or properly compacted and documented structural fill, a modulus of subgrade reaction, *k* value, of 110 pounds per cubic inch (psi/inch) may be used in the grade slab design. This value is calculated using empirical correlations based on a 1 ft. x 1 ft. plate load test. However, depending on how the slab load is applied, the value will have to be geometrically modified as outlined in the Appendix of this report

Floor slab subgrade preparation should be in accordance with the recommendations outlined in the in the Appendix of this report.

Pavement Section Recommendations

Based on the boring information in the proposed pavement areas, Rubino believes the existing soils at this site will have a subgrade pavement bearing characteristic typical of soil with an IBR value of 3. Subgrade stability should be checked during construction by performing a proofroll on the soils prior to placing subbase stone. Based on this value, it is possible to use a locally typical "standard" pavement section consisting of the following:

Recommended Minimum Thicknesses (Inches) based on a CBR of 3		
Pavement Materials	**Car Parking**	**Drive Lanes**
Asphaltic Surface Course	1 ½	1½
Asphaltic Binder Course	2 ½	3½
Base Aggregate	8	8
Or		
Portland Cement Concrete	5	6
Base Aggregate	8	8

Rigid concrete pavement is recommended where trash dumpsters or semi-trailers are to be parked on the pavement or where a considerable load is transferred from relatively small steel wheels.

- Trash dumpster pads should be at least 8-inches thick and properly reinforced.

In large areas of pavement, or where pavements are subject to significant traffic, a more detailed analysis of the subgrade and traffic conditions should be made. The results of such a study will provide information necessary to design an economical and serviceable pavement. Additional pavement considerations are located in Appendix of this report.

Pavement Drainage and Maintenance

Fine-grained soils can be sensitive to remolding in the presence of water. In the areas of surficial clays, the surface should be maintained in a graded condition to prevent standing water on the subgrade. Appropriate measures may include, but are not limited to:

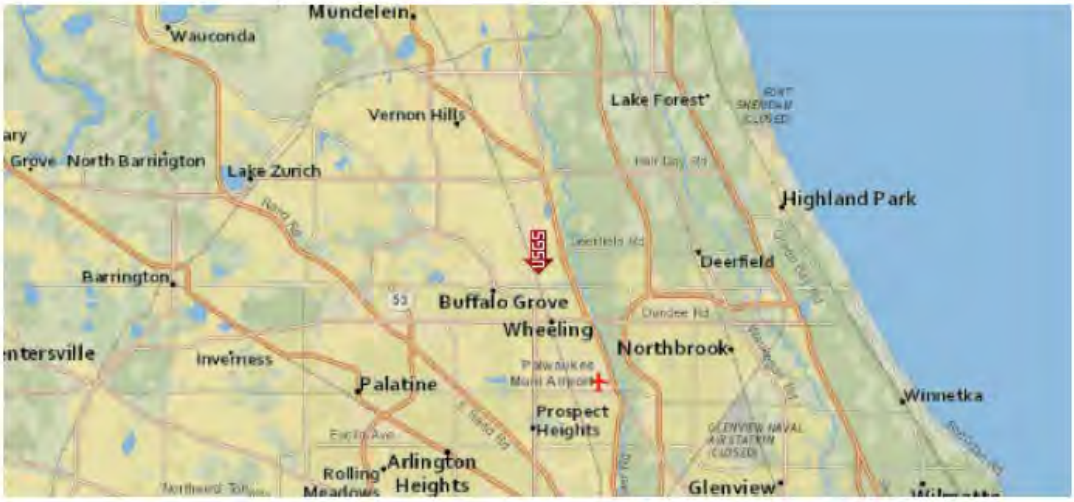
1. **Shaping/pitching the sub-grade to drain toward side drainage ditch along the pavement.**
2. Providing proper filtration for runoff waters. Proper drainage of the pavement is mandated by Article 202.05 of the IDOT Standard Specifications.
3. Rubino recommends placing CA-6 as the fill at the interface of clay and the new pavement. If open-graded stone is used, a geotextile should be placed between the fine-grained soil and the stone.
4. Rubino recommends pavements be sloped to provide rapid surface drainage. Water allowed to pond on or adjacent to the pavement could saturate the subgrade and cause premature deterioration of pavements, and removal and replacement may be required.
5. Consideration should be given to the use of an interceptor drain to collect and remove water collecting in the granular base. The interceptor drains could be incorporated with the storm drains of other utilities located in the pavement areas.

Seismicity

USGS Design Maps Summary Report

User-Specified Input

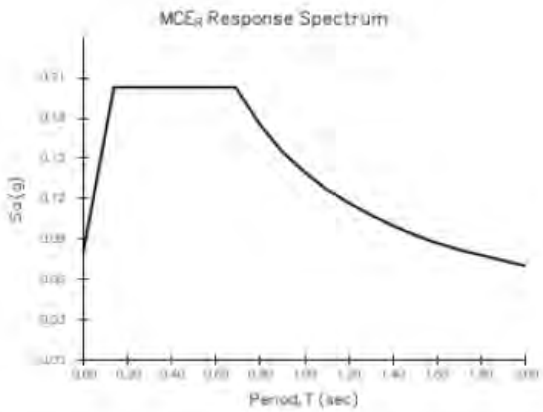
Building Code Reference Document	2012/2015 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	42.16783°N, 87.9352°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

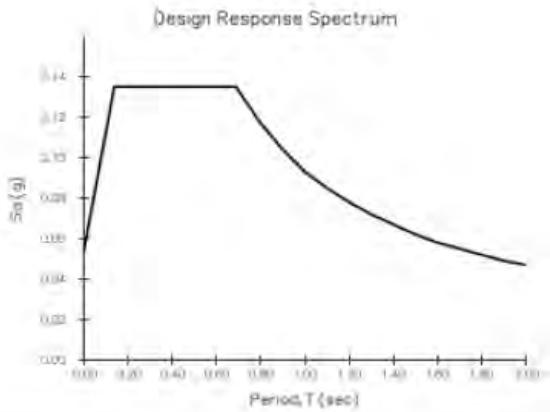


USGS-Provided Output

S_S =	0.127 g	S_{MS} =	0.203 g	S_{DS} =	0.135 g
S_1 =	0.058 g	S_{M1} =	0.140 g	S_{D1} =	0.093 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.

CLOSING

The recommendations submitted are based on the available subsurface information obtained by Rubino Engineering, Inc. and design details furnished by The Village of Buffalo Grove for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, Rubino should be notified immediately to determine if changes in the foundation recommendations are required. If Rubino is not retained to perform these functions, we will not be responsible for the impact of those conditions on the project.

The scope of services did not include an environmental assessment to determine the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater or air, on, or below or around this site. Any statements in this report and/or on the boring logs regarding odors, colors, and/or unusual or suspicious items or conditions are strictly for informational purposes.

After the plans and specifications are more complete, the geotechnical engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At this time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of the Village of Buffalo Grove and their consultants for the specific application to the Proposed CAFT Building and Parking Lot in Buffalo Grove, Illinois.

APPENDIX A - *DRILLING, FIELD, AND LABORATORY TEST PROCEDURES*

ASTM D1586 Penetration Tests and Split-Barrel Sampling of Soils

During the sampling procedure, Standard Penetration Tests (SPT's) were performed at regular intervals to obtain the standard penetration (N-value) of the soil. The results of the standard penetration test are used to estimate the relative strength and compressibility of the soil profile components through empirical correlations to the soils' relative density and consistency. The split-barrel sampler obtains a soil sample for classification purposes and laboratory testing, as appropriate for the type of soil obtained.

Water Level Measurements

Water level observations were attempted during and upon completion of the drilling operation using a 100-foot tape measure. The depths of observed water levels in the boreholes are noted on the boring logs presented in the appendix of this report. In the borings where water is unable to be observed during the field activities, in relatively impervious soils, the accurate determination of the groundwater elevation may not be possible even after several days of observation. Seasonal variations, temperature and recent rainfall conditions may influence the levels of the groundwater table and volumes of water will depend on the permeability of the soils.

Ground Surface Elevations

At this time, no site-specific elevations were available to Rubino. The depths indicated on the attached boring logs are relative to the existing ground surface for each individual boring at the time of the exploration. Copies of the boring logs are located in the Appendix of this report.

ASTM D2216 Water (Moisture) Content of Soil by Mass (Laboratory)

The water content is an important index property used in expressing the phase relationship of solids, water, and air in a given volume of material and can be used to correlate soil behavior with its index properties. In fine grained cohesive soils, the behavior of a given soil type often depends on its natural water content. The water content of a cohesive soil along with its liquid and plastic limits as determined by Atterberg Limit testing are used to express the soil's relative consistency or liquidity index.

ASTM D2974 Standard Test Method for Organic Soils using Loss on Ignition (Laboratory)

These test methods cover the measurement of moisture content, ash content, and organic matter in peats and other organic soils, such as organic clays, silts, and mucks. Ash content of a peat or organic soil sample is determined by igniting the oven-dried sample from the moisture content determination in a muffle furnace at 440°C (Method C) or 750°C (Method D). The substance remaining after ignition is the ash. The ash content is expressed as a percentage of the mass of the oven-dried sample. 2.4 Organic matter is determined by subtracting percent ash content from 100.

ASTM D4318 Atterberg Limits (Laboratory)

Atterberg limit testing defines the liquid limit (LL) and plastic limit (PL) states of a given soil. These limits are used to determine the moisture content limits where the soil characteristics changes from behaving more like a fluid on the liquid limit end to where the soil behaves more like individual soil particles on the plastic limit end. The liquid limit is often used to determine if a soil is a low or high plasticity soil.

The plasticity index (PI) is difference between the liquid limit and the plastic limit. The plasticity index is used in conjunction with the liquid limit to determine if the material will behave like a silt or clay.

ASTM D422 Particle Size Analysis (Laboratory)

The Particle Size Analysis of Soils determines the distribution of particle sizes in order to further classify the soil. The distribution of particle sizes larger than 75µm (retained on the No. 200 sieve) is determined by sieving, while the distribution of particle sizes smaller than 75µm is determined by a sedimentation process, using a hydrometer to secure the necessary data. These soils are then classified more accurately based on the distribution information.

APPENDIX B - SITE PREPARATION – CLEARING & GRUBBING

Rubino recommends that unsuitable soils or fill be removed from the site, as applicable. Unsuitable soils or fills can be described as, but are not limited to:

- organic soil / topsoil / plants / trees / shrubs / grass
- frozen soil
- existing asphalt or concrete pavement sections
- existing foundations
- building debris
- existing curbs

Stripping operations should extend a minimum of: **5** feet beyond proposed pavement limits

Exceptions: where property limits allow. Notify geotechnical engineer if there are property boundary limitations. Stripping operations should be monitored and documented by a representative of the geotechnical engineer at the time of construction.

Proofrolling:

After stripping and excavating to the proposed subgrade level, as required, the paved parking area should be proof-rolled and scarified and compacted to at least 95 percent of the standard Proctor maximum dry density ASTM D 698 for a depth of at least 8 inches below the surface during a period of dry weather.

Proofrolling Equipment:

Tandem-axle dump truck or similar rubber-tired vehicles are acceptable and should be loaded with at least 9 tons per axle.

Benefits of Proofrolling:

- Aids in providing a firm base for compaction of fill soils
- Helps to delineate soft, loose, or disturbed areas that may exist below subgrade level.

Soils which are observed to rut or deflect excessively (typically greater than 1 inch) under the moving load should either be scarified and re-compacted, or undercut and replaced.

- Scarify and re-compact to 95% with a smooth drum vibratory roller for granular soils, a sheepsfoot roller for cohesive soils or
- Undercut in 6 to 12 inch increments and replace with properly compacted and documented structural fill.
    - Clean, 3-inch stone should be worked and incorporated into soft soils to bridge soft areas due to high moisture content. The fine-grained soils should occupy the void spaces of the 3-inch stone.
    - The 3-inch stone should then be capped with a well-graded granular fill (3/4" with fines or CA-6 in Illinois) or compacted and documented fill soils as described in the Fill Placement section of the Appendix.
- The site may require another proofroll and rework when the subgrade becomes either desiccated, wet, or frozen.

APPENDIX C - *FILL RECOMMENDATIONS*

In general, fill materials should meet the following:

- Standard Proctor maximum dry density >100 pcf
- Free of organic or other deleterious materials
- Have a maximum particle size no greater than 3 inches
- Have a liquid limit <45 and plasticity index <25
- Testing should include areas at least 5 feet outside the parking area perimeters, if applicable
- Each lift of compacted, engineered fill should be tested and documented by a representative of the geotechnical engineer prior to placement of subsequent lifts
- If a fine-grained silt or clay soil is used for fill (CL or ML), close moisture content control will be essential to achieve the recommended degree of compaction
- If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying

Suitable Soil Classifications:

CL, ML, SM, SC-SM, and SW will generally be suitable for use as structural fill.

Unsuitable Soil Classifications:

OL, OH, MH, CH and PT should be considered unsuitable.

Each lift of structural fill added to the site shall be tested and documented under the supervision of a geotechnical engineer in accordance with the following table:

MATERIAL TESTED	PROCTOR TYPE*-1	MIN % DRY DENSITY	PLACEMENT MOISTURE CONTENT RANGE	FREQUENCY OF TESTING*-2	MAXIMUM LOOSE LIFT HEIGHT
Structural Fill (Cohesive & Well-graded Granular) – Building Pad	Standard	98%	-2 to +2 %	1 per 2,500 yd^2 of fill placed	8 inches
Structural Fill (Cohesive & Well-graded Granular) – Parking	Standard	98%	-2 to +3 %	1 per 2,500 yd^2 of fill placed	8 inches
Random Fill (non-load bearing)	Standard	95%	-3 to +3 %	1 per 5,000 yd^2 of fill placed	8 inches
Utility Trench Backfill	Standard	95%	-2 to +2 %	1 per 50 LF of fill placed	6 inches

*-1 The test frequency for the laboratory reference shall be one laboratory Proctor or Relative Density test for each material used on the site. If the borrow or source of fill material changes, a new reference moisture/density test should be performed.

*-2A minimum of one test per lift is recommended unless otherwise specified.

Tested fill materials that do not achieve either the required dry density or moisture content range shall be recorded, the location noted, and reported to the Contractor and Owner. A re-test of that area should be performed after the Contractor performs remedial measures. The above test frequencies should be discussed with the contractor prior to starting the work.

The geotechnical engineer of record can only certify work that was performed under their direct observation, or under the observation of a competent person under their specific direction.

APPENDIX D - *FOUNDATION CONSTRUCTION RECOMMENDATIONS*

Rubino recommends that soils at the bottom of the footing design elevation be observed, documented, and tested by a representative of Rubino prior to concrete placement to evaluate the consistency of the soils in the field with the geotechnical report findings. The remedial procedures described in the following paragraph can be used to provide suitable foundation support where unsuitable material such as soft or loose soils, existing fill, or organic soils are encountered.

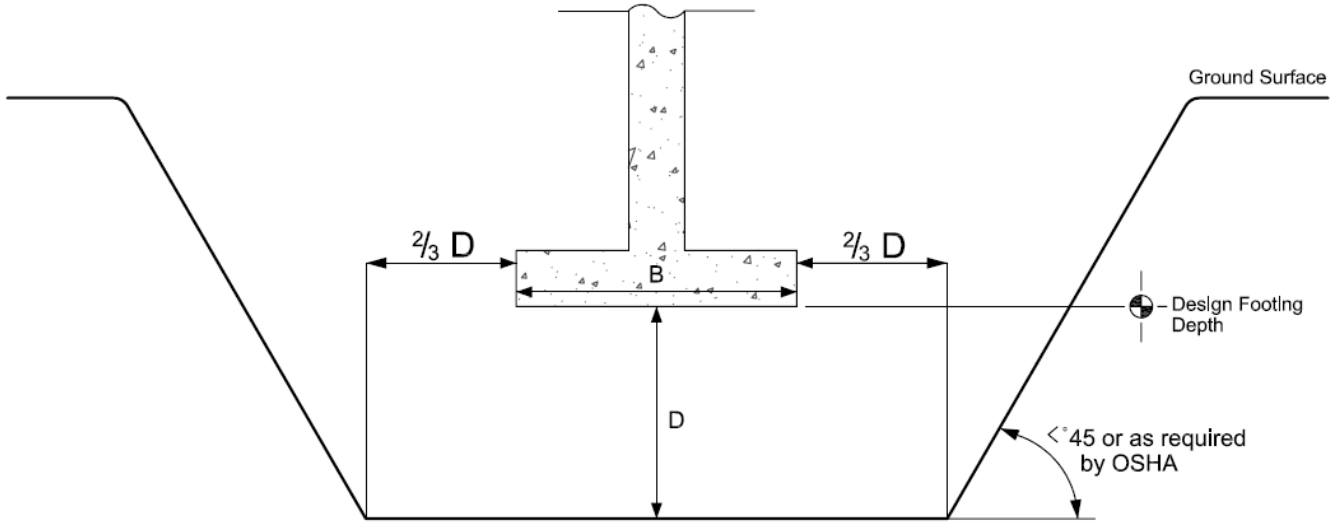
After opening, footing excavations should be observed and concrete placed as quickly as possible to avoid exposure of the footing bottoms to wetting and drying. Surface runoff water should be drained away from the excavations and not be allowed to pond. If possible, the foundation concrete should be placed during the same day the excavation is made. If it is required that footing excavations be left open for more than one day, the soils in the excavation should be protected to reduce evaporation or entry of moisture.

If unsuitable bearing soils are encountered in a footing excavation, the footing should be deepened to competent bearing soil and the footing could be lowered, or an over excavation and backfill procedure could be performed. If an over excavation and backfill procedure will be utilized, it would require widening the deepened excavation in all directions at least 8 inches beyond the edges of the footing for each 12 inches of over excavation depth (See "Over Excavation and Backfill Procedure" diagram below).

The over excavation should then be backfilled in a maximum of 8-inches thick loose lifts with suitable granular fill material, such as ¾ -inch stone with fines (CA-6), compacted to at least 98% of the maximum Standard Proctor dry density (ASTM D 698).

Another alternative is to undercut and refill the unsuitable area with flowable mortar up to the design elevation of the footings. The flowable mortar would serve as a protection to the subgrade during construction of the foundations. In this case, widening the footings is not necessary.

Over Excavation and Backfill Procedure



* Drawing not to scale

APPENDIX E - *SLAB-ON-GRADE CONSIDERATIONS*

The subgrade modulus provided in the main report should be adjusted for larger areas of loading using the following expression for cohesive and cohesionless soil:

Modulus of Subgrade Reaction, $k_s = (\frac{k}{B})$ for cohesive soil and

$$k_s = k\,(\frac{B+1}{2B})^2 \text{ for cohesionless soil}$$

where: k_s = coefficient of vertical subgrade reaction for loaded area,
k = coefficient of vertical subgrade reaction for 1x1 square foot area, and
B = width of area loaded, in feet

The precautions listed below should be followed for construction of slab-on-grade pads.

- Cracking of slab-on-grade concrete is normal and should be expected.
- Cracking can occur not only as a result of heaving or compression of the supporting soil and/or fill material, but also as a result of concrete curing stresses.
- The occurrence of concrete shrinkage cracks and problems associated with concrete curing may be reduced and/or controlled by:
  - Limiting the slump of the concrete
  - Proper concrete placement, finishing, and curing
  - The placement of crack control joints at frequent intervals, particularly where re-entrance slab corners occur.
    - The American Concrete Institute (ACI) recommends a maximum panel size (in feet) equal to approximately three times the thickness of the slab (in inches) in both directions.
- The floor slab should be independent of the foundation walls.
- Areas supporting slabs should be properly moisture conditioned and compacted. Backfill in all interior and exterior water and sewer line trenches should be carefully compacted to reduce the shear stress in the concrete extending over these areas.
- Exterior slabs should be isolated from the building. These slabs should be reinforced to function as independent units. Movement of these slabs should not be transmitted to the building foundation or superstructure.
- Rubino recommends that a minimum 4-inch thick, free-draining granular mat be placed beneath the floor slab to enhance drainage. The floor slabs should have an adequate number of joints to reduce cracking resulting from differential movement and shrinkage. Floor slabs should not be rigidly connected to columns, walls, or foundations.
- A vapor retarder should be considered in areas of tile, carpet, or other moisture sensitive floor finishes. Appropriate curing procedures should be followed to reduce the risk of slab “curling” if a vapor retarder is used.

These details will not reduce the amount of movement, but are intended to reduce potential damage should some settlement of the supporting subgrade take place. Some increase in moisture content in the floor slab is inevitable as a result of development and associated landscaping. However, extreme moisture content increases can be largely controlled by proper and responsible site drainage, building maintenance and irrigation practices.

Appendix F – *Pavement Considerations*

Pavement Design Criteria

Pavement sections were evaluated using Pavement Assessment Software (PAS) which is based on the 1993 AASHTO Design equations; a reliability of 80%; and a 20-year 18-kip single axle load (ESAL) of 30,000 for light duty and 60,000 for drive areas.

Flexible Pavements were evaluated based on an initial serviceability of 4.2 and a terminal service of 2.0.

Rigid Pavements were evaluated based on an initial serviceability of 4.5 and a terminal service of 2.0; an unreinforced concrete mix with a 28 day modulus of rupture of 550 psi.

Pavement Drainage & Maintenance

Rubino recommends pavements be sloped to provide rapid surface drainage. Water allowed to pond on or adjacent to the pavement could saturate the subgrade and cause premature deterioration of pavements. In this case, removal and replacement may be required.

Consideration should be given to the use of an interceptor drain to remove water collecting in the granular base. The interceptor drains could be incorporated with the storm drains of other utilities located in the pavement areas.

Periodic maintenance of the pavement should be anticipated. This should include sealing of cracks and joints and maintenance of proper surface drainage to avoid ponding of water on or near the pavement area.

Asphalt Pavement Planning Guidelines	***Concrete Pavement Planning Guidelines***
The granular base course should be built at least 2 feet wider than the pavement on each side to support the tracks of the slipform paver. This extra width is structurally beneficial for wheel loads applied at pavement edge. The asphalt base course should comply with **IL-19.0L N-50** binder and be compacted to a minimum of 93.0% of the Maximum Theoretical Density as determined by ASTM D2041. Asphaltic surface mixture should comply with **IL-9.5L N-50** surface and be compacted to a minimum of 92.5% of the Maximum Theoretical Density as determined by ASTM D2041. Asphaltic concrete mix designs should be reviewed to determine if they are consistent with the recommendations given in this report.	Because the pavement at this site will be subjected to freeze-thaw cycles, Rubino recommends that an air entrainment admixture be added to the concrete mix to achieve an air content in the range of 5% to 7% to provide freeze-thaw durability in the concrete. Concrete with a 28-day specified compressive strength of 4,000 psi is typically adequate. Pavement for the dumpster area should be planned to be constructed of Portland cement concrete with load transfer device installed where construction joints are required. A thickened edge is recommended on the outside of slabs subjected to wheel loads. This thickened edge usually takes the form of an integral curb. Fill material should be compacted behind the curb or thicken edge of the outside slabs.

Pavement may be placed after the subgrade has been properly compacted, fine graded and proofrolled. The work should be done in accordance with State Department of Transportation guidelines. Pavement materials should conform to local and state guidelines, if applicable.

APPENDIX G - *REPORT LIMITATIONS*

Subsurface Conditions:

The subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in the appendix should be reviewed for specific information at individual boring locations. These records include soil descriptions, stratifications, penetration resistances, locations of the samples and laboratory test data as well as water level information. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur, and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition between layers may be gradual. The samples, which were not altered by laboratory testing, will be retained for up to 60 days from the date of this report and then will be discarded.

Geotechnical Risk:

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools that geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free, and more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The engineering recommendations, presented in the preceding section, constitute Rubino's professional estimate of the necessary measures for the proposed structure to perform according to the proposed design based on the information generated and reference during this evaluation, and Rubino's experience in working with these conditions.

Warranty:

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

Federal Excavation Regulations:

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better insure the safety of workmen entering trenches or excavations. This federal regulation mandates that all excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person," as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. Rubino is providing this information solely as a service to our client. Rubino is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

APPENDIX H - *SOIL CLASSIFICATION GENERAL NOTES*

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1 3/8" I.D., 2" O.D., unless otherwise noted	PS:	Piston Sample
ST:	Thin-Walled Tube - 3" O.D., Unless otherwise noted	WS:	Wash Sample
PM:	Pressuremeter	HA:	Hand Auger
RB:	Rock Bit	HS:	Hollow Stem Auger
DB:	Diamond Bit - 4", N, B	BS:	Bulk Sample

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler (SS), except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:
Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of ground water levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATION:
Soil Classification is based on the Unified Soil Classification System as defined in ASTM D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS:

Unconfined Compressive Strength, Qu (tsf)			N-Blows/ft.			Consistency
	<	0.25	< 2			Very Soft
0.25	-	0.5	2	-	4	Soft
0.5	-	1	4	-	8	Medium Stiff
1	-	2	8	-	15	Stiff
2	-	4	15	-	30	Very Stiff
4	-	8	30	-	50	Hard
>	-	8	> 50			Very Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

N-Blows/ft.			Relative Density
0	-	3	Very Loose
4	-	9	Loose
10	-	29	Medium Dense
30	-	49	Dense
50	-	80	Very Dense
		80+	Extremely Dense

RELATIVE PROPORTIONS OF SAND & GRAVEL

Descriptive Term	% of Dry Weight		
Trace		<	15
With	15	-	29
Modifier		>	30

RELATIVE PROPORTIONS OF FINES

Descriptive Term	% of Dry Weight		
Trace		<	5
With	5	-	12
Modifier		>	12

*Descriptive Terms apply to components also present in sample

GRAIN SIZE TERMINOLOGY

Major Component	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. To 3 in. (300mm to 75mm)
Gravel	3 in. To #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75mm to 0.75mm)

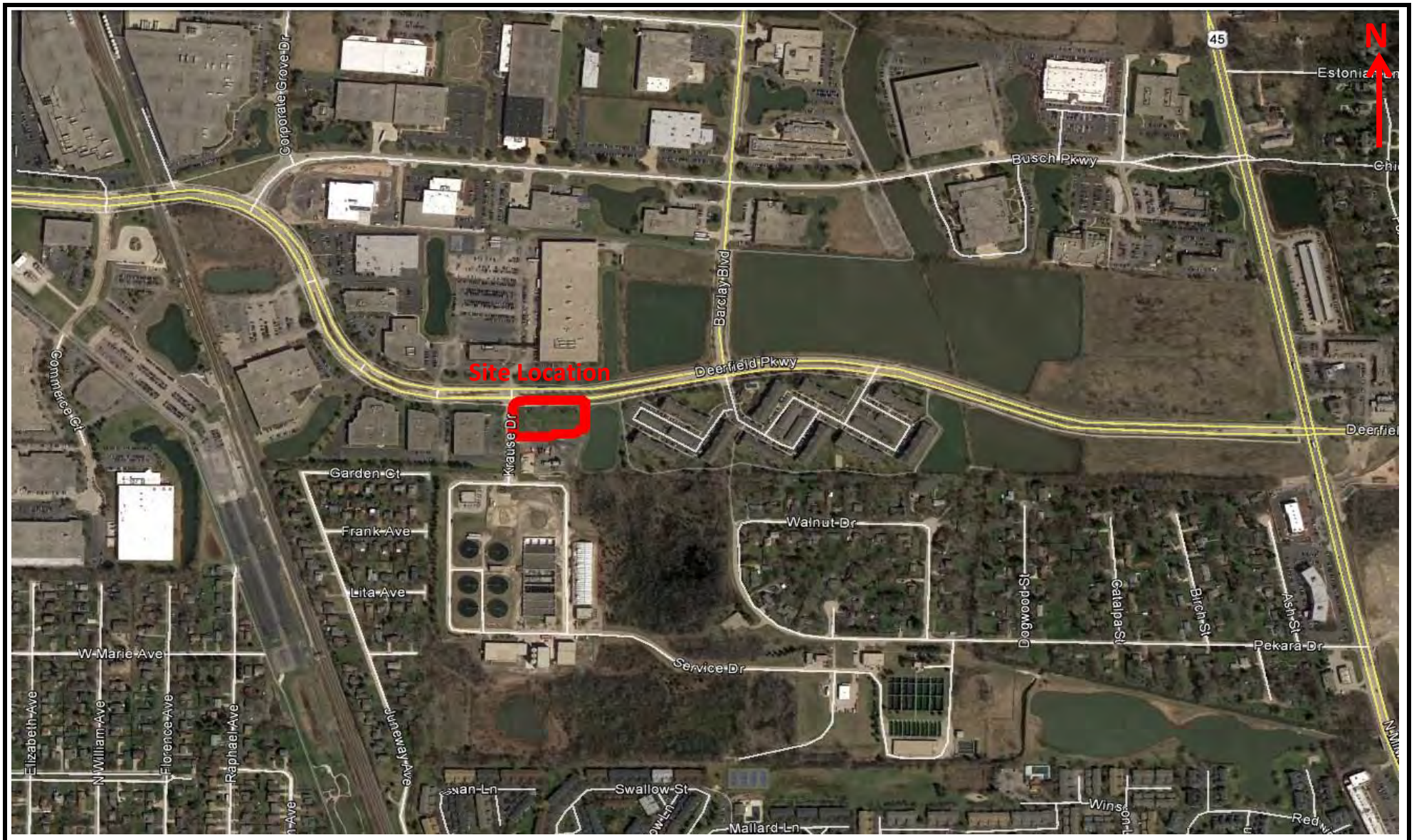
APPENDIX I - *SOIL CLASSIFICATION CHART*

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

APPENDIX J – *SITE VICINITY MAP & BORING LOCATION PLAN*



rubino
ENGINEERING INC.

665 Tollgate Rd. Unit H
Elgin, Illinois 60123

Project Name:	Proposed CAFT Building and Parking Lot
Project Location:	SEC of Deerfield Parkway and Krause Drive Buffalo Grove, Illinois
Client:	Village of Buffalo Grove
Rubino Project # :	G17.0097

Site Vicinity Map

rubino ENGINEERING INC.

665 Tollgate Rd. Unit H
Elgin, Illinois 60123

Project Name:	Proposed CAFT Building and Parking Lot
Project Location:	SEC of Deerfield Parkway and Krause Drive Buffalo Grove, Illinois
Client:	Village of Buffalo Grove
Rubino Project # :	G17.0097

Boring Location Plan

APPENDIX K – *BORING LOGS*

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-01

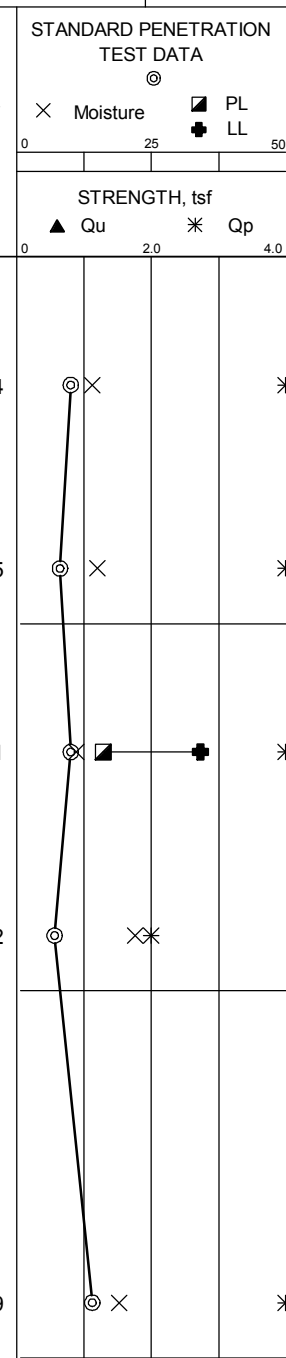
Rubino Job No.:	G17.097	Drilling Method:	3 ¼" Hollow Stem Auger
Project:	Proposed CAFT Building and Parking Lot	Sampling Method:	Split Spoon
Location:	SEC of Deefield Parkway and Krause Drive	Hammer Type:	Automatic
City, State:	Buffalo Grove, Illinois	Boring Location:	Proposed CAFT Building
Client:	Village of Buffalo Grove		Buffalo Grove, Illinois

WATER LEVELS

While Drilling	N/A FT
Upon Completion	N/A FT
Delay	N/A FT

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 3 inches of TOPSOIL				
						Brown and gray mottled with black silty CLAY, trace sand and gravel, oxidation staining; Medium stiff to stiff (Possible fill)				
				1	16			4,5,5 N=10	14	Qp=4.0 tsf
				2	10			3,4,4 N=8	15	Qp=4.0 tsf
	5									
				3	18		CL	2,4,6 N=10	11	Qp=4.0 tsf LL = 34 PL = 16
				4	16			2,3,4 N=7	22	Qp=2.0 tsf
	10									
				5	18			2,6,8 N=14	19	Qp=4.0 tsf
	15					End of boring at approximately 15 feet below existing grade. No free groundwater encountered during drilling operations.				



Completion Depth:	15.0 ft
Date Boring Started:	6/1/17
Date Boring Completed:	6/1/17
Logged By:	J.W.
Drilling Contractor:	Rubino Engineerng, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude: 42.167889°
Longitude: -87.935421°
Drill Rig: Geoprobe 7822DT
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-02

Rubino Job No.:	G17.097	Drilling Method:	3 ¼" Hollow Stem Auger
Project:	Proposed CAFT Building and Parking Lot	Sampling Method:	Split Spoon
Location:	SEC of Deefield Parkway and Krause Drive	Hammer Type:	Automatic
City, State:	Buffalo Grove, Illinois	Boring Location:	Proposed CAFT Building
Client:	Village of Buffalo Grove		Buffalo Grove, Illinois

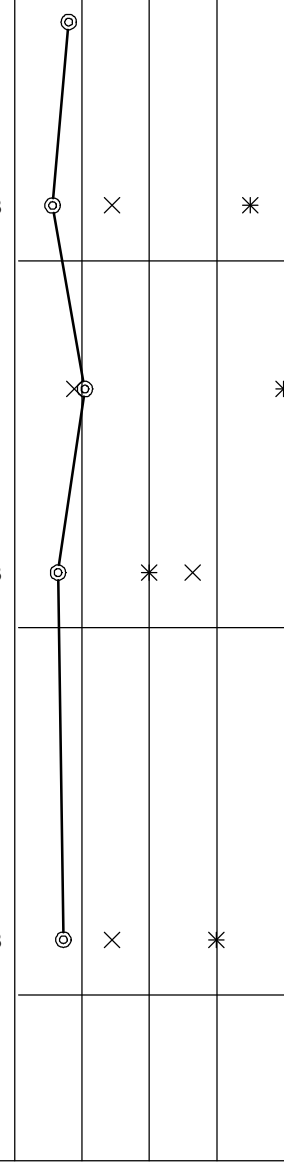
WATER LEVELS

While Drilling	N/A FT
Upon Completion	N/A FT
Delay	N/A FT

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 3 inches of TOPSOIL				
						Brown and gray mottled with black silty CLAY, trace sand and gravel, oxidation staining; Medium stiff to stiff (Possible fill)				
				1	0			6,4,6 N=10		
				2	4		CL	3,3,4 N=7	18	Qp=3.5 tsf
	5									
				3	16			3,5,8 N=13	11	Qp=4.0 tsf
				4	16			3,3,5 N=8	33	Qp=2.0 tsf 9% Organic Content
	10					Black silty CLAY, trace sand and gravel; Medium stiff to stiff (Possible fill)	CL			
				5	16	Brown and gray silty CLAY, trace sand and gravel; Stiff (Possible fill)	CL	3,4,5 N=9	18	Qp=3.0 tsf
	15					End of boring at approximately 15 feet below existing grade. No free groundwater encountered during drilling operations.				

STANDARD PENETRATION TEST DATA
Moisture, PL, LL (0, 25, 50)
STRENGTH, tsf
Qu, Qp (0, 2.0, 4.0)



Completion Depth:	15.0 ft	Sample Types:	Latitude: 42.167757°
Date Boring Started:	6/1/17	Auger Cutting, Shelby Tube	Longitude: -87.935419°
Date Boring Completed:	6/1/17	Split-Spoon, Hand Auger	Drill Rig: Geoprobe 7822DT
Logged By:	J.W.	Rock Core, Texas Cone	Remarks:
Drilling Contractor:	Rubino Engineerng, Inc.		

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

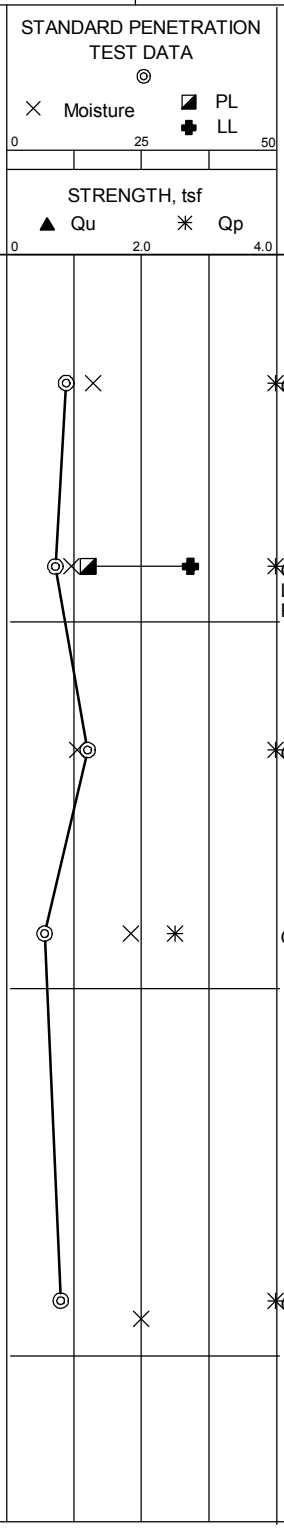
LOG OF BORING B-03

Rubino Job No.:	G17.097	Drilling Method:	3 ¼" Hollow Stem Auger
Project:	Proposed CAFT Building and Parking Lot	Sampling Method:	Split Spoon
Location:	SEC of Deefield Parkway and Krause Drive	Hammer Type:	Automatic
City, State:	Buffalo Grove, Illinois	Boring Location:	Proposed CAFT Building, Buffalo Grove, Illinois
Client:	Village of Buffalo Grove		

WATER LEVELS	
While Drilling	N/A FT
Upon Completion	N/A FT
Delay	N/A FT

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 3 inches of TOPSOIL				
				1	16	Brown and gray mottled with black silty CLAY, trace sand and gravel, oxidation staining; Medium stiff to very stiff (Possible fill)	CL	4,6,5 N=11	16	Qp=4.0 tsf
				2	14			1,3,6 N=9	12	Qp=4.0 tsf LL = 34 PL = 15
	5			3	14			4,7,8 N=15	13	Qp=4.0 tsf
				4	14			2,3,4 N=7	23	Qp=2.5 tsf
	10									
				6	16			2,4,6 N=10	25	Qp=4.0 tsf
	15					End of boring at approximately 15 feet below existing grade. No free groundwater encountered during drilling operations.				



Completion Depth:	15.0 ft
Date Boring Started:	6/1/17
Date Boring Completed:	6/1/17
Logged By:	J.W.
Drilling Contractor:	Rubino Engineerng, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude: 42.167828°
Longitude: -87.935199°
Drill Rig: Geoprobe 7822DT
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-04

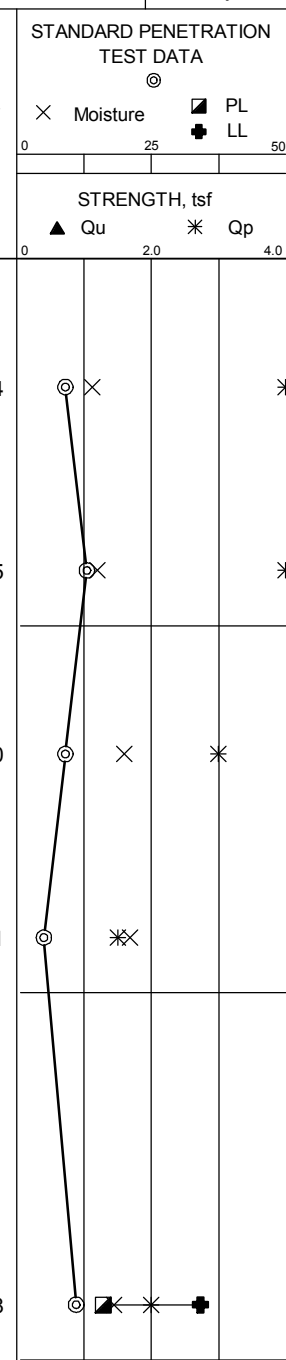
Rubino Job No.:	G17.097	Drilling Method:	3 ¼" Hollow Stem Auger
Project:	Proposed CAFT Building and Parking Lot	Sampling Method:	Split Spoon
Location:	SEC of Deefield Parkway and Krause Drive	Hammer Type:	Automatic
City, State:	Buffalo Grove, Illinois	Boring Location:	Proposed CAFT Building
Client:	Village of Buffalo Grove		Buffalo Grove, Illinois

WATER LEVELS

While Drilling	N/A FT
Upon Completion	N/A FT
Delay	N/A FT

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 3 inches of TOPSOIL				
						Brown and gray mottled with black silty CLAY, trace sand and gravel, oxidation staining; Medium stiff to stiff (Possible fill)				
				1	14			4,4,5 N=9	14	Qp=4.0 tsf
				2	16			4,7,6 N=13	15	Qp=4.0 tsf
	5									
				3	14			5,4,5 N=9	20	Qp=3.0 tsf
							CL			
				4	16			2,2,3 N=5	21	Qp=1.5 tsf
	10									
				5	12			2,5,6 N=11	18	Qp=2.0 tsf LL = 34 PL = 16
	15					End of boring at approximately 15 feet below existing grade. No free groundwater encountered during drilling operations.				



Completion Depth:	15.0 ft
Date Boring Started:	6/1/17
Date Boring Completed:	6/1/17
Logged By:	J.W.
Drilling Contractor:	Rubino Engineerng, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude: 42.167893°
Longitude: -87.934972°
Drill Rig: Geoprobe 7822DT
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-05

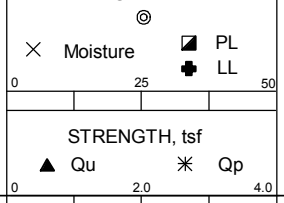
Rubino Job No.:	G17.097	Drilling Method:	3 ¼" Hollow Stem Auger
Project:	Proposed CAFT Building and Parking Lot	Sampling Method:	Split Spoon
Location:	SEC of Deefield Parkway and Krause Drive	Hammer Type:	Automatic
City, State:	Buffalo Grove, Illinois	Boring Location:	Proposed CAFT Building, Buffalo Grove, Illinois
Client:	Village of Buffalo Grove		

WATER LEVELS

While Drilling	13 FT
Upon Completion	12 FT
Delay	N/A FT

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 3 inches of TOPSOIL				
				1	12	Brown and gray mottled with black silty CLAY, trace sand and gravel, oxidation staining; Medium stiff to stiff (Possible fill)		4,4,6 N=10	13	Qp=2.5 tsf
				2	14			5,6,7 N=13	12	Qp=4.0 tsf
	5			3	14		CL	2,3,3 N=6	21	Qp=1.5 tsf
				4	18			3,6,7 N=13	18	Qp=4.0 tsf
	10									
				5	6			3,5,5 N=10	18	Qp=2.0 tsf
	15					End of boring at approximately 15 feet below existing grade.				



Completion Depth:	15.0 ft
Date Boring Started:	6/1/17
Date Boring Completed:	6/1/17
Logged By:	J.W.
Drilling Contractor:	Rubino Engineerng, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude: 42.167757°
Longitude: -87.934972°
Drill Rig: Geoprobe 7822DT
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING P-01

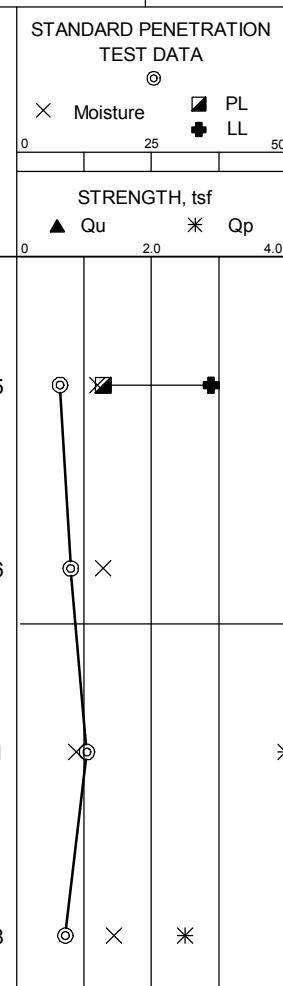
Rubino Job No.:	G17.097	Drilling Method:	3 ¼" Hollow Stem Auger
Project:	Proposed CAFT Building and Parking Lot	Sampling Method:	Split Spoon
Location:	SEC of Deefield Parkway and Krause Drive	Hammer Type:	Automatic
City, State:	Buffalo Grove, Illinois	Boring Location:	Proposed Parking Lot
Client:	Village of Buffalo Grove		Buffalo Grove, Illinois

WATER LEVELS

While Drilling	N/A FT
Upon Completion	N/A FT
Delay	N/A FT

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					UNDOCUMENTED FILL: Black, brown and gray silty clay with sand and gravel				
				1	2			4,3,5 N=8	15	LL = 36 PL = 16
				2	14			3,5,5 N=10	16	
	5									
				3	12	Brown and gray silty CLAY, trace sand and gravel; Stiff (Possible fill)	CL	5,6,7 N=13	11	Qp=4.0 tsf
				4	14			3,4,5 N=9	18	Qp=2.5 tsf
	10					End of boring at approximately 10 feet below existing grade. No free groundwater encountered during drilling operations.				



Completion Depth:	10.0 ft
Date Boring Started:	6/1/17
Date Boring Completed:	6/1/17
Logged By:	J.W.
Drilling Contractor:	Rubino Engineerng, Inc.

Sample Types:
- Auger Cutting
- Split-Spoon
- Rock Core
- Shelby Tube
- Hand Auger
- Texas Cone

Latitude: 42.167824°
Longitude: -87.935608°
Drill Rig: Geoprobe 7822DT
Remarks: Boring performed in reported demolition area of previously existing building

The stratification lines represent approximate boundaries. The transition may be gradual.

Rubino Engineering, Inc.
665 Tollgate Road, Unit H
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING P-02

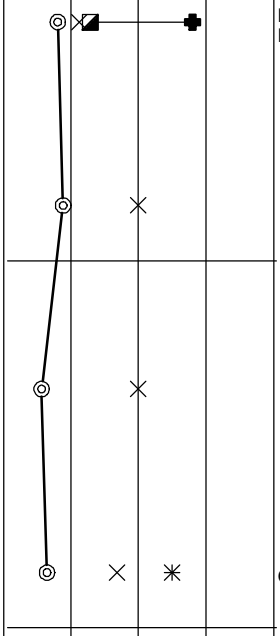
Rubino Job No.:	G17.097	Drilling Method:	3 ¼" Hollow Stem Auger
Project:	Proposed CAFT Building and Parking Lot	Sampling Method:	Split Spoon
Location:	SEC of Deefield Parkway and Krause Drive	Hammer Type:	Automatic
City, State:	Buffalo Grove, Illinois	Boring Location:	Proposed Parking Lot Buffalo Grove, Illinois
Client:	Village of Buffalo Grove		

WATER LEVELS	
While Drilling	N/A FT
Upon Completion	N/A FT
Delay	N/A FT

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Approximately 8 inches of TOPSOIL				
						UNDOCUMENTED FILL: Black, brown and gray silty clay with sand and gravel				
				1	3			3,4,6 N=10	14	LL = 35 PL = 16
				2	16			2,2,9 N=11	25	
	5									
				3	16			2,3,4 N=7	25	
				4	14	Brown and gray silty CLAY, trace sand and gravel; Medium stiff to stiff (Possible fill)	CL	2,3,5 N=8	21	Qp=2.5 tsf
	10					End of boring at approximately 10 feet below existing grade. No free groundwater encountered during drilling operations.				

STANDARD PENETRATION TEST DATA
Moisture (0 – 25 – 50); PL; LL
STRENGTH, tsf: Qu; Qp (0 – 2.0 – 4.0)



Completion Depth:	10.0 ft
Date Boring Started:	6/1/17
Date Boring Completed:	6/1/17
Logged By:	J.W.
Drilling Contractor:	Rubino Engineerng, Inc.

Sample Types: Auger Cutting; Split-Spoon; Rock Core; Shelby Tube; Hand Auger; Texas Cone

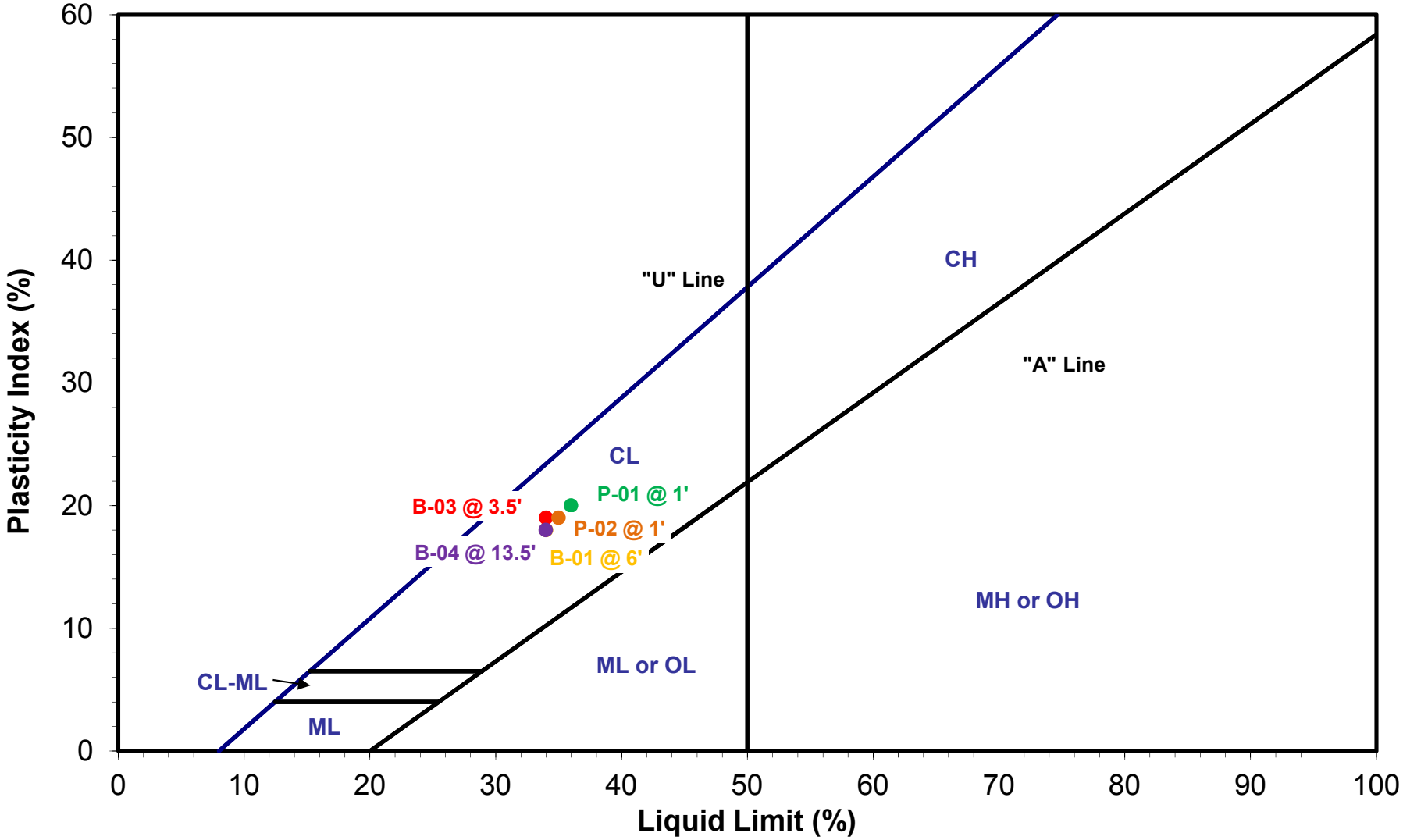
Latitude: 42.167686°
Longitude: -87.935605°
Drill Rig: Geoprobe 7822DT
Remarks: Boring performed in reported demolition area of previously existing building

The stratification lines represent approximate boundaries. The transition may be gradual.

APPENDIX L – *LABORATORY RESULTS*

rubino ENGINEERING INC.

Report of Atterberg Limits Test (ASTM D4318 / AASHTO T89 / AASHTO T90)



Boring #	B-01 @ 6'	B-03 @ 3.5'	B-04 @ 13.5'	P-01 @ 1'	P-02 @ 1'
LL	34	34	34	36	35
PL	16	15	16	16	16
PI	18	19	18	20	19

Project: Propsoed CFTA Building and Parking Lot
Location: Buffalo Grove, Illinois
Client: The Village of Buffalo Grove
Project #: G17.097

SECTION 00 73 43

PREVAILING WAGES

Illinois Department of Labor (IDOL) Prevailing Wages for Lake County with an effective date of September 1, 2017 is attached after this section.

END OF SECTION 00 73 43

Prevailing Wage rates for Lake County effective Sept. 1, 2017												
Trade Title	**Region**	**Type**	**Class**	**Base Wage**	**Fore-man Wage**	**M-F OT**	**OSA**	**OSH**	**H/W**	**Pension**	**Vacation**	**Training**
ASBESTOS ABT-GEN	ALL	ALL		41.20	42.20	1.5	1.5	2	14.65	12.32	0.00	0.50
ASBESTOS ABT-MEC	ALL	BLD		37.46	39.96	1.5	1.5	2	11.62	11.06	0.00	0.72
BOILERMAKER	ALL	BLD		48.49	52.86	2	2	2	6.97	19.61	0.00	0.90
BRICK MASON	ALL	BLD		45.38	49.92	1.5	1.5	2	10.45	16.68	0.00	0.90
CARPENTER	ALL	ALL		46.35	48.35	1.5	1.5	2	11.79	18.87	0.00	0.63
CEMENT MASON	ALL	ALL		44.98	46.98	2	1.5	2	10.00	20.88	0.00	0.50
CERAMIC TILE FNSHER	ALL	BLD		38.56	38.56	1.5	1.5	2	10.65	11.18	0.00	0.68
COMMUNICATION TECH	ALL	BLD		36.54	38.94	1.5	1.5	2	11.72	13.23	2.17	0.55
ELECTRIC PWR EQMT OP	ALL	ALL		0.00	0.00	0	0	0	0.00	0.00	0.00	0.00
ELECTRIC PWR EQMT OP	ALL	HWY		41.45	56.38	1.5	1.5	2	5.50	12.87	0.00	0.73
ELECTRIC PWR GRNDMAN	ALL	ALL		30.33	53.29	1.5	1.5	2	5.00	9.40	0.00	0.30
ELECTRIC PWR GRNDMAN	ALL	HWY		32.00	56.38	1.5	1.5	2	5.50	9.92	0.00	0.66
ELECTRIC PWR LINEMAN	ALL	ALL		45.36	51.48	1.5	1.5	2	5.00	14.06	0.00	0.45
ELECTRIC PWR LINEMAN	ALL	HWY		49.67	56.38	1.5	1.5	2	5.50	15.40	0.00	0.88
ELECTRIC PWR TRK DRV	ALL	ALL		30.34	51.48	1.5	1.5	2	5.00	9.40	0.00	0.30
ELECTRIC PWR TRK DRV	ALL	HWY		33.14	56.38	1.5	1.5	2	5.50	10.29	0.00	0.59
ELECTRICIAN	ALL	BLD		40.00	44.00	1.5	1.5	2	14.10	19.74	4.00	0.65
ELEVATOR CONSTRUCTOR	ALL	BLD		51.94	58.43	2	2	2	14.43	14.96	4.16	0.90
FENCE ERECTOR	ALL	ALL		39.58	41.58	1.5	1.5	2	13.40	13.90	0.00	0.40
GLAZIER	ALL	BLD		42.45	43.95	1.5	1.5	2	14.04	20.14	0.00	0.94
HT/FROST INSULATOR	ALL	BLD		50.50	53.00	1.5	1.5	2	12.12	12.96	0.00	0.72
IRON WORKER	ALL	ALL		47.33	49.33	2	2	2	14.15	22.39	0.00	0.35
LABORER	ALL	ALL		41.20	41.95	1.5	1.5	2	14.65	12.32	0.00	0.50
LATHER	ALL	ALL		46.35	48.35	1.5	1.5	2	11.79	18.87	0.00	0.63
MACHINIST	ALL	BLD		45.35	47.85	1.5	1.5	2	7.26	8.95	1.85	0.00

MARBLE FINISHERS	ALL	ALL		33.95	33.95	1.5	1.5	2	10.45	15.52	0.00	0.47
MARBLE MASON	ALL	BLD		44.63	49.09	1.5	1.5	2	10.45	16.28	0.00	0.59
MATERIAL TESTER I	ALL	ALL		31.20	31.20	1.5	1.5	2	14.65	12.32	0.00	0.50
MATERIALS TESTER II	ALL	ALL		36.20	36.20	1.5	1.5	2	14.65	12.32	0.00	0.50
MILLWRIGHT	ALL	ALL		46.35	48.35	1.5	1.5	2	11.79	18.87	0.00	0.63
OPERATING ENGINEER	ALL	BLD	1	50.10	54.10	2	2	2	18.80	14.35	2.00	1.30
OPERATING ENGINEER	ALL	BLD	2	48.80	54.10	2	2	2	18.80	14.35	2.00	1.30
OPERATING ENGINEER	ALL	BLD	3	46.25	54.10	2	2	2	18.80	14.35	2.00	1.30
OPERATING ENGINEER	ALL	BLD	4	44.50	54.10	2	2	2	18.80	14.35	2.00	1.30
OPERATING ENGINEER	ALL	BLD	5	53.85	54.10	2	2	2	18.80	14.35	2.00	1.30
OPERATING ENGINEER	ALL	BLD	6	51.10	54.10	2	2	2	18.80	14.35	2.00	1.30
OPERATING ENGINEER	ALL	BLD	7	53.10	54.10	2	2	2	18.80	14.35	2.00	1.30
OPERATING ENGINEER	ALL	FLT	1	55.90	55.90	1.5	1.5	2	18.05	13.60	1.90	1.30
OPERATING ENGINEER	ALL	FLT	2	54.40	55.90	1.5	1.5	2	18.05	13.60	1.90	1.30
OPERATING ENGINEER	ALL	FLT	3	48.40	55.90	1.5	1.5	2	18.05	13.60	1.90	1.30
OPERATING ENGINEER	ALL	FLT	4	40.25	55.90	1.5	1.5	2	18.05	13.60	1.90	1.30
OPERATING ENGINEER	ALL	FLT	5	57.40	55.90	1.5	1.5	2	18.05	13.60	1.90	1.30
OPERATING ENGINEER	ALL	FLT	6	38.00	55.90	1.5	1.5	2	18.05	13.60	1.90	1.30
OPERATING ENGINEER	ALL	HWY	1	48.30	52.30	1.5	1.5	2	18.80	14.35	2.00	1.30
OPERATING ENGINEER	ALL	HWY	2	47.75	52.30	1.5	1.5	2	18.80	14.35	2.00	1.30
OPERATING ENGINEER	ALL	HWY	3	45.70	52.30	1.5	1.5	2	18.80	14.35	2.00	1.30
OPERATING ENGINEER	ALL	HWY	4	44.30	52.30	1.5	1.5	2	18.80	14.35	2.00	1.30
OPERATING ENGINEER	ALL	HWY	5	43.10	52.30	1.5	1.5	2	18.80	14.35	2.00	1.30
OPERATING ENGINEER	ALL	HWY	6	51.30	52.30	1.5	1.5	2	18.80	14.35	2.00	1.30
OPERATING ENGINEER	ALL	HWY	7	49.30	52.30	1.5	1.5	2	18.80	14.35	2.00	1.30
ORNAMNTL IRON WORKER	ALL	ALL		46.75	49.25	2	2	2	13.90	19.79	0.00	0.75
PAINTER	ALL	ALL		45.55	51.24	1.5	1.5	1.5	11.56	11.44	0.00	1.87
PAINTER SIGNS	ALL	BLD		37.45	42.05	1.5	1.5	2	2.60	3.18	0.00	0.00
PILEDRIVER	ALL	ALL		46.35	48.35	1.5	1.5	2	11.79	18.87	0.00	0.63
PIPEFITTER	ALL	BLD		47.50	50.50	1.5	1.5	2	10.05	17.85	0.00	2.12

PLASTERER	ALL	BLD		44.85	44.85	2	1.5	2	10.00	21.18	0.00	0.50
PLUMBER	ALL	BLD		49.25	52.20	1.5	1.5	2	14.34	13.35	0.00	1.28
ROOFER	ALL	BLD		42.30	45.30	1.5	1.5	2	9.08	12.14	0.00	0.58
SHEETMETAL WORKER	ALL	BLD		43.50	46.98	1.5	1.5	2	11.03	23.43	0.00	0.78
SIGN HANGER	ALL	BLD		31.31	33.81	1.5	1.5	2	4.85	3.28	0.00	0.00
SPRINKLER FITTER	ALL	BLD		47.20	49.20	1.5	1.5	2	12.25	11.55	0.00	0.55
STEEL ERECTOR	ALL	ALL		42.07	44.07	2	2	2	13.45	19.59	0.00	0.35
STONE MASON	ALL	BLD		45.38	49.92	1.5	1.5	2	10.45	16.68	0.00	0.90
TERRAZZO FINISHER	ALL	BLD		40.54	40.54	1.5	1.5	2	10.65	12.76	0.00	0.73
TERRAZZO MASON	ALL	BLD		44.38	47.88	1.5	1.5	2	10.65	14.15	0.00	0.82
TILE MASON	ALL	BLD		45.49	49.49	1.5	1.5	2	10.65	13.88	0.00	0.86
TRAFFIC SAFETY WRKR	ALL	HWY		32.75	34.35	1.5	1.5	2	8.45	6.05	0.00	0.50
TRUCK DRIVER	ALL	ALL	1	37.05	37.60	1.5	1.5	2	9.50	7.50	0.00	0.15
TRUCK DRIVER	ALL	ALL	2	37.20	37.60	1.5	1.5	2	9.50	7.50	0.00	0.15
TRUCK DRIVER	ALL	ALL	3	37.40	37.60	1.5	1.5	2	9.50	7.50	0.00	0.15
TRUCK DRIVER	ALL	ALL	4	37.60	37.60	1.5	1.5	2	9.50	7.50	0.00	0.15
TUCKPOINTER	ALL	BLD		45.42	46.42	1.5	1.5	2	8.32	15.42	0.00	0.80

Legend

M-F OT Unless otherwise noted, OT pay is required for any hour greater than 8 worked each day, Mon through Fri. The number listed is the multiple of the base wage.

OSA Overtime pay required for every hour worked on Saturdays

OSH Overtime pay required for every hour worked on Sundays and Holidays

H/W Health/Welfare benefit

Explanations LAKE COUNTY

The following list is considered as those days for which holiday rates of wages for work performed apply: New Years Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Christmas Day and Veterans Day in some classifications/counties. Generally, any of these holidays which fall on a Sunday is celebrated on the following Monday. This then makes work performed on that Monday payable at the appropriate overtime rate for holiday pay. Common practice in a given local may alter certain days of celebration. If in doubt, please check with IDOL.

EXPLANATION OF CLASSES

ASBESTOS - GENERAL - removal of asbestos material/mold and hazardous materials from any place in a building, including mechanical systems where those mechanical systems are to be removed. This includes the removal of asbestos materials/mold and hazardous materials from ductwork or pipes in a building when the building is to be demolished at the time or at some close future date.

ASBESTOS - MECHANICAL - removal of asbestos material from mechanical systems, such as pipes, ducts, and boilers, where the mechanical systems are to remain.

CERAMIC TILE FINISHER

The grouting, cleaning, and polishing of all classes of tile, whether for interior or exterior purposes, all burned, glazed or unglazed products; all composition materials, granite tiles, warning detectable tiles, cement tiles, epoxy composite materials, pavers, glass, mosaics, fiberglass, and all substitute materials, for tile made in tile-like units; all mixtures in tile like form of cement, metals, and other materials that are for and intended for use as a finished floor surface, stair treads, promenade roofs, walks, walls, ceilings, swimming pools, and all other places where tile is to form a finished interior or exterior. The mixing of all setting mortars including but not limited to thin-set mortars, epoxies, wall mud, and any other sand and cement mixtures or adhesives when used in the preparation, installation, repair, or maintenance of tile and/or similar materials. The handling and unloading of all sand, cement, lime, tile, fixtures, equipment, adhesives, or any other materials to be used in the preparation, installation, repair, or maintenance of tile and/or similar materials. Ceramic Tile Finishers shall fill all joints and voids regardless of method on all tile work, particularly and especially after installation of said tile work. Application of any and all protective coverings to all types of tile installations including, but not be limited to, all soap compounds, paper products, tapes, and all polyethylene coverings, plywood, masonite, cardboard, and any new type of products that may be used to protect tile installations, Blastrac equipment, and all floor scarifying equipment used in preparing floors to receive tile. The clean up and removal of all waste and materials. All demolition of existing tile floors and walls to be re-tiled.

COMMUNICATION TECHNICIAN

Low voltage construction, installation, maintenance and removal of telecommunication facilities (voice, sound, data and video) including outside plant, telephone, security systems and data inside wire, interconnect, terminal equipment, central offices, PABX, fiber optic cable and equipment, micro waves, V-SAT, bypass, CATV, WAN (wide area network), LAN (local area networks), and ISDN (integrated system digital network), pulling of wire in raceways, but not the installation of raceways.

MARBLE FINISHER

Loading and unloading trucks, distribution of all materials (all stone, sand, etc.), stocking of floors with material, performing all rigging for heavy work, the handling of all material that may be needed for the installation of such materials, building of scaffolding, polishing if needed, patching, waxing of material if damaged, pointing up, caulking, grouting and cleaning of marble, holding water on diamond or Carborundum blade or saw for setters cutting, use of tub saw or any other saw needed for preparation of material, drilling of holes for wires that anchor material set by setters, mixing up of molding plaster for installation of material, mixing up thin set for the installation of material, mixing up of sand to cement for the installation of material and such other work as may be required in helping a Marble Setter in the handling of all material in the erection or installation of interior marble, slate, travertine, art marble, serpentine, alberene stone, blue stone, granite and other stones (meaning as to stone any foreign or domestic materials as are specified and used in building interiors and exteriors and customarily known as stone in the trade), carrara, sanionyx, vitrolite and similar opaque glass and the laying of all marble tile, terrazzo tile, slate tile and precast tile, steps, risers treads, base, or any other materials that may be used as substitutes for any of the aforementioned materials and which are used on interior and exterior which are installed in a similar manner.

MATERIAL TESTER I: Hand coring and drilling for testing of materials; field inspection of uncured concrete and asphalt.

MATERIAL TESTER II: Field inspection of welds, structural steel, fireproofing, masonry, soil, facade, reinforcing steel, formwork, cured concrete, and concrete and asphalt batch plants; adjusting proportions of bituminous mixtures.

OPERATING ENGINEER - BUILDING

Class 1. Asphalt Plant; Asphalt Spreader; Autograde; Backhoes with Caisson Attachment; Batch Plant; Benoto (requires Two Engineers); Boiler and Throttle Valve; Caisson Rigs; Central Redi-Mix Plant; Combination Back Hoe Front End-loader Machine; Compressor and Throttle Valve; Concrete Breaker (Truck Mounted); Concrete Conveyor; Concrete Conveyor (Truck Mounted); Concrete Paver Over 27E cu. ft; Concrete Paver 27E cu. ft. and Under: Concrete Placer; Concrete Placing Boom; Concrete Pump (Truck Mounted); Concrete Tower; Cranes, All; Cranes, Hammerhead; Cranes, (GCI and similar Type); Creter Crane; Spider Crane; Crusher, Stone, etc.; Derricks, All; Derricks, Traveling; Formless Curb and Gutter Machine; Grader, Elevating; Grouting Machines; Heavy Duty Self-Propelled Transporter or Prime Mover; Highlift Shovels or Front Endloader 2-1/4 yd. and over; Hoists, Elevators, outside type rack and pinion and similar machines; Hoists, One, Two and Three Drum; Hoists, Two Tugger One Floor; Hydraulic Backhoes; Hydraulic Boom Trucks; Hydro Vac (and similar equipment); Locomotives, All; Motor Patrol; Lubrication Technician; Manipulators; Pile Drivers and Skid Rig; Post Hole Digger; Pre-Stress Machine; Pump Cretes Dual Ram; Pump Cretes: Squeeze Cretes-Screw Type Pumps; Gypsum Bulker and Pump; Raised and Blind Hole Drill; Roto Mill Grinder; Scoops - Tractor Drawn; Slip-Form Paver; Straddle Buggies; Operation of Tie Back Machine; Tournapull; Tractor with Boom and Side Boom; Trenching Machines.

Class 2. Boilers; Broom, All Power Propelled; Bulldozers; Concrete Mixer (Two Bag and Over); Conveyor, Portable; Forklift Trucks; Highlift Shovels or Front Endloaders under 2-1/4 yd.; Hoists, Automatic; Hoists, Inside Elevators; Hoists, Sewer Dragging Machine; Hoists, Tugger Single Drum;

Laser Screed; Rock Drill (Self-Propelled); Rock Drill (Truck Mounted); Rollers, All; Steam Generators; Tractors, All; Tractor Drawn Vibratory Roller; Winch Trucks with "A" Frame.

Class 3. Air Compressor; Combination Small Equipment Operator; Generators; Heaters, Mechanical; Hoists, Inside Elevators (remodeling or renovation work); Hydraulic Power Units (Pile Driving, Extracting, and Drilling); Pumps, over 3" (1 to 3 not to exceed a total of 300 ft.); Low Boys; Pumps, Well Points; Welding Machines (2 through 5); Winches, 4 Small Electric Drill Winches.

Class 4. Bobcats and/or other Skid Steer Loaders; Oilers; and Brick Forklift.

Class 5. Assistant Craft Foreman.

Class 6. Gradall.

Class 7. Mechanics; Welders.

OPERATING ENGINEERS - HIGHWAY CONSTRUCTION

Class 1. Asphalt Plant; Asphalt Heater and Planer Combination; Asphalt Heater Scarfire; Asphalt Spreader; Autograder/GOMACO or other similar type machines: ABG Paver; Backhoes with Caisson Attachment; Ballast Regulator; Belt Loader; Caisson Rigs; Car Dumper; Central Redi-Mix Plant; Combination Backhoe Front Endloader Machine, (1 cu. yd. Backhoe Bucket or over or with attachments); Concrete Breaker (Truck Mounted); Concrete Conveyor; Concrete Paver over 27E cu. ft.; Concrete Placer; Concrete Tube Float; Cranes, all attachments; Cranes, Tower Cranes of all types: Creter Crane: Spider Crane; Crusher, Stone, etc.; Derricks, All; Derrick Boats; Derricks, Traveling; Dredges; Elevators, Outside type Rack & Pinion and Similar Machines; Formless Curb and Gutter Machine; Grader, Elevating; Grader, Motor Grader, Motor Patrol, Auto Patrol, Form Grader, Pull Grader, Subgrader; Guard Rail Post Driver Truck Mounted; Hoists, One, Two and Three Drum; Heavy Duty Self-Propelled Transporter or Prime Mover; Hydraulic Backhoes; Backhoes with shear attachments up to 40' of boom reach; Lubrication Technician; Manipulators; Mucking Machine; Pile Drivers and Skid Rig; Pre-Stress Machine; Pump Cretes Dual Ram; Rock Drill - Crawler or Skid Rig; Rock Drill - Truck Mounted; Rock/Track Tamper; Roto Mill Grinder; Slip-Form Paver; Snow Melters; Soil Test Drill Rig (Truck Mounted); Straddle Buggies; Hydraulic Telescoping Form (Tunnel); Operation of Tieback Machine; Tractor Drawn Belt Loader; Tractor Drawn Belt Loader (with attached pusher - two engineers); Tractor with Boom; Tractaire with Attachments; Traffic Barrier Transfer Machine; Trenching; Truck Mounted Concrete Pump with Boom; Raised or Blind Hole Drills (Tunnel Shaft); Underground Boring and/or Mining Machines 5 ft. in diameter and over tunnel, etc; Underground Boring and/or Mining Machines under 5 ft. in diameter; Wheel Excavator; Widener (APSCO).

Class 2. Batch Plant; Bituminous Mixer; Boiler and Throttle Valve; Bulldozers; Car Loader Trailing Conveyors; Combination Backhoe Front Endloader Machine (Less than 1 cu. yd. Backhoe Bucket or over or with attachments); Compressor and Throttle Valve; Compressor, Common Receiver (3); Concrete Breaker or Hydro Hammer; Concrete Grinding Machine; Concrete Mixer or Paver 7S Series to and including 27 cu. ft.;

Concrete Spreader; Concrete Curing Machine, Burlap Machine, Belting Machine and Sealing Machine; Concrete Wheel Saw; Conveyor Muck Cars (Haglund or Similar Type); Drills, All; Finishing Machine - Concrete; Highlift Shovels or Front Endloader; Hoist - Sewer Dragging Machine; Hydraulic Boom Trucks (All Attachments); Hydro-Blaster; Hydro Excavating (excluding hose work); Laser Screed; All Locomotives, Dinky; Off-Road Hauling Units (including articulating) Non Self-Loading Ejection Dump; Pump Cretes: Squeeze Cretes - Screw Type Pumps, Gypsum Bulker and Pump; Roller, Asphalt; Rotary Snow Plows; Rototiller, Seaman, etc., self-propelled; Self-Propelled Compactor; Spreader - Chip - Stone, etc.; Scraper - Single/Twin Engine/Push and Pull; Scraper - Prime Mover in Tandem (Regardless of Size); Tractors pulling attachments, Sheeps Foot, Disc, Compactor, etc.; Tug Boats.

Class 3. Boilers; Brooms, All Power Propelled; Cement Supply Tender; Compressor, Common Receiver (2); Concrete Mixer (Two Bag and Over); Conveyor, Portable; Farm-Type Tractors Used for Mowing, Seeding, etc.; Forklift Trucks; Grouting Machine; Hoists, Automatic; Hoists, All Elevators; Hoists, Tugger Single Drum; Jeep Diggers; Low Boys; Pipe Jacking Machines; Post-Hole Digger; Power Saw, Concrete Power Driven; Pug Mills; Rollers, other than Asphalt; Seed and Straw Blower; Steam Generators; Stump Machine; Winch Trucks with "A" Frame; Work Boats; Tamper-Form-Motor Driven.

Class 4. Air Compressor; Combination - Small Equipment Operator; Directional Boring Machine; Generators; Heaters, Mechanical; Hydraulic Power Unit (Pile Driving, Extracting, or Drilling); Light Plants, All (1 through 5); Pumps, over 3" (1 to 3 not to exceed a total of 300 ft.); Pumps, Well Points; Vacuum Trucks (excluding hose work); Welding Machines (2 through 5); Winches, 4 Small Electric Drill Winches.

Class 5. SkidSteer Loader (all); Brick Forklifts; Oilers.

Class 6. Field Mechanics and Field Welders

Class 7. Dowell Machine with Air Compressor; Gradall and machines of like nature.

OPERATING ENGINEER - FLOATING

Class 1. Craft Foreman; Master Mechanic; Diver/Wet Tender; Engineer; Engineer (Hydraulic Dredge).

Class 2. Crane/Backhoe Operator; Boat Operator with towing endorsement; Mechanic/Welder; Assistant Engineer (Hydraulic Dredge); Leverman (Hydraulic Dredge); Diver Tender.

Class 3. Deck Equipment Operator, Machineryman, Maintenance of Crane (over 50 ton capacity) or Backhoe (115,000 lbs. or more); Tug/Launch Operator; Loader/Dozer and like equipment on Barge, Breakwater Wall, Slip/Dock, or Scow, Deck Machinery, etc.

Class 4. Deck Equipment Operator, Machineryman/Fireman (4 Equipment Units or More); Off Road Trucks; Deck Hand, Tug Engineer, Crane Maintenance (50 Ton Capacity and Under) or Backhoe Weighing (115,000 pounds or less); Assistant Tug Operator.

Class 5. Friction or Lattice Boom Cranes.

Class 6. ROV Pilot, ROV Tender

TRAFFIC SAFETY - work associated with barricades, horses and drums used to reduce lane usage on highway work, the installation and removal of temporary lane markings, and the installation and removal of temporary road signs.

TRUCK DRIVER - BUILDING, HEAVY AND HIGHWAY CONSTRUCTION

Class 1. Two or three Axle Trucks. A-frame Truck when used for transportation purposes; Air Compressors and Welding Machines, including those pulled by cars, pick-up trucks and tractors; Ambulances; Batch Gate Lockers; Batch Hopperman; Car and Truck Washers; Carry-alls; Fork Lifts and Hoisters; Helpers; Mechanics Helpers and Greasers; Oil Distributors 2-man operation; Pavement Breakers; Pole Trailer, up to 40 feet; Power Mower Tractors; Self-propelled Chip Spreader; Skipman; Slurry Trucks, 2-man operation; Slurry Truck Conveyor Operation, 2 or 3 man; Teamsters; Unskilled Dumpman; and Truck Drivers hauling warning lights, barricades, and portable toilets on the job site.

Class 2. Four axle trucks; Dump Crets and Adgetors under 7 yards; Dumpsters, Track Trucks, Euclids, Hug Bottom Dump Turnapulls or Turnatrailers when pulling other than self-loading equipment or similar equipment under 16 cubic yards; Mixer Trucks under 7 yards; Ready-mix Plant Hopper Operator, and Winch Trucks, 2 Axles.

Class 3. Five axle trucks; Dump Crets and Adgetors 7 yards and over; Dumpsters, Track Trucks, Euclids, Hug Bottom Dump Turnatrailers or turnapulls when pulling other than self-loading equipment or similar equipment over 16 cubic yards; Explosives and/or Fission Material Trucks; Mixer Trucks 7 yards or over; Mobile Cranes while in transit; Oil Distributors, 1-man operation; Pole Trailer, over 40 feet; Pole and Expandable Trailers hauling material over 50 feet long; Slurry trucks, 1-man operation; Winch trucks, 3 axles or more; Mechanic--Truck Welder and Truck Painter.

Class 4. Six axle trucks; Dual-purpose vehicles, such as mounted crane trucks with hoist and accessories; Foreman; Master Mechanic; Self-loading equipment like P.B. and trucks with scoops on the front.

TERRAZZO FINISHER

The handling of sand, cement, marble chips, and all other materials that may be used by the Mosaic Terrazzo Mechanic, and the mixing, grinding, grouting, cleaning and sealing of all Marble, Mosaic, and Terrazzo work, floors, base, stairs, and wainscoting by hand or machine, and in addition, assisting and aiding Marble, Masonic, and Terrazzo Mechanics.

Other Classifications of Work:

For definitions of classifications not otherwise set out, the Department generally has on file such definitions which are available. If a task to be performed is not subject to one of the classifications of pay set out, the Department will upon being contacted state which neighboring county has such a classification and provide such rate, such rate being deemed to exist by reference in this document. If no neighboring county rate applies to the task, the Department shall undertake a special determination, such special determination being then deemed to have existed under this determination. If a project requires these, or any classification not listed, please contact IDOL at 217-782-1710 for wage rates or clarifications.

LANDSCAPING

Landscaping work falls under the existing classifications for laborer, operating engineer and truck driver. The work performed by landscape plantsman and landscape laborer is covered by the existing classification of laborer. The work performed by landscape operators (regardless of equipment used or its size) is covered by the classifications of operating engineer. The work performed by landscape truck drivers (regardless of size of truck driven) is covered by the classifications of truck driver.

MATERIAL TESTER & MATERIAL TESTER/INSPECTOR I AND II

Notwithstanding the difference in the classification title, the classification entitled "Material Tester I" involves the same job duties as the classification entitled "Material Tester/Inspector I". Likewise, the classification entitled "Material Tester II" involves the same job duties as the classification entitled "Material Tester/Inspector II".

SECTION 01 11 00

SUMMARY OF THE WORK

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents.
2. Use of premises.
3. Owner's occupancy requirements.
4. Work restrictions.
5. Specification formats and conventions.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.03 PROJECT IDENTIFICATION

A.	Project Name:	Combined Area Fire Training Facility Buffalo Grove, Illinois
B.	Owner:	Village of Buffalo Grove 50 Raupp Boulevard Buffalo Grove, Illinois 60089
C.	Architect:	Wold | Ruck Pate 110 North Brockway, Suite 220, Palatine, Illinois, 60067
D.	Civil Engineer:	Meritcorp Group 50 North Brockway, Suite 3-9 Palatine, Illinois 60067
E.	Structural Engineer:	Johnson Wilbur Adams 175 North Washington Street Wheaton, Illinois 60187
F.	Mechanical Engineer:	Gage Consulting Engineers 1301 West 22nd Street, Suite 220 Oak Brook, Illinois 60523
G.	Electrical Engineer:	Gage Consulting Engineers 1301 West 22nd Street, Suite 220 Oak Brook, Illinois 60523

1.04 SUMMARY OF THE WORK

Briefly and without force and effect upon the Contract Documents, the Work of this single prime Contract can be summarized as follows:

A. Work under this Contract includes:

1. Sitework

   a. Site utilities: Water mains, storm sewers, sanitary sewers.

   b. Rough and finish grading, paving, concrete sidewalks and plazas, ground cover, and swales.

   c. Fencing and miscellaneous site improvements.

   d. Construction details for site improvements and site utilities.

2. Building Structure

   a. Concrete footings, masonry and concrete foundation walls, concrete slabs on grade, pre-engineered wood building system with metal roof and wall panels, and miscellaneous metal items including stairs, railings.

3. Building Enclosure

   a. Face brick, veneer and cast stone sills.

   b. Aluminum windows, storefront entrance systems and glazing.

   c. Overhead garage door.

4. Interior Finishes

   a. Insulated gypsum board stud partitions.

   b. Floor finishes of epoxy painted concrete, ceramic tile, and decorative quartz flooring.

   c. Wall finishes of paint and ceramic tile.

   d. Ceiling finishes of acoustical lay-in tile, and gypsum board.

   e. Plastic laminate casework, HM doors and frames, wood doors, access panels, hardware, glazing, toilet accessories, signage.

5. Plumbing:

   a. New combined incoming fire protection/domestic water service. New water meter and RPZ. 4" blind flange for fire protection.

   b. New gas fired water heater.

   c. New Plumbing fixtures and drains.

   d. New domestic hot water, hot water return, and cold water distribution.

   e. New triple basin oil interceptor.

f. New sanitary and sanitary vent system.

6. Fire Protection:

   a. New incoming service backflow device connected to incoming combined fire protection/domestic water service.

   b. New dry valve with riser mounted compressor and piping system to serve attic, overhangs and apparatus bay.

   c. Wet piping system serving all interior heated spaces.

   d. New fire department connection.

7. Mechanical Systems

   a. Plumbing including, supply and waste piping systems, piping insulation, plumbing fixtures.

   b. Heating including piping, piping insulation, boilers, furnaces.

   c. Ventilation to include, air handlers, unit ventilators, fan coils, ductwork, duct insulation, chilled water piping, DX condensers, chillers, cooling towers.

   d. Temperature control system.

   e. New gas/dx single zone vav unit located on pad outdoors serving all interior rooms.

   f. Low pressure supply, return, and exhaust duct systems.

   g. New diffusers, grilles, and registers.

   h. New general exhaust and apparatus bay exhaust systems.

   i. New electric cabinet unit heaters in vestibule and toilet rooms with exterior walls.

   j. New gas fired unit heaters in apparatus bay.

   k. New intake and exhaust louvers in apparatus bay.

   l. New incoming gas service and piping to gas fired mechanical and plumbing equipment.

   m. New stand-alone controls for all systems.

8. Electrical Systems

   a. Electrical service, distribution panels, conduit and wiring.

   b. Interior and exterior lighting. Parking lot lighting.

   c. Communications including telephone and data wiring.

   d. Fire alarm and rough-in for future security systems.

9. Keep Architect fully informed about progress of the work, performance of the work and potential problems.

10. The Owner will hold a ground breaking at the start of construction. The Contractor is responsible to supply 20 new hard hats and 20 new shovels for the participants.

B. The Village of Buffalo Grove is tax exempt. A copy of their exemption shall be provided to the awarded contractor.

1.05 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

   1. Contractor is to visit site and be familiar with existing conditions. Contractor will be required to accept existing conditions on site prior to mobilizing.

B. Use of Site: Limit use of premises to work in areas where indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

   1. Allow for Owner occupancy of Project site.

   2. Driveways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

      a. Schedule deliveries to minimize use of driveways and entrances.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

   3. Public Streets: Maintain clear of automobile parking, equipment or material storage unless arrangements have been made with the appropriate jurisdiction.

   4. Lock automotive type vehicles, such as passenger cars and trucks and other mechanized or motorized construction equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place.

C. Do not allow construction waste and debris to accumulate; remove debris as it accumulates and, unless specified otherwise, dispose of legally off-site.

D. Conform to Village's noise control regulations, including limited hours of construction operations.

1.06 LAYING OUT WORK

A. Locate all general reference points. Where dimensions or observed scope of work differ substantially from Drawings, notify Architect for decision.

B. Lay out Work from the reference points furnished and be responsible for all lines, elevations, and measurements inside workspace. Exercise proper precaution to verify figures shown on Drawings before laying out work and will be held responsible for any error resulting from its failure to exercise such precaution.

C. Hire the services of a locator company to locate all privately owned utilities that may be disturbed by construction operations.

D. Coordinate utility connections with Village/utility company in which project is being constructed.

1.07 OWNER'S OCCUPANCY REQUIREMENTS

A. Partial Owner Occupancy: Owner will occupy the site during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.

   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.

2. Provide not less than 72 hour's notice to Owner of activities that will affect Owner's operations.

B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a punchlist for each specific portion of the Work to be occupied before Owner move in.

2. Obtain a temporary Certificate of Occupancy if required from authorities having jurisdiction before Owner occupancy to install furnishings and equipment.

1.08 WORK RESTRICTIONS

A. The Contractor shall limit access to grounds as indicated on Civil Drawings.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than seven (7) days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's or Owner's permission.

1.09 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Division and Sections using the 49-division format and CSI/CSC's "Master Format" numbering system.

1. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

END OF SECTION 01 11 00

SECTION 01 23 00

ALTERNATES

PART 1: GENERAL

1.01 DESCRIPTION

A. This Section describes the limits of the requested alternates to the Contract work. Refer to the Product/Execution Articles of the appropriate Specifications and the Drawings for information pertaining to the work of each alternate.

B. Each proposal under an alternate shall include all incidental work and all adjustments necessary to accommodate the changes. All work shall meet the requirements of the Drawings, Specifications and appropriate details.

C. Submit each alternate proposal as an individual cost for the particular alternate and shall be proposed under the premise that no other alternates have been accepted. Should the work of an alternate called for by the Bid Form not affect the cost of the work, state "No Change" in the space provided. If an alternate is left blank, the Owner reserves the right to throw out the entire bid or interpret the alternate as "No Change".

D. Include taxes which are applicable to work involved in alternates as well as costs, if any, for increased coverage of bonds and insurance.

E. Any of the alternates may be accepted by Owner and will be used in determining the low bidder.

F. Owner may, at his option, vary the scope of the work by authorizing alternates which will add to the work, deduct from the work or substitute materials, equipment or methods.

G. Each Bidder shall examine the Drawings and Specifications to determine the extent to which his work is affected by bid alternates. Include in the space provided on the bid form the cost of any added or deducted work resulting from each alternate.

H. Contractor is responsible for providing work if applicable to each alternate, whether or not an added or deducted cost is included on his bid form.

PART 2: EXECUTION

2.01 IMPLEMENTATION

A. If the Owner elects to proceed on the basis of one or more of the alternates, make all modifications to the Work required in the furnishing and installation of the selected alternate or alternates subject to the approval of the Architect at no additional cost to the Owner except as proposed in the Bid.

B. Coordinate pertinent related work and modify surrounding work as required to properly integrate the work under each alternate, and to provide the complete construction required by Contract Documents.

C. If so stated in the Agreement, or modifications thereto, provide alternate materials, equipment and/or construction as specified.

2.02 ALTERNATES

A. Alternate No. 1 Building Canopy

1. Provide cost to add building canopy; including all associated concrete, site work, masonry, electrical, etc.

B. Alternate No. 2 Skylights

1. Provide cost to add skylights by Pre-Engineered Wood Building manufacturer at locations shown.

C. Alternate No. 3 Tornado Siren Relocation

1. Provide cost to relocate tornado siren as noted on the drawings.

END OF SECTION 01 23 00

SECTION 01 25 00

SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1: GENERAL

1.01 DESCRIPTION

A. This Section defines procedures to be followed to gain acceptance of products in the Work which are not listed in the individual specification sections. A two step process is required.

B. Requests for acceptance for bidding purposes of alternative manufacturers is encouraged except where specifically prohibited by this Project Manual.

C. Submit Prior Approval request via email to mail@woldae.com with the following information in the subject line: Prior Approval 173013 XX XX XX (Specification Section).

1.02 PRODUCT OPTIONS NOT REQUIRING PRE-BID SUBMITTAL

A. Where a single manufacture is specified and acceptable manufacturer are also listed, acceptable manufacturers must provide an identical product or accept responsibility for all design implications when providing a product other than the specified product.

B. Where products are specified by reference standards, any product established by a material testing agency to meet these standards is acceptable.

C. Where multiple manufacturers and associated models are specified, select any one named.

D. Where manufacturer(s) alone are specified, select any manufacturer and the product recommended in writing by the manufacturer as most suited to the application shown on the Drawings and Specifications.

E. Where the phrase "or equal" follows the name of a manufacturer, any product which meets the performance and appearance standards established by the specified manufacturer may be selected, subject to the Architect's acceptance.

F. Where a manufacturer is listed in both a technical specification section and the Material Finish/Color Schedule, on Architectural Drawings and a color is provided.

1.03 PRODUCT SUBSTITUTIONS REQUIRING PRE-BID SUBMITTALS

A. Step One - Manufacturers Acceptance

1. Individual specification sections may be amended by the Architect during the bid period to include additional names of manufacturers determined to be capable of providing acceptable materials.

2. The Material Finish/Color Schedule, on Architectural Drawings or Specifications may be amended by the Architect during the bid period to include colors by manufacturers listed in technical sections, but not noted on the Material Finish/Color Schedule, on Architectural Drawings or Specifications.

3. To propose the names of specific manufacturers, submit, or arrange for suppliers to submit, written requests to Architect or appropriate Architect's Consultant. Requests received ten (10) calendar days prior to bid date will be considered.

   a. Provide sufficient review data. Include specified manufacturer's model numbers and proposed manufacturer's product literature, noting product numbers for proposed substitutions, and where appropriate, samples and data relating to construction details. If the product is not identical to specified product, submit letter stating proposed manufacturer will custom make products to meet specified product.

b. Architect's acceptance is based upon their determination that a manufacturer is capable of supplying acceptable materials. Approval is not assured or implied for a specific material, item of equipment, color or finish.

c. Official notification will be by addendum to the Contract Documents. However, in addition, if letters of request are delivered in duplicate with accompanying stamped self addressed envelopes, copies may be returned with Architect's decision in advance.

B. Step Two - Product Acceptance

1. Upon award of a construction contract, accepted manufacturers may submit for review to the Architect through the General Contractor or Construction Manager, specific products, materials or equipment items as substitutes for those specified. Contractor to provide letter stating they will reimburse Architect to review substitutions.

2. Architect will review substitute products for performance, appearance, color, finish, size and suitability for inclusion in the work. If a substitute product is not accepted, submit another product by the same or other accepted manufacturer or provide the specified product.

3. Match specified colors and dimensions exactly, whether or not they are standard with the substitute product, unless a minor variation is accepted by the Architect.

4. If a substitute product is accepted, coordinate any necessary changes in other related work and pay for these changes. Pay cost of architectural or engineering services, if any, required to incorporate substitute products in the Work.

1.04 SUBSTITUTIONS BY CHANGE ORDER

A. A substitution for a specified product may be permitted by "change order" at no additional cost to the Owner if product proposed is determined to be equivalent in performance and suitability, and if at least one of the following conditions apply:

1. Owner is given a credit for the work.

2. Product is of superior quality than product specified.

3. Product color or finish selection is preferable.

4. Products specified and upon which building is designed have been discontinued by manufacturer.

B. Provide Architect, through Owner, reasonable compensation for product evaluation.

END OF SECTION 01 25 00

SECTION 01 26 63

CHANGE ORDERS

1.01 CHANGE ORDER PROCEDURES

A. Changes in the Project scope of work affecting the project cost can be made only through AIA Document G701 - Change Order.

B. The procedures for processing changes in the scope of Work are listed as follows:

1. The Architect prepares one of the following documents to modify the scope of work. Documents and attachments revising the drawings and specifications will be distributed electronically and the Contractor will be responsible for printing.

    a. Supplemental Instructions (SI) which are used for no cost changes.

    b. Proposal Request (PR) to be used for proposed changes that need written approval on cost prior to proceeding.

    c. Construction Change Directive AIA Document G714 (CCD) which is used when the work must proceed immediately and time and material cost submitted as soon as possible for review by the Architect.

2. The Contractor reviews and responds as follows:

    a. Supplemental Instructions (SI): This no cost change is to be carried out in accordance with the following modifications to the contract documents described herein. If this change effects cost, do not proceed with this change. Notify the Architect in writing within 10 calendar days of receipt that an itemized (labor and material) quotation will be submitted within 21 calendar days of initial receipt of this Supplemental Instruction. If a cost is not submitted within 21 calendar days, this Supplemental Instruction will be accepted at no additional cost.

    b. Proposal Request (PR): Submit an itemized (labor and material) quotation for the proposed modifications to the contract documents as described herein within 21 calendar days of receipt. If a cost is not submitted within 21 calendar days, this Proposal Request can be accepted at no additional cost. Written approval is required prior to proceeding with this change.

    c. Construction Change Directive AIA Document G714 (CCD): Proceed immediately to carry out this change in the contract documents as described herein. If this revision effects cost, submit an itemized (labor and material) quotation within 21 calendar days of receipt. If a cost is not submitted within 21 calendar days this Change Directive will be accepted at no additional cost.

3. The Architect will review the Contractor's labor and material itemized quotation and respond in writing whether it is acceptable or needs revision. When all pricing is accepted by the Architect and Owner, a Change Order will be processed. Change Orders will be processed at increments determined by the Architect throughout the construction schedule.

C. See General Conditions and Supplementary Conditions of the Work for methods of determining cost or credit, mark-up and schedule on submitting claims.

END OF SECTION 01 26 63

SECTION 01 31 19

PROJECT MEETINGS

PART 1: GENERAL

1.01 DESCRIPTION

A. Schedule and administer pre-construction meeting, periodic progress meetings, and specially called meetings throughout the progress of the work.

1. Notify Architect in advance.

2. Prepare agenda for meetings.

3. Make physical arrangements for meetings.

4. Preside at meetings.

B. Representatives of contractors, subcontractors and suppliers attending the meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. Architect may attend meetings to ascertain that Work is expedited consistent with Contract Documents and the construction schedules.

1.02 PRE-CONSTRUCTION MEETING

A. Schedule within 15 calendar days after date of Notice to Proceed.

B. Location: A central site, convenient for all parties, designated by Contractor.

C. Attendance:

1. Owner's representative

2. Architect and his professional consultants

3. Contractor's superintendent

4. Major subcontractors

5. Major suppliers

6. Others as appropriate

D. Suggested Agenda:

1. Distribution and discussion of:

a. List of major subcontractors and suppliers

b. Projected construction schedules Refer to Section 01 32 00

- Critical Path Method. Schedule for entire construction period.
- Submittal Schedule
- Schedule pre-scheduling conf.

2. Critical work sequencing.

3. Major equipment deliveries and priorities.

4. Project coordination and scheduling:

    a. Designation of responsible personnel.

    b. Pre-installation conferences as specified:

        - Weather barrier
        - Slab on grade
        - Masonry flashing
        - Windows
        - Tile

    c. Mock-up panels.

5. Procedures and processing of:

    a. Field decisions

    b. Proposal Requests/Supplemental Instructions

    c. Submittals

        1) Mechanical Electrical Coordination drawings

    d. 21 day time limit on claims

    e. Change orders

    f. Applications for payment

6. Adequacy of distribution of Contract Documents.

7. Procedures for maintaining Record Documents.

8. Use of premises:

    a. Office, work and storage areas

    b. Owner's requirements

9. Construction facilities, controls and construction aids.

10. Temporary utilities.

11. Safety and first-aid procedures

12. Security procedures

13. Housekeeping procedures Refer 01 50 00

    - Debris removed weekly
    - Daily clean requirements
    - Failure to maintain clean site will result in Owner cleaning and back charging Contractor.

14. Final Cleaning Refer to Spec 01 74 00

- Schedule in time for Owner to complete furniture installation, required clean (i.e. floors)
- Any cleaning done by Owner due to unacceptable cleaning by Contractor, or to and contractor in completing cleaning on schedule will be back charged to Contractor.

1.03 PROGRESS MEETINGS

A. Schedule regular periodic meetings, as required.

B. Hold called meetings as required by progress of the work.

C. Location of the meetings: The project field office of the Contractor.

D. Attendance:

1. Architect and his professional consultants may attend as needed.

2. Subcontractors as appropriate to the agenda.

3. Suppliers as appropriate to the agenda.

4. Others

E. Suggested Agenda:

1. Review, approval of minutes of previous meeting.

2. Review of work progress since previous meeting.

3. Field observations, problems, conflicts.

4. Problems which impede Construction Schedule.

5. Review of off-site fabrication, delivery schedules.

6. Corrective measures and procedures to regain projected schedule.

7. Revisions to Construction Schedule.

8. Plan progress, schedule, during succeeding work period.

9. Coordination of schedules.

10. Review submittal schedules; expedite as required.

11. Maintenance of quality standards.

12. Review proposed changes for:

a. Effect on Construction Schedule and on completion date.

b. Effect on other contracts of the Project.

13. Other business

END OF SECTION 01 31 19

SECTION 01 31 26

ELECTRONIC COMMUNICATION PROTOCOLS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including Division-1 Specification Sections.

1.02 SUMMARY

A. The Architect will provide the Contractor with one (1) electronic copy of the background drawing relevant to their request. Requested files will be provided via email to the Contractor in AutoDesk AutoCAD format.

B. The terms and conditions on the attached form "Agreement Between Architect and Contractor for Transfer of Computer Aided Drafting (CAD) Files on Electronic Media" apply to all Electronic Documents issued by Wold Architects and Engineers or it's consultants for the project.

C. Electronic Document Availability

1. Pre Bid: AutoCAD backgrounds pertaining only to Survey and/or proposed grading will be available prior to bid. Requesting Contractors must complete "Attachment A - Agreement Between Civil Engineer and Contractor for Transfer of Computer Aided Drafting (CAD) Files on Electronic Media" at time of request.
2. After Bid: Backgrounds as requested by the awarded contractors at the discretion of the Architect or Engineer. Electronic Documents are available upon completion of "Attachment A - Agreement Between Architect and Contractor for Transfer of Computer Aided Drafting (CAD) Files on Electronic Media" by the General Contractor on project.

D. See attached form "Attachment A – Agreement Between Architect and Contractor for Transfer of Computer Aided Drafting (CAD) Files on Electronic Media."

PART 2: PRODUCTS – (Not Applicable)

PART 3: EXECUTION – (Not Applicable)

END OF SECTION 01 31 26

ATTACHMENT A – AGREEMENT BETWEEN ARCHITECT AND CONTRACTOR FOR THE TRANSFER OF COMPUTER AIDED DRAFTING (CAD) FILES ON ELECTRONIC MEDIA

The purpose of this agreement is to grant permission from the Transmitting Party (Architect and/or Engineer) to the Receiving Party for the Receiving Party's use of electronic media on the Project, and to set forth the terms. All data transmitted is defined as the electronic media and is considered confidential and containing business proprietary information. Wold Architects & Engineers and its consultants grant Bidders and Contractors a limited license to use Electronic Media issued by Wold Architects & Engineers exclusively for this project. The terms are set forth as follows:

1. The files are transmitted for the Receiving Party's convenience and remain the sole property of Wold Architects and Engineers and/or its consultants. No warranty, expressed or implied, is made respecting this electronic data.
2. The Architect and/or Engineer makes no representation regarding the accuracy, completeness, or permanence of Electronic Media files (ie CAD files). Addenda information or revisions made after the date indicated on the files may not have been incorporated. In the event of a conflict between the Architect and/or Engineers sealed Contract Drawings and Electronic Media files, the sealed Contract Drawings shall govern. It is the Owner, Contractor, or Third Party's responsibility to determine if any conflicts exist.
3. The information contained in the Electronic Media may not included final data or represent exact as-built conditions. The accuracy of the information is not guaranteed and the recipient shall be solely responsible to verify and check all field conditions against the information and to make all adjustments necessary to utilize such information for its work.
4. The Electronic Media files shall not be considered to be Contract Documents as defined by the General Conditions of the Contract for Construction.
5. Wold Architects and Engineers and their consultants shall not be responsible for any decline in accuracy or readability due to the medium on which the Electronic Media are stored, or for any unintentional transmission of computer viruses.
6. Information contained in the Electronic Media shall not be used by Contractor (Receiving Party) for any purpose other than as a convenience in the preparation of Shop Drawings, layout, and other purposes related to the Project. Any other use or reuse by the Receiving Party or others, will be at the Receiving Party's sole risk and without liability or legal exposure to the Architect, Engineers, or their consultants.
7. This Agreement is entered into as of the day and year written below and will terminate upon Substantial Completion of the Project, as defined in the General Conditions of the Contract for Construction, unless otherwise agreed by the parties and set forth below.
8. The Architect reserves the right to determine what content will be distributed to the Receiving Party.

By signing below, the Receiving Party agrees to the terms set for by this Agreement.

AUTHORIZED ACCEPTANCE:

By Receiving Party/Contractor of Record

_____
Signature

_____
Print Name and Title

_____
Print Name of Company

_____
Date

SECTION 01 32 00

CONSTRUCTION SCHEDULING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction (CPM) Schedule.
2. Shop Drawing Submittals Schedule
3. CPM Reports

1.03 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.

2. Predecessor activity is an activity that must be completed before a given activity can be started.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1. Float time is for the exclusive use or benefit of the Contractor to meet schedule milestones and Contract completion date.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.

3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

G. Major Area: A story of construction, a separate building, or a similar significant construction element.

H. Milestone: A key or critical point in time for reference or measurement.

I. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

1.04 SUBMITTALS

A. Submittals Schedule: Submit six copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's final release or approval. (Assume 15 working day turnaround.)
7. Identify submittals that effect critical path.

B. Contractor's Construction (CPM) Schedule: Submit two printed copies of initial schedule large enough to show entire schedule for entire construction period.

C. CPM Reports: Concurrent with CPM schedule, submit three printed copies of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, early start date, early finish date, late start date, late finish date, and total float.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.

1.05 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to review methods and procedures related to the Contractor's Construction (CPM) Schedule, including, but not limited to, the following:

1. Discuss constraints, including phasing, work stages, area separations, interim milestones and partial Owner occupancy.
2. Review delivery dates for Owner-furnished products.
3. Review schedule for work of Owner's separate contracts.
4. Review time required for review of submittals and resubmittals.
5. Review requirements for tests and inspections by independent testing and inspecting agencies.
6. Review time required for completion and startup procedures.
7. Review and finalize list of construction activities to be included in schedule.
8. Review submittal requirements and procedures.
9. Review procedures for updating schedule.

1.06 COORDINATION

A. Coordinate requirements in this Article with "Submittals Schedule" Article in Part 2. If a submittal review sequence policy governs, revise this Article to comply with requirements. See Evaluations for discussion on submittal review sequence policies.

PART 2: PRODUCTS

2.01 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates. Identify items that affect critical path.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using CPM (critical path method) format.

B. Preliminary Network Diagram: Submit diagram within 14 days from the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a CPM network analysis diagram.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted prior to first pay request.

2. Establish procedures for monitoring monthly and updating CPM schedule if work is not on schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.

3. Use "one workday" as the unit of time. Activities should not be shorter than 2 work days or longer than 10 work days for projects with a construction period over 6 months and/or longer than 5 work days for projects with a construction period under 6 months.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.
b. Purchase of materials.
c. Delivery.
d. Fabrication.
e. Installation.

2. Processing: Process data to produce output data or a computer-drawn, logic network diagram. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.

PART 3: EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating:

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.

2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 33 00

SUBMITTALS

PART 1: GENERAL

1.01 DESCRIPTION

A. This Section defines procedures for the following submittals required by the Contract Documents.

B. Provide submittals as noted in each Section.

C. Allow for two weeks review of submittals to avoid delay of Work.

D. Include with submittal preparation, field verifications of measurements, field construction criteria, verification of catalog numbers and similar data, and coordination of Work requirements and Contract Documents.

E. Submit all color samples within 45 days of contract award for Architect's use in color selections. The Architect will not start the color schedule until all samples are received.

PART 2: REQUIRED SUBMITTALS

2.01 SHOP DRAWINGS AND SAMPLES

A. Submit shop drawings in accordance with Article 3 of the General Conditions and the following.

B. Prepare clearly identified shop drawings or schedules to this specific project, containing only data applicable. Include with the shop drawings or schedules a letter of transmittal listing and dating the submitted drawings in sets.

C. Contractor to review all submittals prior to submittal to Architect, and indicate such review with a stamp and signature. Review submittals for conformance to Drawings, Specifications, coordination with other trades and adjacent construction and verification of field dimensions. Failure of Contractor to adequately review submittals shall be cause for rejection.

D. Prepare and submit electronically (with exception for color charts and samples) to Architect for review, all shop drawings and manufacturers catalog sheets showing illustrated cuts of items to be furnished, scale details, sizes, dimensions, performance characteristics, capacities, wiring diagrams, weights and arrangements. Each submittal to include a transmittal on contractor letterhead. Submittal to be in the form of one combined PDF, professionally assembled so all documents are facing the same way.

1. The Contractor will provide submittals labeled as follows:

   a. 173013, CAFT Bldg, XX-XX-XX-X [SPECIFICATION # AND CONSECUTIVELY NUMBERED SUBMITTAL] _____[SPECIFICATION NAME] _____[SUBMITTAL NAME].

   [Example: 173013, CAFT Bldg, 04 20 00-1, Non-Bearing Masonry – Masonry Accessories]

E. Reproduction or exact replication of contract documents are not an acceptable form of shop drawings. Contractor is to generate shop drawings based on the information identified in the contract documents and notify the architect of discrepancies in the documents.

F. The Architect will take one of the following actions on submittals:

1. “Reviewed”: Contractor shall proceed with ordering and/or fabrication.

2. “Review Comments”: Contractor shall proceed with ordering and/or fabrication after taking into account noted comments.

3. “Rejected”: Contractor shall provide a submittal that meets the intent of the specifications.

4. “Revise and Resubmit”: Contractor shall modify submittal to address comments and resubmit.

G. If equipment other than that used in the design of this project is proposed to be used, the Contractor and/or supplier shall verify electrical differences, dimension variations and weight increases. The Contractor shall be responsible for any extra costs incurred as a result of equipment substitutions.

H. Information submittals and submittals that are not required shall be for Architects’ and Engineers’ use and be available for the design team’s review at the jobsite. Quantity of submittals will be the same for Architect as noted under shop drawings. These submittals will not be reviewed, stamped or returned to the Contractor.

I. Unless otherwise specified, submit to the Architect's office samples of size, and nature representing typical qualities. Where required, submit a sufficient number of samples to demonstrate the complete range of variations of the material or quality. Written acceptance of the Architect is required prior to ordering any item for which samples are required.

J. Submit samples to Architect's office, securely packaged, with the name of the Project clearly indicated on the package exterior. Each physical sample shall have a label or tag, firmly attached to the sample, bearing the following information: (a) Name of Project, (b) Name of Supplier, (c) Name of Contractor, and (d) Product information such as manufacturer's designation, finish, type, class, grade, etc. as is appropriate. The Architect will retain one copy of each sample.

2.02 LIST OF MATERIALS

A. Within 7 days after the award of the Contract (notice to proceed or letter of intent), submit 4 copies of a complete list of all material, products, and equipment proposed to be used in construction to the Architect for acceptance. Do not order materials until the proposed listed materials, products and equipment to be used in construction are accepted by the Architect.

B. Where two or more makes or kinds of items are named in the specifications (or additional names are called for in addenda), the Contractor shall state which particular make or kind of each item he proposes to provide. If the Contractor fails to state a preference, the Owner shall have the right to select any of the makes or kinds named without change in price.

C. This list shall be arranged generally in order of specification sections. The items listed shall fully conform to project requirements and specifications. All materials are subject to the Architect's acceptance. After acceptance, changes or substitutions will not be permitted.

D. Clearly identify or list the material, product or equipment by manufacturer and brand by listing the names for all items, including those where only one material or product is specified. Each and every material, product and equipment shall be specifically named, not listed "as specified".

2.03 LIST OF SUBCONTRACTORS

A. Refer to the General Conditions of the Contract for Construction.

B. Propose use of subcontractors or sub-subcontractors who are established, reputable firms of recognized standing with a record of successful and satisfactory past performance. Include the following information: specification section, item of work, subcontractor or supplier, material/manufacturer (as specified will not be allowed), project manager, phone and facsimile numbers. List major sub-subcontractors for mechanical and electrical work. Use only those subcontractors (and sub-sub-contractors, when appropriate) who are acceptable to the Architect and Owner on the Work.

2.04 SCHEDULE OF VALUES

A. Requirements

1. Submit Schedule of Values to Architect ten (10) days prior to first Application For Payment (AIA Form G702, G702a).

2. Use Schedule of Values only as basis for Contractor's Application For Payment.

B. Form of Submittal

1. Base format on Sections listed in Section 00 01 10 Table of Contents, as well as, the Mechanical and Electrical Table of Contents. Break down labor and material separately.

2. Provide a separate line item on the schedule of values for coordination drawings as defined in Division 23 Specification Section 23 05 00 “Common Work Results for HVAC”.

3. Round off amounts to nearest ten dollars.

2.05 PROGRESS SCHEDULE

A. Refer to the General Conditions of the Contract for Construction and Section 01 32 00 Construction Scheduling for submittal requirements.

END OF SECTION 01 33 00

SECTION 01 45 16

QUALITY CONTROL

PART 1: GENERAL

1.01 SELECTION AND PAYMENT

A. The Contractor shall select, hire and pay for the services of an independent testing laboratory(s) acceptable to the Owner and Architect to perform specified Source Quality Control and other tests and inspections called for in the Specifications.

B. The Owner will select, hire, pay for services of an independent testing laboratory, to perform specified Field Quality Control and other inspections, test of materials and construction called for in the Specifications.

1.02 RESPONSIBILITY OF CONTRACTOR

A. Be responsible for furnishing materials and construction in full conformance with Plans and Specifications.

B. Pay for all tests, conducted by the testing laboratory that fail and also pay for all scheduled tests for which the pours are cancelled and a test field crew is on site before that particular pour is cancelled.

1.03 COOPERATION OF CONTRACTOR

A. Contractor: Cooperate with the Laboratory, and:

1. Make available, without cost, samples of all materials to be tested in accordance with applicable standard specifications.

2. Furnish such nominal labor and working space as is necessary to obtain samples at the Project.

3. Advise Laboratory of the identity of material sources and instruct the suppliers to allow test or inspections by the Laboratory.

4. Notify Laboratory sufficiently in advance of operations to allow completion of initial tests or inspections by the Laboratory.

1.04 REJECTION OF MATERIALS/INSTALLATION

A. Laboratory: Notify the Owner, Architect, Engineer and Contractor or his authorized representative of any materials or installation which are not in full conformance with the specifications.

1.05 FILING OF REPORTS

A. Laboratory: File a copy of the inspection report with the Architect, appropriate Architect's Consultant, Owner and Building Official.

PART 2: PRODUCTS – Not Applicable.

PART 3: EXECUTION

3.01 GENERAL SCOPE OF TESTING, INSPECTION

A. Require laboratory to conduct tests and inspections as directed by the Owner, Architect or Engineer.

B. Refer to individual specification sections for test requirements.

3.02 QUALIFICATION TESTING

A. In addition to tests specified, if a product, material, or method of assembly that is of unknown or questionable quality to Architect, the Architect may require and order suitable tests to establish a basis for acceptance or rejection. Pay for these tests. "Standard" test reports or reports on "similar" material will not be accepted.

3.03 MISCELLANEOUS (REGULATORY) INSPECTIONS

A. Should specifications, Architect's instructions, laws, ordinances or any public authority require any work to be inspected or approved, Contractor shall give timely notice of its readiness for inspection and a reasonable date fixed for such inspection. If any work should be covered up without approval or consent of approving agency, or Architect, it must be uncovered for examination at Contractor's expense.

END OF SECTION 01 45 16

SECTION 01 45 43

TESTING, ADJUSTING, AND BALANCING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

B. Related Sections:

1. Other Division 22 and Division 23 Sections specify balancing devices and their installation, and materials and installations of mechanical systems.

2. Individual Division 23 system sections specify leak testing requirements and procedures.

1.02 SUMMARY

A. The testing, adjusting, and balancing contractor will be hired by the mechanical contractor for the work scope as defined under this specification section.

B. This Section specifies the requirements and procedures for mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, recording and reporting the results.

C. Test, adjust, and balance the following mechanical systems:

1. Supply air systems.
2. Return air systems.
3. Exhaust air systems.
4. Hydronic systems.
5. Domestic hot water recirculation loop.

D. Test systems for proper sound and vibration levels.

E. This Section does not include:

1. Testing boilers and pressure vessels for compliance with safety codes;

2. Specifications for materials for patching mechanical systems;

3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

4. Requirements and procedures for piping and ductwork systems leakage tests.

1.03 DEFINITIONS

A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

1. the balance of air and water distribution;
2. adjustment of total system to provide design quantities;

3. electrical measurement;
4. sound and vibration measurement.

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

F. Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal: The point where the controlled fluid enters or leaves the distribution system. There are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

H. Main: Duct or pipe containing the system's major or entire fluid flow.

I. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.

J. Branch main: Duct or pipe serving two or more terminals.

K. Branch: Duct or pipe serving a single terminal.

L. Construction Tests: Tests specified in other sections. Includes leak testing of piping and duct systems.

1.04 SUBMITTALS

A. Agency Data:

1. Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

B. Engineer and Technicians Data:

1. Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

C. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

D. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in maintenance data specified in Division 1 and Section 23 05 00.

E. Test and Balance Reports:

1. Sample Forms: Submit sample forms, if other than those standard forms prepared by the AABC, NEBB, TABB are proposed.

2. Sample Forms: Submit sample forms, if other than those standard forms prepared by the NEBB are proposed.

3. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

   a. Preliminary Reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports shall be submitted prior to Substantial Completion and include at a minimum documentation of required ventilation airflows and preliminary balancing of all primary supply air equipment including central air handlers, rooftop units, fan coil units and unit ventilators. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.

   b. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.

   c. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:

      1) General Information and Summary
      2) Air Systems
      3) Hydronic Systems
      4) Temperature Control Systems
      5) Special Systems
      6) Sound and Vibration Systems
      7) Domestic Hot Water Recirculation Loop

   d. Report Contents: Provide the following minimum information, forms and data:

      1) General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the name, address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

      2) The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

4. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.05 QUALITY ASSURANCE

A. Test and Balance Engineer's Qualifications: The on-site test and balance technician shall be NEBB or TABB certified, be in the employ of the Test and Balance agency and have at least 3-years of successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for this project.

B. Agency Qualifications: The testing, adjusting and balancing technicians and supervisor staffed to perform work on site shall be certified by the National Environmental Balancing Bureau (NEBB) or TABB in the following disciplines:

   1. Testing, adjusting, and balancing.

      a. Air
      b. Hydronics

C. Codes and Standards:

1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems".
2. ASHRAE: ASHRAE Handbook, 2007 HVAC Applications, Chapter 37. Testing, Adjusting, and Balancing.

D. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect and representatives of installers of the mechanical systems, and the Owner's commissioning agent. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.06 PROJECT CONDITIONS

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate all onsite inspections with the prime contractor.

B. Develop detailed work plan with the prime contractor, HVAC subcontractors, and Building Automation System contractor such that testing work will proceed in areas as systems are started and available.

PART 2: PRODUCTS

Not Used.

PART 3: EXECUTION

3.01 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform these steps:

1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.

2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.

3. Compare design to installed equipment and field installations.

4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.

5. Check filters for cleanliness.

6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.

7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.

8. Determine best locations in main and branch ductwork for most accurate duct traverses.

9. Place outlet dampers in the full open position.

10. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.

11. Lubricate all motors and bearings.

12. Check fan belt tension.

13. Check fan rotation.

3.02 PRELIMINARY PROCEDURES FOR HYDRONIC SYSTEM BALANCING

A. Before operating the system perform these steps:

1. Open valves to full open position. Close coil bypass valves.

2. Remove and clean all strainers.

3. Examine hydronic systems and determine if water has been treated and cleaned.

4. Check pump rotation.

5. Clean and set automatic fill valve for required system pressure.

6. Check expansion tanks to determine that they are not air bound and that the system is completely full of water.

7. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).

8. Set temperature controls so all coils are calling for full flow.

9. Check operation of automatic bypass valves.

10. Check and set operating temperatures of chillers to design requirements.

11. Lubricate all motors and bearings.

3.03 MEASUREMENTS

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Apply instrument as recommended by the manufacturer.

E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

G. Take all readings with the eye at the level of the indicated value to prevent parallax.

H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

I. Take measurements in the system where best suited to the task.

3.04 PERFORMING TESTING, ADJUSTING, AND BALANCING

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts and piping, and test for and repair leaks.

E. Seal insulation to re-establish integrity of the vapor barrier.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

G. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.05 TESTING FOR SOUND AND VIBRATION

A. Testing, adjusting, and balancing work shall include an allowance of 16 hours to perform sound and vibration testing at the direction of the Engineer. The goal of the testing will be to identify corrective work such that all areas perform within the design sound levels. All teaching and office areas are designed for a sound level of NC 35 or less. Sound testing shall be conducted in accordance with the referenced standards.

3.06 RECORD AND REPORT DATA

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

C. Include an allowance of 8 hours per building location to provide re-testing and re-balancing at the direction of the architect/engineer. The goal of this re-testing and re-balancing will be to verify the performance of any corrective work and to help assure that all areas perform within the design range set for air and water flow rates.

3.07 DEMONSTRATION AND TRAINING

A. Training:

1. Train the Owner's maintenance personnel on troubleshooting procedures and testing, adjusting, and balancing procedures (minimum of 8 hours) in accordance with the requirements of specification section 01 79 00, “Demonstration and Training.”

2. Schedule training with Owner through the Architect/Engineer with at least 7 days prior notice.

END OF SECTION 01 45 43

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

B. Support facilities include, but are not limited to, the following:

1. Dewatering facilities and drains.
2. Project identification and temporary signs.
3. Housekeeping and waste disposal facilities.
4. Field offices.
5. Storage and fabrication sheds.
6. Lifts and hoists.
7. Construction aids and miscellaneous services and facilities.
8. Temporary heating, cooling, and ventilation.
9. Temporary power and lighting.

C. Security and protection facilities include, but are not limited to, the following:

1. Environmental protection.
2. Stormwater control.
3. Tree and plant protection.
4. Pest control.
5. Site enclosure fence.
6. Security enclosure and lockup.
7. Barricades, warning signs, and lights.
8. Temporary enclosures.
9. Temporary partitions.
10. Fire protection.

D. Related Sections include the following:

1. Division 1 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.

2. Part 3 of this specification "Execution Requirements" for progress cleaning requirements.

3. Division 1 Section “Construction Dust Control” for partitions and procedures for control of construction dust.

4. Divisions 3 through 49 for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.03 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weather-tight; exterior walls are insulated and weather-tight; and all openings are closed with permanent construction or substantial temporary closures.

1.04 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:

1. Owner's construction forces.
2. Occupants of Project.
3. Architect.
4. Testing agencies.
5. Personnel of authorities having jurisdiction.

B. Water Service: Use water from Owner's existing water system without metering and without payment of use charges.

1. Pay for pumps, pipe, hoses, and backflow preventors as required to distribute water.

B. Electric Power Service: Use electric power from Owner's existing system without metering and without payment of use charges.

PART 2: PRODUCTS

2.01 MATERIALS

A. General: Provide new materials or undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

B. Portable Chain-Link Fencing: Minimum 2-inch 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top and bottom rails. Provide concrete or galvanized steel bases for supporting posts.

C. Lumber and Plywood: Comply with requirements in Division 6 Section "Carpentry."

D. Gypsum Board: Minimum 1/2 inch thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36.

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

F. Paint: Comply with requirements in Division 9 Section "Painting."

G. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.

H. Water: Potable.

I. Wood Walkways: ¾" Plywood, framed with 2x__ joists (size as required to support span), with wood rails to contain occupants.

J. Poly Film Guard: 3 mil. self adhering clear poly film utilizing tack water-based adhesive.

2.02 EQUIPMENT

A. General: Provide equipment suitable for use intended.

B. Field Offices: Prefabricated with lockable entrances, insulated, weather-tight; heated and air conditioned. Provide stairs with handrails as required for accessibility.

C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

D. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

E. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.

F. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.

PART 3: EXECUTION

3.01 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.

3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

1. Provide rubber hoses as necessary to serve Project site.

2. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

3. Provide pumps if required due to low static pressure on-site. Equip pumps with surge and storage tanks and automatic controls to supply water uniformly at reasonable pressures.

4. Provide backflow prevention devices to protect Owner's water system.

B. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.

2. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel as required by government jurisdictions.

C. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.

1. Maintain a minimum temperature of 50 deg F (10 deg C) in permanently enclosed portions of building for normal construction activities, and 65 deg F (18.3 deg C) for finishing activities and areas where finished Work has been installed.

D. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

F. Power is available on-site.

1. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations and to maintain schedule.

2. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and to meet government regulations.

a. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

E. Telephone/Computer Service:

1. Provide a computer with internet service in each field office.

2. Provide a portable cellular telephone for superintendent's use in making and receiving telephone calls.

3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.

2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.

3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.

C. Dewatering Facilities and Drains: Comply with requirements in applicable Division 33 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.

2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.

3. Remove snow and ice as required to minimize accumulations and provide access to and throughout the site as required to complete the work/fire department access.

D. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.

1. Prepare temporary signs to provide directional information to construction personnel and visitors.

2. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood in sizes and thicknesses indicated. Support on posts or framing of preservative-treated wood or steel.

E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section for progress cleaning requirements.

1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.

2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

F. Housekeeping

1. Do not allow debris to accumulate on-site or within the building work areas. The contractor shall implement and provide the following cleaning services:

a. Debris shall be removed from the construction site and police exterior project site area on a weekly basis at a minimum to clean-up any wind-blown or excess construction materials or debris and dispose of in construction dumpsters to maintain a clean project site.

b. Debris shall be removed from interior of the buildings on a daily basis and disposed of in construction dumpsters.

c. Lower waste materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

d. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

e. Once floor slabs are in place, walk-off mats shall be provided at all exterior entrances that are utilized by the workers. Mats shall be cleaned on a daily basis and change out mats on a monthly basis.

f. Areas without final floor finish in place shall be cleaned of debris and swept on a daily basis.

g. Areas that workers have access to with final floor finish in place shall be vacuumed on a daily basis. Carpeted major circulation paths shall be covered with poly film guard. Replace poly film guard when it develops holes or tears as they occur. Poly film guard to be replaced if left in place over 45 days. Horizontal and vertical surfaces shall be wiped down as construction dust has accumulated.

h. Where Contractor has periodic access to ancillary spaces occupied by Owner, thoroughly clean after each use, so as to not disrupt Owner's ongoing operations.

i. Failure to maintain a clean construction area may result in the Owner cleaning the site and back-charging the Contractor.

j. Remove waste materials, rubbish and debris from the site and legally dispose of at public or private dumping areas off the Owner's property.

G. Common-Use Field Office: Provide an insulated, weather-tight, air-conditioned field office for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings of 12 persons at Project site. Keep office clean and orderly.

1. Furnish and equip offices as follows:

a. Desk and four chairs, file cabinets in quantities to file shop drawings, supplemental instructions, proposal requests, and change orders, a plan table, a plan rack, and bookcase to store project manuals, detail books, and addenda.

b. Provide a room of not less than 240 sq. ft. for Project meetings. Furnish room with conference table, 12 folding chairs, and 4-foot square markerboard.

H. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.

I. Lifts and Hoists: Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.

C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

D. Site Enclosure Fence: Before construction operations begin, install chain-link enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.

1. Drive fence posts in existing soil of gravel and earth.

2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.

3. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.

E. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

F. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

1. For safety barriers, sidewalk bridges, and similar uses, provide minimum ¾-inch thick exterior plywood and appropriate 2x___ framing for support.

G. Food Consumption: Limit food and soft drink consumption to within the Contractor's trailer or out of the building.

H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather-tight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

I. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses as required by the local fire marshal.

3.05 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Temporary Facility Changeover: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.

2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 57 13 – TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

D. Performance bond.

E. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.2 RELATED REQUIRMENTS

A. Section 31 10 00- Site Clearing: Limits on clearing; disposition of vegetative clearing debris.

B. Section 31 22 00- Grading: Temporary and permanent grade changes for erosion control.

C. Section 32 11 23- Aggregate Base Courses: Temporary and permanent roadways.

1.3 REFERENCE STANDARDS

A. EPA (NPDES) – National Pollutant Discharge Elimination System (NPDES), Construction General Permit; current edition.

1.4 PERFORMANCE REQUIREMENTS

A. Comply with all requirements of U.S. Environmental Protection Agency for erosion and sedimentation control, as specified for the Notional Pollutant Discharge Elimination System (NPDES), Phases I and II, under requirements for the Construction General Permit (CGP), if required by law to comply.

B. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.

C. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
   1. Obtain and pay for permits and provide security required by authority having jurisdiction.

D. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

E. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
   2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.

F. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
   1. Control movement of sediment and soil from temporary stockpiles of soil.
   2. Prevent development of ruts due to equipment and vehicular traffic.
   3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

G. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
   1. Prevent windblown soil from leaving the project site.
   2. Prevent tracking of mud onto public roads outside site.
   3. Prevent mud and sediment from flowing onto sidewalks and pavements.
   4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

H. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
   2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

I. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

J. Open Water: Prevent standing water that could become stagnant.

K. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.5 SUBMITTALS

A. See Section 01 30 00 -Administrative Requirements, for submittal procedures.

B. Erosion and Sedimentation Control Plan: See Soil Erosion Control Plan Sheets.

C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

D. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.1 MATERIALS: As specified on drawing Sheets.

A. Mulch: Use one of the following:
   1. Straw or hay.
   2. Erosion control matting or netting.

B. Grass Seed for Temporary Cover: As Specified on Plan Sheets. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

C. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
   1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM 04751.
   2. Permittivity: 0.05 sec ∧ -1, minimum, when tested in accordance with ASTM 04491.
   3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM 04355 after 500 hours exposure.
   4. Tensile Strength: 1 00 lb-f, minimum, in cross-machine direction; 124 lb-f, minimum, in machine direction; when tested in accordance with ASTM 04632.
   5. Elongation: 15 to 30 percent, when tested in accordance with ASTM 04632.
   6. Tear Strength: 55 lb-f, minimum, when tested in accordance with ASTM 04533.
   7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

D. Silt Fence Posts: One of the following, minimum 5 feet long:
   1. Steel U- or T-section, with minimum mass of 1.33 lb per linear fool.
   2. Softwood, 4 by 4 inches in cross section.

E. Gravel: See Section 32 11 23 for aggregate.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.2 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.3 SCOPE OF PREVENTIVE MEASURES: See Soil Erosion Control Plan Sheets.

A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Construction Entrances: Traffic-bearing aggregate surface.
   1. Width: As required; 20 feel, minimum.
   2. Length: 50 feet, minimum.
   3. Provide at each construction entrance from public right-of-way.
   4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

C. Linear Sediment Barriers: Made of silt fences.
   1. Provide linear sediment barriers:
      a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
      b. Along the top of the slope or top bank of drainage channels and swales that traverse disturbed areas.
      c. Along the toe of cut slopes and fill slopes.
      d. Perpendicular to flow across the bottom of existing and new drainage channels and swales that traverse disturbed areas or carry runoff from disturbed areas; space at maximum of 200 feet apart.
      e. Across the entrances to culverts that receive runoff from disturbed areas.
   2. Space sediment barriers with the following maximum slope length upslope from barrier:
      a. Slope of Less Than 2 Percent: 1 00 feet.
      b. Slope Between 2 and 5 Percent: 75 feet.
      c. Slope Between 5 and 1 0 Percent: 50 feet.
      d. Slope Between 10 and 20 Percent: 25 feet.
      e. Slope Over 20 Percent: 15 feet.

D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
   1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
   2. Straw bale row blocking entire inlet face area; anchor into pavement.

E. Storm Drain Drop inlet Sediment Traps: As detailed on drawings.

F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.

G. Soil Stockpiles: Protect using one of the following measures:
   1. Cover with polyethylene film, secured by placing soil on outer edges.
   2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, woodchips, or shredded leaves, or 6 inches of straw or hay.

H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.

I. Temporary Seeding: Use where temporary vegetated cover is required.

3.4 INSTALLATION: See Soil Erosion Control Plan Sheets.

A. Traffic-Bearing Aggregate Surface:
   1. Excavate minimum of 6 inches.
   2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
   3. Place and compact at least 6 inches of 1.5 to 3.5 inch diameter stone.

B. Silt Fences:
   1. Store and handle fabric in accordance with ASTM D4873.
   2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
   3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
   4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feel, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feel maximum, with fabric embedded at least 6 inches in ground.
   5. Install with lop of fabric at nominal height and embedment as specified.
   6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
   7. Fasten fabric to wood posts using one of the following:
      a) Four 3/4 inch diameter, 1 inch long, 14 gage nails.
      b) Five 17-gage staples with 3/4 inch wide crown and 1/2 inch legs.
   8. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
   9. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feel.

C. Mulching Over Large Areas:
   1. Dry Straw and Hay: Apply 2-1/2 tons per acre; anchor using dull disc harrow or emulsified asphalt applied using same spraying machine at 100 gallons of water per ton of mulch.
   2. Erosion Control Matting: Comply with manufacturer's instructions.

D. Mulching Over Small and Medium Areas:
   1. Dry Straw and Hay: Apply 4 to 6 inches depth.
   2. Erosion Control Matting: Comply with manufacturer's instructions.

E. Temporary Seeding:
   1. When hydraulic seeder is used, seedbed preparation is not required.

2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.
4. On soils of very low fertility, apply 1 0-1 0-1 0 fertilizer at rate of 12 to 16 pounds per 1 000 sq ft.
5. Incorporate fertilizer into soil before seeding.
6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep.
7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
8. Repeat irrigation as required until grass is established.

3.5 MAINTENANCE

A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Silt Fences:
1. Promptly replace fabric that deteriorates unless need for fence has passed.
2. Remove silt deposits that exceed one-third of the height of the fence.
3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Clean out temporary sediment control structures weekly and relocate soil on site.

E. Place sediment in appropriate locations on site; do not remove from site.

3.6 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Owner.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

SECTION 01 74 00

FINAL CLEANING

PART 1: GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Cleaning required for specified work is specified in sections pertaining to that work.

B. Cleaning during construction and prior to substantial completion – Section 01 50 00 Temporary Facilities and Controls.

PART 2: PRODUCTS

2.01 CLEANING MATERIALS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3: EXECUTION

3.01 FINAL CLEANING

A. Employ experienced workers or professional cleaners for final cleaning.

B. At completion of construction and just prior to acceptance or occupancy, conduct a final inspection of exposed interior and exterior surfaces.

C. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from interior and exterior surfaces.

D. Repair, patch and touch up marred surfaces to match adjacent finishes.

E. Broom clean paved surfaces; rake clean other surfaces of grounds.

F. Maintain cleaning until the Building or portion thereof, is occupied by the Owner.

END OF SECTION 01 74 00

SECTION 01 77 00

PROJECT CLOSEOUT

1.01 GENERAL

A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the Work.

B. Related requirements in other parts of the Project Manual

1. Fiscal provisions, legal submittals and additional administrative requirements: Conditions of the Contract.

C. Related requirements specified in other sections

1. Closeout Submittals Required: The respective sections of specifications.

1.02 SUBSTANTIAL COMPLETION

A. Refer to the General Conditions of the Contract for Construction.

B. When the Project is determined by the Architect to be sufficiently complete to permit utilization for the intended use, the Architect will issue a Certificate of Substantial Completion.

C. To receive the Certificate of Substantial Completion, perform the following:

1. Submit to the Architect a notice declaring that work is believed to be substantially complete.

2. Submit a list of work items that remain to be completed or corrected and the date this work will be accomplished.

3. Obtain Occupancy certificate when required from governing municipality.

4. Submit a signed document from a Registered Land Surveyor certifying that completed contours meet the requirements of the drawings.

D. Architect will visit the project to evaluate the request for issuance of a Certificate of Substantial Completion.

1. If the Architect concurs that the Project is substantially complete, the Architect will deliver a Certificate of Substantial Completion and a list of work items necessary for completion or correction prior to request for inspection for final completion.

2. If the Architect determines that the work is not substantially complete, the Architect will deliver to the Contractor a written statement including reasons.

3. Complete work on the items required by the Architect for achieving substantial completion and make additional written requests for issuance of a Certificate of Substantial Completion until the Architect determines that sufficient Work has been performed.

1.03 FINAL INSPECTION

A. When the Work is considered complete, submit written certification that:

1. Contract Documents have been reviewed.

2. Work has been completed and inspected by the Contractor for compliance with Contract Documents and is ready for final inspection.

3. Building Permit Final has been submitted.

B. Architect will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should Architect consider that the Work is incomplete or defective:

1. Architect will notify the Contractor in writing, listing the incomplete or defective work.

2. Take immediate steps to remedy the stated deficiencies, and send a second written certification to Architect that the Work is complete.

3. Architect will reinspect the Work.

D. When the Architect finds that the Work is acceptable under the Contract Documents, he will request preparation of closeout submittals.

1.04 REINSPECTION FEES

A. Should Architect perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:

1. Owner will compensate Architect for such additional services.

2. Owner will deduct the amount of such compensation from the final payment.

1.05 CLOSEOUT SUBMITTALS TO ARCHITECT

A. When the Architect has determined that the Construction Work is acceptable under the Contract Documents and the Contract fully performed, prepare and submit final Application for Payment to the Architect together with one original and one copy of the following:

1. A letter recommending acceptance of the Project and indicating all punch list items are complete.

2. Contractor's Affidavit of Payment of Debts and Claims, AIA Document G706, with bonds for any exceptions.

3. Consent of Surety to Final Payment on Consent of Surety Company to Final Payment, AIA Document G707.

4. Contractors Affidavit of Release of Liens, AIA Document G706A.

5. Project Record Documents, if required.

6. Warranties and Bonds.

7. Documentation from Building Official that building permit has been closed out.

1.06 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to Architect.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.

2. Additions and deductions resulting from:

a. Previous Change Orders

b. Allowances

c. Unit Prices

d. Deductions for uncorrected Work

e. Penalties and Bonuses

f. Deductions for liquidated damages

g. Deductions for reinspection payments and costs incurred by Architect or Architect's Consultants if project is not closed out within sixty (60) days of Substantial Completion.

h. Other adjustments

3. Total Contract Sum, as adjusted.

4. Previous payments.

5. Sum remaining due.

C. Architect will prepare a final Change Order, reflecting approved adjustments to the Contract Sums which were not previously made by Change Orders.

1.07 FINAL APPLICATION FOR PAYMENT

A. Submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

END OF SECTION 01 77 00

SECTION 01 78 23

OPERATING, MAINTENANCE AND WARRANTY DATA

1.01 GENERAL

A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under the Contract.

B. Prepare operating, maintenance and warranty data as specified in this Section and as referenced in other pertinent section of Project Manual.

C. Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.

D. Related requirements specified in other sections:

1. Shop drawings, product data and samples: Section 01 33 00.
2. Project Closeout: Section 01 77 00.
3. Project Record Documents: Section 01 78 39.

1.02 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel with the following qualifications:

1. Trained and experienced in maintenance and operation of the described products.
2. Completely familiar with requirements of this Section.
3. Skilled as a technical writer to the extent required to communicate essential data.
4. Skilled as a draftsman competent to prepare required drawings.

1.03 FORM OF SUBMITTALS

A. Prepare data in the form of an instructional manual for use by the Owner's personnel.

B. Format shall conform to the following:

1. Size: 8½" x 11".
2. Paper: 20 pound minimum, white, for typed pages.
3. Text: Manufacturer's printed data, or neatly typewritten.
4. Drawings
   a. Provide reinforced punched binder tab, bind in with text.
   b. Fold larger drawings to the size of the text pages.
5. Provide fly-leaf for each separate product, or each piece of operating equipment.
   a. Provide typed description of product, and major component parts of equipment.
   b. Provide indexed tabs.
6. Cover: Identify each volume with typed or printed title "OPERATING, MAINTENANCE AND WARRANTY INSTRUCTIONS". List:
   a. Title of Project
   b. Identity of separate structure as applicable.

c. Identity of general subject matter covered in the manual.

C. Binders

1. Commercial quality three-ring binders with durable and cleanable plastic cover.

2. Maximum ring size: 2 inch.

3. When multiple binders are used, correlate the data into related consistent groupings.

D. Digital Format: Submit one PDF copy of the O&M Manual on a DVD Disk.

1.04 CONTENT OF MANUAL

A. Arrange neatly typewritten table of contents for each volume, in the following systematic order.

1. Contractor, name of responsible principal, address and telephone number.

2. A list of each product required to be included, indexed to the content of volume.

3. List, with each product, the name, address and telephone number of:

a. Contractor or installer.

b. Maintenance contractor, as appropriate.

c. Identify the area of responsibility of each.

d. Local source of supply for parts and replacement.

e. Include warranty information as specified.

4. Identify each product by product name and other identifying symbols such as set in Contract Documents.

B. Product Data

1. Include only those sheets which are pertinent to the specific product.

2. Annotate each sheet to:

a. Clearly identify the specific product or part installed.

C. Content, for moisture-protection and weather-exposed products:

1. Manufacturer's data, giving full information on products.

a. Applicable standards

b. Chemical composition

c. Details of installation

2. Instructions for inspection, maintenance and repair.

D. Additional requirements for maintenance data: The respective section of the Project Manual.

1.05 SUBMITTAL SCHEDULE

A. Submit one copy of completed data in final form within thirty days of substantial completion. Copy will be returned with comments.

B. Submit two copies of approved data in final form ten (10) days after comments are received.

END OF SECTION 01 78 23

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

1.01 GENERAL

A. Fully cooperate with the Architect to accomplish the following.

B. These requirements supplement the requirements set forth in the General Conditions.

C. Maintain at each site one record copy, as applicable, of:

1. Drawings and Details with addenda marked in.
2. Specifications with addenda marked in.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Architect/Engineer Supplemental Instructions, Proposal Requests or written instructions.
6. Approved shop drawings, product data and samples.
7. Field test records.

1.02 MAINTENANCE OF RECORD DOCUMENTS AND SAMPLES

A. Store record documents and samples in Contractor's field office in files and racks. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with the Construction Specifications Institute MASTERFORMAT.

C. Maintain record documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

D. Make record documents and samples available at all times for inspection by Architect or Owner.

1.03 RECORDING

A. Label each document "PROJECT RECORD" in neat large printed letters.

B. Continuously record information and changes.

C. Drawings: Legibly mark to record actual construction.

1. Depths of various elements of foundation in relation to finish first floor datum.
2. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
4. Field changes of dimension and detail.

5. Changes made by Field Order or by Change Order.

6. Details not on original contract drawings.

D. Specifications and Addenda - Legibly mark each Section to record:

1. Manufacturer, trade name, catalog number, and Supplier of each Product and item of equipment actually installed.

2. Changes made by Field Order or by Change Order.

E. Shop Drawings – Label each set by corresponding specification section. At the completion of the project, provide the Owner with one complete set, reviewed and stamped by architect, organized by specification section in the following formats:

1. Paper (various sizes) folded to 8 1/2" x 11" and boxed with project name and completion date clearly labeled on exterior.

2. Scanned PDF copy on a compact disk, ordered by specification section.

1.04 SUBMITTAL

A. Deliver Record Documents to the Owner at contract close-out.

B. Accompany submittal with transmittal letter in duplicate, containing:

1. Date

2. Project title

3. Title and number of each Record Document

END OF SECTION 01 78 39

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Recording of training sessions.

B. Related Sections:

1. Division 1-14 – Individual sections with training requirements.
2. Divisions 21-25 – Mechanical sections with training requirements.
3. Divisions 26-28 – Electrical sections with training requirements.

1.03 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. At completion of training, submit one complete training manual for Owner's use.

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

E. Demonstration and Training DVD: Submit one copy at end of each training module.

1.04 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.05 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 – PRODUCTS

2.01 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project Record Documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.

g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training through Architect with at least seven days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

E. Demonstration and Training Recording: Record each training module separately on digital, window's compatible DVD media.. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.03 REQUIRED DEMONSTRATION AND TRAINING

A. The following is a list of demonstration and training requirements listed in individual specification sections. Inconsistencies or omissions from the list does not relieve the Contractor from providing required demonstration and training delineated in each specification section.

Specification Section	**Item**	**Minimum Time***
01 45 43	Testing, Adjusting and Balancing	8 hours
21 10 00	Water-Based Fire-Suppression Systems	As required
28 31 11	Digital, Addressable Fire-Alarm System	4 hours + 2 site visits

3.04 DEMONSTRATION

A. Manufacturer's onsite field technician shall demonstrate the operation of the doors to the Owner. A video outlining the operation of the item or system, scheduled maintenance, basic troubleshooting and care of the item or system shall be provided to the Owner by the door manufacturer. Refer to Section 01 79 00 Demonstration and Training.

END OF SECTION 01 79 00

SECTION 02 01 10

EXISTING UTILITIES

PART 1: GENERAL

1.01 NOTIFICATION

A. The Contractor shall notify public utility companies and municipalities as to which of their properties (such as pole lines, conduits, gas pipes, water pipes, sewers and tile lines) must be removed or relocated to complete the work. This notice shall note the locations to where their properties could be relocated. However, no warranty is made or implied that the utility owners will remove or relocate their properties prior to commencement of construction operations or in sufficient time or manner to prevent interference with the Contractor's operations.

B. The Contractor shall give notice to the owners of all known utilities at least 48 hours before starting any operations affecting those properties. If during the course of his operations, the Contractor discovers utility property whose existence was not known, he shall immediately notify the owner thereof and the Engineer.

C. Construction operations adjacent to utility property shall not be commenced until arrangements satisfactory to the utility owner have been made for the protection of said property and continuation of service. Should any of the Contractor's equipment come in contract with or damage utility property in any way, even though there may be no apparent evidence of breakage or harm, the Contractor shall promptly notify the proper authorities and cooperate with them in determining damage and restoring interrupted services as may be needed. Where contact is made with a utility, operations shall be suspended immediately, and the area vacated, until it has been determined by the utility owner that it is safe to resume operations.

1.02 COMPENSATION

A. It is understood and agreed that the Bidder has considered in his bid the relative locations of existing utilities, as shown on the Plans and that no additional compensation will be allowed for any delays, inconveniences or damages sustained due to interference which may result from those utilities or the operations of moving them.

B. If the Contractor is required to perform any special work or use special construction methods in prosecuting work adjacent to underground utility property whose existence was not indicated in the Contract, equitable compensation will be made for the additional costs incurred.

C. The Contractor shall employ the local utility companies to relocate existing utilities which are affected by the proposed construction. **No additional compensation will be provided for relocation of existing utilities, as shown on the Drawings.**

D. The Contractor is responsible to hire the services of a utility locator company to locate all privately owned utilities that may be disturbed by construction operations.

1.03 CARE AND RESPONSIBILITY

A. The Contractor shall employ special equipment or construction methods (including hand labor, if necessary) to accomplish the work as planned adjacent to utility properties without damage thereto. At no time shall the Contractor interfere with any persons engaged in protecting or moving utility property or in the operation of the utility.

B. The Contractor shall assume full responsibility for reimbursing the utility owners for any damages caused to utility properties whose existence and approximate locations were made known to him before the damage was done. Nothing in this Section shall make the Contractor liable for damage to utility property located below the ground surface, in the absence of negligence, if the owner of the utility, after reasonable notice from the Contractor, fails to advise the Contractor of its location and approximate depth below the ground surface.

PART 2: PRODUCTS – Not Applicable.

PART 3: EXECUTION – Not Applicable.

END OF SECTION 02 01 10

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction, and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.03 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION:

A. Pipe sleeves

B. Embedded steel and miscellaneous items.

1.04 RELATED REQUIREMENTS

A. Section 01 4533 - Structural Testing and Special Inspection

B. Section 03 2000 - Concrete Reinforcing.

C. Section 03 3000 - Cast-in-Place Concrete.

1.05 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2006.

B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute; 2005.

C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2005.

D. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute; 2004.

1.06 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

1.07 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on void form materials and installation requirements.

C. Submit product data for form release agents, form materials, form ties, shelf angle inserts, dovetail anchor slots, flashing reglets, and waterstops.

1.08 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 347, ACI 301, and ACI 318.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver void forms and installation instructions in manufacturer's packaging.

B. Store void forms off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.

C. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.

D. Comply with relevant portions of ACI 347, ACI 301, and ACI 318.

2.02 WOOD FORM MATERIALS

A. Form Materials: At the discretion of the Contractor.

2.03 FORMWORK ACCESSORIES

A. Form Ties: Removable type, galvanized metal, adjustable length, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Form Release Agent: Colorless mineral oil that will not stain concrete, absorb moisture, impair natural bonding of concrete finish coatings, or affect color characteristics of concrete finish coatings.

C. Corners: Chamfered, wood strip type; 3/4x3/4 inch size; maximum possible lengths.

D. Flashing Reglets: Galvanized steel, 22 gage thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

PART 3 EXECUTION

3.01 EXAMINATION

A. Establish a bench mark in an accessible location and use as a reference point for various construction levels. Maintain in an undisturbed condition until final completion.

B. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

A. Earth forms are not permitted.

3.03 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Hold inner and outer forms for vertical concrete together with combination steel ties and spreaders accepted by the Architect.

D. Lay out all work and check general building lines and levels established. Coordinate layout and measurements and if discrepancies arise, report them to the Architect.

E. Keep wood forms wet as necessary to prevent shrinkage.

F. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

G. Align joints and make watertight. Keep form joints to a minimum.

H. Obtain approval before framing openings in structural members that are not indicated on drawings.

I. Provide chamfer strips on exposed external corners of columns and walls.

J. Coordinate this section with other sections of work that require attachment of components to formwork.

K. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

L. Protect work at all times against the elements and other hazards. Cover and secure work.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

3.06 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117.

1. Provide Class B surface for exposed concrete.

2. Provide Class C surface for concealed concrete.

3. Provide Class C or Class D surface for concealed pan and joist forms.

B. Tolerances given in ACI 117 are not cumulative. Maximum tolerance for any formed surface, except footings, shall be one inch.

3.08 FIELD QUALITY CONTROL

A. Structural Special Inspection

1. Structural Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provision of Section 01 4533.

2. Formwork for slabs on grade, strip footings without transverse reinforcement, and topping slabs does not require inspection. Additional exceptions may be noted on the structural drawings.

3. Personnel Qualifications: Special Inspector – Structural I: ICBO certified concrete inspector or a graduate civil/structural engineer, or other personnel acceptable to the Structural Engineer of Record (SER), with the experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed structural engineer, as defined in Section 01 4533. The licensed engineer shall review and approve all inspection reports.

4. The Owner will provide the following inspections:

   a. Verify formwork for all concrete, except as noted above, will result in member size, location, and configuration as described on the contract documents, only as it affects the structural integrity of the concrete elements to be placed. Verify removal of shoring conforms to this section. Qualifications: Structural I.

3.09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Forms for sides of beams, columns, and footings shall remain in place for a minimum of 24 hours.

C. Form Removal for Horizontal Members (Non-Post-Tensioned):

1. Do not remove horizontal member soffit forms until one of the following has been met:

   a. At least one third of cylinders field cured according to ASTM C31 reach 100% of the specified 28-day strength.
      1) Prepare at least six cylinders from the final 100 cubic yards, or portions thereof, plus at least three cylinders for each 2 hours of placing time or each additional 100 cubic yards of concrete placed, whichever provides the greater number of cylinders.
      2) Coordinate number of cylinders, testing dates, and all associated costs with the Owner's testing laboratory

2. Provide reshores if members must support any superimposed loads. Place reshores the same day forms are removed. Do not remove reshores until concrete has reached its specified strength.

   a. Apply no construction loads to members being reshored during reshoring operations.

D. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

E. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction, and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.03 RELATED REQUIREMENTS

A. Section 01 4533 - Structural Testing and Special Inspection

B. Section 03 1000 - Concrete Forming and Accessories.

C. Section 03 1510 - Post-Installed Anchors.

D. Section 03 3000 - Cast-in-Place Concrete.

1.04 REFERENCE STANDARDS

A. ACI 117 - Standard Specification for Tolerances for Concrete Construction and Materials; 2007

B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2005.

C. ACI 315 - Details and Detailing of Concrete Reinforcement; 1999

D. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2005.

E. ASTM A 82/A 82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.

F. ASTM A 185/A 185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.

G. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2007.

H. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2002

I. CRSI (DA4) - Manual of Standard Practice; Concrete Reinforcing Steel Institute; 2001.

J. CRSI (P1) - Placing Reinforcing Bars; Concrete Reinforcing Steel Institute; Eighth Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Follow recommended practices of ACI 315. Include size, length, bar schedules, shapes of bent bars, spacing of bars, methods of supporting reinforcing, and location and length of splices. Provide details as necessary to show final position of reinforcement in elements.

C. Product Data: Submit adhesive for rebar anchorage.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver all reinforcement to the Project site bundled, tagged, and marked.

B. Store all reinforcing steel bars, ties, wire fabric, etc., on the site in a manner that will permit access for proper inspection and identification.

C. Do not exceed design capacity of existing construction or formwork.

D. Store reinforcing to avoid contact with mud, grease, or other materials that would affect bond.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420).

1. Deformed billet-steel bars.
2. Unfinished.

B. Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain type.

1. Flat Sheets.
2. Mesh Size and Wire Gage: As indicated on drawings.

C. Reinforcement Accessories:

1. Chairs, Bolsters, Bar Supports, Spacers: CRSI MSP-1 Chapter 3. Sized and shaped for adequate support of reinforcement during concrete placement.
   a. Class 1 for all surfaces exposed to weather.
   b. Class 1 or 2 for interior surfaces exposed to view.
   c. Class 3 for surfaces not exposed to view.
2. Post-installed reinforcing adhesive: See section 03 1510

2.02 DETAILING

A. Detail reinforcing steel in accordance with ACI 315 and ACI 318.

B. Splice reinforcing where indicated on drawings. Specifically note proposed splices not shown on the drawings on the shop drawings and highlight for reviewer's acceptance.

C. Provide bar supports and other accessories sufficient to maintain reinforcing within specified placing tolerances. Consider requirements of CRSI MSP-1 to be a minimum.

D. Provide bar supports for all reinforcing, including footings, slabs on grade, grade beams, caissons, and slab temperature reinforcing.

E. Consider normal construction activities while detailing number and type of bar supports.

F. Provide side form spacers and spreader bars for all walls, for beams deeper than 30 inches, and for footings with two or more layers of reinforcing.

G. Detail reinforcing to accommodate forming, fabricating, and placing tolerances and maintain a minimum cover as specified.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with ACI 318 and ACI 301.

B. Fabricate within tolerances given in ACI 117.

C. Welding of reinforcement is not permitted.

PART 3 EXECUTION

3.01 PREPARATION - PLAIN BARS

A. Clean all reinforcement before placing. Remove oil, mill scale, pitting, mud, loose rust, strong alkali or organic matter.

B. Remove all excessive rust with wire brush or by sandblasting.

C. Reinforcement with rust and/or mill scale shall be acceptable if a hand-brushed test specimen meets the applicable ASTM requirements for dimension, weight, and height of deformations.

3.02 PLACEMENT

A. Place reinforcing in accordance with approved shop drawings, support and secure reinforcement against displacement. Do not deviate from required position. Place within maximum tolerances given in ACI 117.

B. Splice reinforcing where indicated on drawings.

C. Install mechanical connectors in accordance with connection manufacturer's recommendations.

D. All bars must be placed before concrete is poured.

E. Provide templates for all column dowels.

F. Do not bend bars embedded in hardened or partially hardened concrete without approval from the Architect/Engineer. If bending is permitted, conform to procedures of ACI 301.

G. Support footing and slab on grade reinforcing. Do not lift or "step in" during placement of concrete. Use precast concrete, block, brick, or wire supports with earth bearing bases.

H. Lap wire mesh in slabs on grade and topping slabs so that full, uncut squares of mesh of both sheets lap each other at least 1-1/2 times or 6", whichever is greater.

I. Do not displace or damage vapor barrier.

J. Reinforcing shall have the minimum concrete cover as given on the drawings.

3.03 POST-INSTALLED REINFORCING

A. See section 03 1510 for installation requirements.

3.04 FIELD QUALITY CONTROL

A. Structural Special Inspection

1. Structural Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provision of Section 01 4533.

2. Concrete reinforcing in slabs on grade, footings without transverse reinforcement, topping slabs, and other locations as noted on the structural drawings does not require inspection. Special Inspector need not be present during entire reinforcing installation, but must observe all required reinforcing prior to concrete placement.

3. Personnel Qualifications:

   a. Special Inspector - Structural I: ICBO certified concrete inspector or a graduate civil/structural engineer, or other personnel acceptable to the structural Engineer of Record (SER), with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed structural engineer, as defined in Section 01 4533. The licensed engineer shall review and approve all inspection reports.

4. The Owner will provide the following inspections:

   a. Inspect reinforcement in all cast in place concrete. Qualifications: Structural I. Verify the following:
      1) Reinforcing bar grade.
      2) Reinforcing bars are free of oil, dirt, excessive rust, and damage.

3) Reinforcing bars are adequately tied, chaired, and supported to prevent displacement during concrete placement.
4) Proper chair and tie wire materials are used.
5) Proper clear distances between bars and to surfaces of concrete.
6) Reinforcing bar size and placement.
7) Bar laps for proper length and stagger.
8) Bar bends for minimum diameter, slope and length.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 CONTRACT CONDITIONS

A. Drawings, Details of Construction, and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Section Includes: Providing all items, articles and materials listed, mentioned, or scheduled on the Drawings or herein, including all labor, materials, equipment, and incidentals necessary and required for the installation of all cast-in-place concrete indicated on the Drawings or specified herein.

B. Concrete footings

C. Concrete building frame members.

D. Floors and slabs on grade.

   1. Including vapor barrier.

E. Concrete foundation walls.

F. Concrete curing.

1.03 RELATED REQUIREMENTS

A. Section 01 45 33 - Structural Testing and Special Inspection

B. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.

C. Section 03 20 00 - Concrete Reinforcing.

D. Section 07 92 00 - Joint Sealants: Products and installation for sealants for saw cut joints and isolation joints in slabs.

E. Section 05 12 00 - Embedded Structural Steel, Anchor Bolts

F. Section 07 21 00 - Insulation: Vapor barrier, vapor barrier, and None - N/A.

1.04 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2009).

B. ACI 301 - Specifications for Structural Concrete; American Concrete Institute International; 2010 (Errata 2012).

C. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (errata 2007).

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.

E. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.

F. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.

G. ACI 306.1 - Standard Specification for Cold Weather Concreting, American Concrete Institute; 1990

H. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).

I. ACI 308.1 - Standard Specification for Curing Concrete, American Concrete Institute; 1998

J. ACI 309R - Guide for Consolidation of Concrete, American Concrete Institute; 1996

K. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2011.

L. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Billet-Steel Bars for Concrete Reinforcement; 2015.

M. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2003

N. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.

O. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2014.

P. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

Q. ASTM C 157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete; 2006.

R. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method; 1997

S. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.

T. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete; 2012.

U. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2012.

V. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.

W. ASTM C 1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2007.

1.05 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Concrete mix designs for each mix used. On request, include field test data used to determine required average strength (if that method was used) and field test or trial mix data used to document required average compressive strength.

C. Product data for admixtures, curing materials and compounds, joint fillers, fiber reinforcing, vapor retarders, non-shrink grout, moisture vapor reducing admixture, and slab construction joint devices.

D. Cold weather concreting procedures.

E. Drawings showing construction and control joint locations and details for interior supported floor slabs and slabs on grade.

F. Certification of admixture conformance to chloride ion requirements.

G. Field quality control test results.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

D. Pre-Installation Conference: Prior to installation of any concrete, a conference shall be held at the Project Site. General Contractor, ready-mix supplier, admixture supplier, concrete, formwork, and reinforcing subcontractors, Engineer, Special Inspectors, Independent Testing Laboratory, moisture vapor reducing admixture manfacturer or authorized representative, and other subcontractors whose work requires coordination with this Work shall attend. Specification requirements, submittals, materials, proposed mix designs, methods and procedures associated with this Work will be reviewed to assist in determining acceptable methods and procedures for achieving the specified concrete quality.

E. Source Limitations: Obtain each type of concrete moisture vapor reducing admixture from same manufacture.

1.07 MATERIAL DELIVERY, HANDLING, AND STORAGE

A. Materials shall be delivered in the Manufacturer's undamaged, unopened containers. Each container shall be clearly marked with the product name, manufacturer's name, batch number, component designation, and ratio of component mixtures.

B. Provide equipment and personnel to handle the materials by methods that prevent damage.

C. Promptly inspect shipments to assure that materials comply with requirements, quantities are correct, and materials are undamaged.

D. Store materials in accordance with the Manufacturer's instructions, with seals and label intact and legible. Maintain temperatures within the Manufacturer's recommended ranges.

E. Furnish delivery tickets with each load of concrete delivered to the Project. Information on each ticket shall be as required by ASTM C94 and shall also include: type of concrete (mix number), weights of all ingredients, maximum aggregate size, type, brand, and amount of admixture, total water in the batch, maximum amount of water that can be added at the site without exceeding design mix proportions, and amount of water added at site and initials of person adding water. Retain tickets until substantial completion unless directed otherwise.

1.08 NATIONAL VOLATILE ORGANIC COMPOUND (VOC) EMISSION STANDARDS

A. All products shall comply with the E.P.A. rulings establishing national v.o.c. emission standards for architectural coatings as listed in the Federal Register: September 11,1998 (Volume 63, Number 176), [Rules and Regulations] [Page 48848-48887].

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 03 10 00.

2.02 REINFORCEMENT

A. Comply with requirements of Section 03 20 00.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type.

B. Fine and Coarse Aggregates: ASTM C 33.

1. Maximum aggregate size is specified in mix design schedule.

C. Fly Ash: ASTM C618, Class F.

D. Water: Clean and not detrimental to concrete.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

D. Accelerating Admixture: ASTM C494/C494M Type C.

E. Water Reducing Admixture: ASTM C494/C494M Type A.

F. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than.05% chloride ions.

G. Do not use accelerating or retarding admixtures without written approval of the Architect.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Barrier: See Section 07 21 00 - Insulation

B. Non-Shrink Grout: ASTM C 1107; Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Conformance to ASTM C1107 shall occur with a minimum temperature range of 45 degrees F to 90 degrees F, a fluid consistency, and a minimum 30 minute working time.

2.06 BONDING AND JOINTING PRODUCTS

A. Slab Isolation Joint Filler: 1/4 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

B. Semi-Rigid Joint Filler: Two-component, semi-rigid, 100 % solids, minimum Shore A hardness of 80 per ASTM D2240.

2.07 CURING MATERIALS

A. All curing agents and sealers shall have no adverse affect on finishes, traffic topping, MVRA or other sealers. Coordinate with the appropriate finish manufacturer and receive written confirmation before applying.

B. Moisture-Retaining Cover: ASTM C 171; regular curing paper, white curing paper, white polyethylene film at temperatures above 60 degrees F., black polyethylene film at temperatures below 80 degrees F., clear polyethylene, or white burlap-polyethylene sheet at temperatures above 60 degrees F.

C. Curing and Sealing Compound: ASTM C1315, Type 1, Class A, VOC compliant, 25% minimum solids.

D. Exterior Concrete Curing Compound: Wax base, membrane forming curing compound, ASTM C309, Type II, white pigmented.

2.08 CONCRETE MIX DESIGN REQUIREMENTS

A. Submit concrete mix design for each type of concrete at least 30 days prior to the proposed start of placement. Mix designs must be reviewed prior to pouring concrete. Review is for conformance with specification requirements only. Contractor is responsible for performance.

B. Concrete shall conform to the requirements of ASTM C94 (Option A) unless other requirements of this project specification are more stringent.

C. Provide concrete with workability such that it will fill the forms, without voids or honeycombs, when properly vibrated, without permitting materials to separate or excess water to collect on the surface.

D. Slump at point of discharge: 5" max. for concrete without superplasticizer and 9" max. for concrete with superplasticizer.

E. Proportioning Normal Weight Concrete: ACI 301. Establish proportions based on the standard practices contained in ACI 211.1.

F. Determine required average strength as required by ACI 301.

G. Concrete Strength: Document that mixes produce required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

H. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

2.09 CONCRETE MIX DESIGN SCHEDULE

A. Normal Weight Concrete:

   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch.

   2. Fly Ash Content: Maximum 25 percent of cementitious materials by weight.

   3. Maximum Chloride Ion Content: 0.30 percent by weight of cement.

B. Normal Weight Concrete: Grade Beams

   1. Minimum Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4,000 psi.

   2. Water-Cement Ratio: Maximum 0.45 by weight.

   3. Maximum Aggregate Size: 1-1/2" Class 1S.

   4. Maximum Chloride Ion Content: 0.30 percent by weight of cement.

C. Normal Weight Concrete: Exterior Concrete, Garage Floors

   1. Exterior concrete includes: exterior aprons and stoop slabs, slabs at overhead doors and loading docks, exterior walls, piers, and columns, and other similar conditions.

   2. Minimum Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4,000 psi.

   3. Fly Ash Content: Maximum 25 percent of cementitious materials by weight.

   4. Water-Cement Ratio: Maximum 0.45 by weight.

5. Total Air Content: 4-1/2% to 7-1/2% percent, determined in accordance with ASTM C231.

6. Maximum Aggregate Size: 3/4" Class 4S.

7. Maximum Chloride Ion Content: 0.15 percent by weight of cement.

D. Normal Weight Concrete: Slabs on grade

1. Minimum Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4,000 psi.

2. Water-Cement Ratio: Maximum 0.45 by weight.

3. Maximum Aggregate Size: 3/4" Class 2S, well graded to achieve shrinkage limits specified.

4. Maximum 28-day shrinkage per ASTM C157: 0.05%

5. Maximum Chloride Ion Content:.30 percent by weight of cement.

2.10 SOURCE QUALITY CONTROL

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

B. Do not embed pipes other than non-aluminum electrical conduit or snow melting pipes in any structural concrete.

1. Any pipes embedded in concrete, even those meeting the guidelines given herein, are subject to acceptance by Architect. Remove any unacceptable pipes.

2. Outside diameter of pipes placed in slabs and walls shall not exceed 25% of the thickness of the slab or wall and shall be placed in groups of not more than 3. Space pipes within a group at not less than 4 diameters clear. Space groups of pipes at not less than 48 diameters clear.

3. Maximum total dimension or area of pipes and their fittings embedded in concrete beams and columns shall not exceed, at any location, 15% of least section dimension or 4% of the gross cross sectional area.

C. Where new concrete is to be bonded to existing or previously placed concrete, clean existing surface to remove dust, dirt, grease, oil, curing compounds and other items that would be detrimental to bonding. Saturate existing surface with clean water (8 hours minimum), remove excess water, and slush with a neat cement grout immediately before placing new concrete.

D. Protect existing concrete work to be exposed to view and other finished materials from damage and staining resulting from concreting operations. Cover sills, ledges and other surfaces with protective coverings as necessary to protect the work.

E. Slabs on Grade:

1. Verify subgrade compaction tests have been performed and are accepted.

2. Verify subgrade is level and within acceptable tolerances.

3. Verify subgrade is substantially dry with no freestanding water, muddy spots, or soft spots and is free from snow or ice.

4. Verify completion of all underfloor mechanical and electrical work.

5. Provide 3 inch minimum cover bottom and 3 inch minimum cover sides at electrical conduits and other embedded items.

F. Vapor Barrier Placement

1. Install in accordance with ASTM E1643 and manufacturer's written instructions.
   a. Place with longest dimension parallel with the direction of the concrete pour.
   b. Lap over footings and seal to foundation walls with vapor-proofing mastic.
   c. Overlap joints 6 inches minimum and seal with manufacturer's tape.
   d. Seal all penetrations including, but not limited to, pipes, conduits, columns, and piers with pipe boots in accordance with manufacturer's written instructions. No unsealed penetrations will be permitted.
   e. Repair damaged areas by applying patches of vapor barrier, overlapping damaged area 6" and sealing on all four sides with tape.

3.03 CONCRETE MIXING

A. Transit Mixers: Comply with ASTM C 94/C 94M.

B. Use cooled or heated water in accordance with ACI 306 and 305.

C. Air-entraining and chemical admixtures, if approved, shall be charged into mixer as a solution and dispensed by an automatic dispenser or similar metering device. Powdered admixtures shall be weighted or measured by volume as recommended by the manufacturer. Superplasticizer may be added at the job site to maintain slump.

D. Two or more admixtures may be used in same concrete, provided such admixtures are added separately during batching sequence. Admixtures used in combination shall retain full efficiency and have no deleterious effect on concrete or on properties of each other.

E. Ready mixed concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of rated capacities. Schedule and dispatch trucks from the batching point so that they shall arrive at the site of the work just before the concrete is required to avoid excessive mixing of concrete while waiting.

F. Discharge at the site shall begin within one (1) hour after charging. Concrete may be used as long as it is of such slump that it can be placed and properly consolidated without the addition of water to the batch (other than water added prior to the start of discharge as given below). If elapsed time since batching exceeds 90 minutes, or if drum has revolved more than 300 revolutions since batching, test air content, slump, and temperature for conformance to this specification prior to placing. In no case shall the time between batching and complete discharge exceed 120 minutes. Do not permit retempering of concrete. Discard concrete that has obtained its initial set.

G. Do not add water after the initial introduction of the mixing water for the batch, except at the start of discharge, subject to the conditions below. In this case, the producer may add water in an amount not exceeding that allowed to achieve the design water/cement ratio. The drum blades shall then be turned an additional 30 revolutions minimum at mixing speed. Water shall not be added to the batch at any later time. Reject concrete if water is added and these conditions are not met.

1. The measured slump of the concrete is less than that specified in the mix design.

2. No more than 60 minutes have elapsed from the time of batching.

3. The ready-mix plant is notified and approves.

4. Truck tickets indicate maximum amount of water to be added.

5. Water is added in a manner to control volume.

6. Special Inspector is notified, if concrete placement requires inspection.

H. Maximum concrete temperature delivered to Project site shall be 85 degrees F.

I. To use materials other than those accepted originally, or if the materials from the source originally accepted change in characteristics, make additional tests with proposed new materials that will verify production of concrete meeting with the stated requirements without causing objectionable change in the color or appearance of the structure. Pay the testing agency for these additional tests. Do not use concrete made from such different materials until the Architect has given his approval.

J. If, during the progress of the work, it is impossible to secure concrete of the required workability and strength with the materials being furnished by the Vendor, the Architect may order such changes in the proportions or materials, or both, as may be necessary to secure the desired properties, subject to the stated requirements. Make any changes so ordered without extra compensation.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 301. Follow recommended practice of ACI 304R.

B. Place concrete for floor slabs following recommended practices of ACI 302.1R.

C. Do not place in rain, sleet or snow unless exposed concrete surface is protected from moisture.

D. If, for any reason, the concrete pour is delayed for more than 45 minutes, bulkhead pour at last acceptable construction joint. Immediately remove excess concrete and clean all forms and in situ concrete surfaces.

E. Do not permit concrete to drop more than 4 feet from its point of release to mixers, hoppers, or conveyances. Use tremmies, chutes, or pumps as necessary to place columns and walls.

F. Deposit concrete in wall forms in layers not greater than 24 inches in depth. Consolidate each layer before the succeeding layer is placed.

G. Place concrete as near as possible to its final position to prevent segregation. Do not use vibrators to transport concrete.

H. Do not interrupt successive placement; do not permit cold joints to occur.

I. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

J. Immediately remove concrete spilled on existing surfaces.

K. Concrete at tops of forms: Strike concrete at top of wall, footing, and pier forms. Smooth and float to texture comparable to adjacent formed surfaces.

L. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 JOINTS

A. Vertical construction joints in walls shall be a maximum of 80 feet on center and shall be located as shown on structural drawings. Vertical control joints in wall shall be a maximum of 20 feet on center between construction joints and shall be located as shown on the structural drawings. If locations are not shown, locate joints at edges of piers integral with wall and near corners and in concealed locations where possible.

B. Locate construction joints for beams, slabs, joists and girders in the middle 1/3 of the span. Place so they do not compromise the strength of the structure. Offset joints in a girder at least twice the beam width from a beam-girder intersection.

C. Horizontal joints in walls and columns shall be at underside of slabs, beams and girders and at top of footings. At least 24 hours shall elapse between placing concrete in a wall or column and placing concrete in an area supported by the wall or column.

D. Reinforcing shall be continuous across construction joints. Provide dowels where detailed or requested. Joints in walls shall be keyed with longitudinal keys at least 1-1/2 inches deep unless detailed otherwise.

3.06 SLAB JOINTING

A. Locate slab on grade construction and control joints as given on Drawings and submit drawings showing proposed locations. Cut joints as soon as concrete has hardened sufficiently to prevent aggregate dislodgement. Use a "Soff Cut" saw to cut to a depth of 1 1/4" immediately after final finishing. Use a conventional saw to cut to a depth of one-fourth the slab thickness or as shown on the drawings. Complete sawing within 12 hours of placement.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

3.07 CONSOLIDATION

A. Consolidation of concrete shall conform to ACI 301, unless modified herein.

B. Follow recommended practices of ACI 309, unless modified herein.

C. Consolidate concrete using internal vibrators.

D. Maintain a spare vibrator at the Project Site during all placing operations.

3.08 CONCRETE FINISHING

A. Concrete Finish Schedule

1. Concealed walls, columns, beams, and slabs: As-cast rough form finish.

2. Exposed walls, columns, beams, and wall caps: Smooth form finish.

3. Exposed interior concrete floors and floors to receive carpeting: Troweled finish.

4. Floors to receive topping or mortar setting beds for tile or pavers: Scratched finish.

5. Exterior platforms, aprons, ramps, loading docks, and garage slabs: Broom finish.

6. Floors to receive thin-set ceramic tile, resilient flooring, and vinyl tile: Flat troweled finish.

B. Formed Surfaces

1. Repair surface defects, immediately after removing formwork.

2. Provide finishes per ACI 301 as scheduled and to the following tolerances.

3. Rough Form Finish: Rub down or chip off fins or other raised areas 1/2 inch or more in height. Rough form finish per ACI 301. Class C surface per ACI 117.

4. Smooth Form Finish: Rub down or chip off and smooth fins or other raised areas 1/8 inch or more in height. Smooth form finish per ACI 301. Class B surface per ACI 117.
    a. Where scheduled herein or noted on drawings provide the following improved surfaces and additional architectural finish.
        1) Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal. Class A surface per ACI 117

C. Unformed Surfaces

1. Provide finishes per ACI 301 as scheduled and to the following tolerances (F Numbers) per ACI 117 and measured according to ASTM E1155.
    a. Troweled Finish: Moderately flat tolerance.
        1) F(F): Specified Overall Value of 25; Minimum Localized Value of 15.
        2) F(L): Specified Overall Value of 20; Minimum Localized Value of 12.
    b. Flat Troweled Finish: Flat tolerance
        1) F(F): Specified Overall Value of 35; Minimum Localized Value of 21.
        2) F(L): Specified Overall Value of 25; Minimum Localized Value of 15.
    c. Scratched Finish: Conventional tolerance.
        1) F(F): Specified Overall Value of 20; Minimum Localized Value of 12.
        2) F(L): Specified Overall Value of 15; Minimum Localized Value of 10.
    d. Broom Finish: Moderately flat tolerance.
        1) F(F): Specified Overall Value of 25; Minimum Localized Value of 15.
        2) F(L): Specified Overall Value of 20; Minimum Localized Value of 12.
    e. Floated Finish: Conventional tolerance.
        1) F(F): Specified Overall Value of 20; Minimum Localized Value of 12.
        2) F(L): Specified Overall Value of 15; Minimum Localized Value of 10.
    f. Non-Slip Finish: Broom finish or a troweled finish with a "dry shake" abrasive application, wet abrasive prior to installation, and apply at a rate not less than 25 pounds per 100 square feet. Moderately flat tolerance.
        1) F(F): Specified Overall Value of 25; Minimum Localized Value of 15.
        2) F(L): Specified Overall Value of 20; Minimum Localized Value of 12.

2. Clean exposed concrete to remove laitance, efflorescence and stains.

3.09 CURING AND PROTECTION

A. Comply with requirements of ACI 308.1 as amended by this section. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature above 55° F for the period necessary for hydration of cement and hardening of concrete as follows:

1. Normal concrete: Not less than 7 days.

C. Curing may be terminated earlier than the minimum time above if at least one of the following conditions is met:

1. At least 4 field cylinders for each pour, prepared and cured according to ASTM C31 alongside the concrete they represent, reach 70% of the specified 28-day strength.

2. The concrete temperature is maintained above 50°F and laboratory cylinders reach 85% of the specified 28-day strength.

D. Formed Surfaces: Cure by moist curing with forms in place for full curing period. If forms are removed during the curing period, cure by one of the methods specified for unformed surfaces.

1. Keep steel forms heated by the sun and all wood forms wet during the curing period.

E. Unformed Surfaces: Apply curing materials as soon as finishing operations are complete and the concrete's sufficiently hard to be undamaged by the curing process.

1. Waterproof paper or polyethylene film: Use appropriate color of film based on ambient temperature. Sprinkle concrete with water as necessary during application of covering. Lap edges and ends at least 6 inches, and seal laps. Weight down covering to prevent movement. Patch holes and tears that occur during the curing period.

2. Curing Compounds: Apply strictly according to the manufacturer's instructions using low pressure spray equipment.
   a. Maximum 300 square feet per gallon for curing and sealing compound.

3. Use the following methods:
   a. Interior floors and stairs exposed in the finished work or receiving mastic applied adhesives: Cure using a curing and sealing compound.
      1) For surfaces exposed in the finished work, provide a second coat of acrylic curing and sealing compound immediately prior to substantial completion. Clean floors, and apply sealer strictly according to manufacturer's instructions.
   b. Interior surfaces receiving adhesive applied finishes: Cure using wet curing methods or by covering with waterproof paper or polyethylene film.
      1) Curing and sealing compound may be used upon receipt of a letter from the adhesive manufacturer that this compound is compatible with the adhesive.
   c. Exterior concrete: Cure using exterior concrete curing compound.
   d. All other unformed surfaces: Cure using a strippable curing compound, by wet curing methods, or by covering with waterproof paper or polyethylene film.

4. Protect concrete from excessive changes in temperature during the curing period and at the termination of the curing process. Changes in the temperature of the concrete shall be as uniform as possible and shall not exceed 5° F in any one hour or 50° F in any 24 hour period.

3.10 HOT WEATHER CONCRETING

A. Apply recommended practices of ACI 305R when wind, temperature and humidity conditions cause evaporation rates (using Figure 2.1.5 of ACI 305R) exceeding the following:

1. 0.2 lb/sq ft/hr for concrete with Portland cement only.

2. 0.1 lb/sq ft/hr for concrete with Portland cement and fly ash.

3. 0.05 lb/sq ft/hr for concrete with Portland cement and silica fume.

B. Determine and document expected evaporation rate for the duration of concrete pour.

C. Wet or fog forms and reinforcing immediately prior to placement to bring temperature to ambient conditions.

D. Maintain surface moisture during the period immediately after placement and before final finishing by using wind breaks, fog sprayers, evaporation retarders, or shade (individually or in combination) to prevent plastic shrinkage cracking.

1. Use evaporation retarders according to manufacturer's instructions. Do not use as a finishing aid.

3.11 COLD WEATHER CONCRETING

A. Concrete placed during cold weather shall conform to the requirements of ACI 306.1.

B. Cold weather is defined as 3 or more successive days when the average daily outdoor temperature is less than 40 degrees F.

C. All surfaces, including subgrade and reinforcing shall be above 35 degrees F. prior to placing concrete. Surfaces shall not be more than 10 degrees warmer than the minimum concrete temperatures required by ACI 306.1.

D. Maintain cold weather protection for the following duration but not less than the duration specified in "Curing and Protection" above:

1. Maintain protection for a minimum of 48 hours after placement of concrete.

2. Maintain protection for columns and supported slabs until at least 4 field cylinders, prepared and cured in accordance with ASTM C31, reach 85 percent of the specified 28-day strength, or, laboratory cured cylinders reach the specified 28-day strength.

E. Submit detailed procedures for cold weather concreting for engineer's information only.

F. Follow recommended practices of ACI 306R. Subject to other requirements of this section, a non-chloride accelerator may be used to normalize initial set and for early strength gain.

3.12 FIELD QUALITY CONTROL

A. Provide free access to concrete operations at project site and cooperate with appointed firm.

B. Structural Testing and Special Inspection

1. Structural Testing and Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provisions of Section 01 45 33.

2. Personnel Qualifications
   a. Testing Technician: Technical I - ACI Certified Concrete Field Testing Technician, Grade I, employed by a testing laboratory with C.C.R.L. certification at the National Bureau of Standards, under the direct supervision of a licensed civil/structural engineer. The licensed engineer shall review and approve all reports.
   b. Special Inspector – Structural I: ICC Certified Concrete Inspector, ACI Concrete Construction Inspector, or a graduate civil/structural engineer, or other personnel acceptable to the Structural Engineer of Record (SER), with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed structural engineer, as defined in Section 01 45 33. The licensed engineer shall review and approve all inspection reports.

3. The Owner will provide the following tests and inspections:
   a. Tests for cast in place concrete. Qualifications: Technical I.
      1) Compression test specimens: ASTM C31. One set of four standard cylinders of concrete for each compressive strength test. Mold and store cylinders for laboratory cured specimens.
      2) Compressive strength tests: ASTM C39. One set of four cylinders for each day's pour between one and 25 cubic yards. If a day's pour exceeds 25 cubic yards, one set of four cylinders for each additional 50 cubic yards, or fraction thereof. One specimen tested at 7 days for information, two at 28 days for acceptance, and one specimen retained in reserve for later testing if required. (When frequency of testing will provide less than five strength tests for a given class of concrete, conduct at least five strength tests from randomly selected batches. If fewer than five batches are used, conduct one test from each batch.)
      3) Slump: ASTM C143. One test at point of discharge for each set of compression test specimens; additional tests when concrete consistency appears to have changed.
      4) Air entrainment: ASTM C231. Test the first batch of air entrained concrete and one additional test for each set of compression test specimens.
      5) Concrete temperature: Test hourly when air temperature is below 40°F or above 80°F and each time a set of compression test specimens is made.

b. Concrete mix verification. Qualifications: Technical I. Verify the following:
    1) Mixer truck trip ticket conforms to approved mix design.
    2) Total water added to mix on site does not exceed that allowed by concrete mix design.
    3) Concrete quality is indicative of adequate mixing time, consistency, and relevant time limits.

c. Observe preparation for and placement of all concrete, excluding slabs on grade, strip footings without transverse reinforcement, and unbonded topping slabs. Additional exclusions may be noted on the structural drawings. Special Inspector must be present during entire concrete pour. Qualifications: Structural I. Verify the following:
    1) Acceptable general condition of concrete base prior to placement.
    2) Proper surface preparation at bonded topping slabs.
    3) Concrete conveyance and depositing avoids segregation and contamination.
    4) Concrete is properly consolidated.
    5) Reinforcement remains at proper location.

d. Observe protection and curing methods for all concrete, excluding slabs on grade, strip footings without transverse reinforcement, and unbonded topping slabs Additional exclusions may be noted on the structural drawings. Observations to be made periodically during the curing period. Qualifications: Structural I. Verify the following:
    1) Specified curing procedures are followed.
    2) Specified hot and cold weather procedures are followed.

e. Observe all bolts installed in concrete. Qualifications: Structural I. Verify the following:
    1) Specified size, type, spacing, configuration, embedment, and quantity.
    2) Proper concrete placement and consolidation around all bolts.

C. Contractor Requirements:

1. Provide services of an independent laboratory to perform the following:
    a. Make and test additional cylinders to determine time for form removal.
    b. Make and test additional cylinders to determine termination of curing procedures.
    c. Make and test additional cylinders to determine termination of cold weather practices.

2. Provide the services of a qualified technical representative to instruct the construction team in proper batching, mixing, placement, and finishing of fiber reinforced concrete.

D. Slab Testing: Cooperate with manufacturer of specified moisture vapor reduction admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

3.13 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

C. Acceptance criteria for concrete strength tests shall be as outlined in section 5.6 of ACI 318. If concrete does not meet acceptance criteria, investigation generally following the provisions of section 5.6.5 of ACI 318 will be used at the discretion of the Structural Engineer of Record. Contractor shall reimburse Owner for all costs associated with this investigation. If, in the judgment of the Structural Engineer of Record, the structural adequacy cannot be shown by this investigation, the Contractor shall remove and replace the concrete in question.

3.14 CLEAN-UP

A. Perform concrete washout only in designated area as required by either Division 31 section Erosion Control or the project NPDES permit.

END OF SECTION

SECTION 04 05 14 - GROUTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Portland cement grout.
2. Rapid curing epoxy grout.
3. Non-shrink cementitious grout.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete.

1.2 REFERENCES

A. (SSWSC) Standard Specification for Water and Sewer Construction in Illinois

B. U.S. Army Corps of Engineers Concrete Research Division (CRD):
1. CRD C61 – Non-Shrink Grout

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit product data on grout.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the municipality.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver grout in manufacturer's unopened containers with proper labels intact.

C. Store grout in a dry shelter, protect from moisture.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Per Manufacturer Specifications.

PART 2 PRODUCTS

2.1 NON-SHRINK CEMENTITIOUS GROUT

A. Non-shrink Cementitious Grout: Pre-mixed ready for use formulation requiring only addition of water; non-shrink, non-corrosive, non-metallic, non-gas forming, no chlorides.

B. Properties: Certified to maintain initial placement volume or expand after set and meet the following minimum properties when tested in accordance with CRD-C621, for Type D non-shrink grout:

Property	Test	Time	Result
Setting Time	ASTM C191	Initial	2 hours (Approx)
		Final	3 hours (Approx)
Expansion			0.10% - 0.4% Maximum
Compressive Strength	CRD-C621	1 day	4,000 psi (27.6 MPa)
		7 days	7,000 psi (48.3 MPa)
		28 days	10,000 psi to 10,800 psi (69.0 MPa to 74.5 MPa)

2.2 FORMWORK

A. Refer to Section 03 10 00 for formwork requirements.

2.3 CURING

A. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or with use of wet burlap method.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify areas to receive grout.

3.2 PREPARATION

A. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.

B. Rough concrete lightly, but not enough to interfere with placement of grout.

C. Remove foreign materials from metal surfaces in contact with grout.

D. Align, level and maintain final positioning of components to be grouted.

E. Saturate concrete surfaces with clean water; remove excess water, leave none standing.

3.3 INSTALLATION - FORMWORK

A. Construct leakproof forms anchored and shored to withstand grout pressures.

B. Install formwork with clearances to permit proper placement of grout.

3.4 MIXING

A. Mix grout components in proximity to work area and transport mixture quickly and in manner not permitting segregation of materials.

3.5 PLACING GROUT

A. Place grout material quickly and continuously.

B. Do not use pneumatic-pressure or dry-packing methods.

C. Apply grout from one side only to avoid entrapping air.

D. Do not vibrate placed grout mixture, or permit placement when area is being vibrated by nearby equipment.

E. Thoroughly compact final installation and eliminate air pockets.

F. Do not remove leveling shims for at least 48 hours after grout has been placed.

3.6 CURING

A. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. After grout has attained its initial set, keep damp for minimum of 3 days.

3.7 FIELD QUALITY CONTROL

A. Section [01 40 00 - Quality Requirements] [01 70 00 - Execution and Closeout Requirements]: Field inspecting, testing, adjusting, and balancing.

B. Tests of grout components may be performed to ensure conformance with specified requirements.

END OF SECTION

SECTION 04 20 00

NON-BEARING UNIT MASONRY

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Furnish and install brick where shown on the drawings.

2. Furnish and install mortar, cavity insulation, masonry accessories, masonry reinforcing and other items embedded in masonry construction.

3. Composite Sample Panel

   a. Prior to laying of any brick, gain acceptance on preliminary sample panels.

   b. Prior to applying cleaning agent to masonry or stone, apply to sample panel for Architect's review.

4. Prior to installation of finished materials, all flexible flashings shall be observed by the Architect. The Architect shall be given a minimum of 72 hours notice prior to the desired observation time. Any finish materials (i.e., brick, insulation, metal, etc.) installed without observation by the Architect shall be removed and replaced at the Contractor's expense.

B. Related work specified in other sections:

1. Structural Testing and Special Inspection – Section 01 45 33.
2. Insulation – Section 07 21 00.
3. Flashings – Section 07 65 00/13.

1.03 REFERENCES

A. The following specifications and standards are incorporated by reference. Where provisions of these Project Specifications are at variance with those reference specifications, the maximum criteria or requirements shall govern.

1. ACI 530.1/ASCE 6/TMS 602 – "Specifications for Masonry Structures"; American Concrete Institute International 2005.
2. ASTM A82/A 82M, "Steel Wire, Plain, for Concrete Reinforcement"; 2005a.
3. ASTM A153/A 153M, "Zinc Coating (Hot-Dip) on Iron and Steel Hardware"; 2005.
4. ASTM A615/A 615M, "Deformed and Plain Billet-Steel Bars for Concrete Reinforcement"; 2007.
5. ASTM C55 – "Concrete Building Brick"; 2006.
6. ASTM C67 – "Sampling and Testing Brick and Structural Clay Tile"; 2007.
7. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2004.
8. ASTM C150 - Standard Specification for Portland Cement; 2005.
9. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006.
10. ASTM C216 – "Facing Brick (Solid Masonry Units Made From Clay or Shale)"; 2007.
11. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2007.
12. ASTM C387, "Packaged, Dry, Combined Materials for Mortar and Concrete"; 2006.

13. ASTM C780 - Standard Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2006a.
14. ASTM C1072 – "Measurement of Masonry Flexural Bond Strength"; 2006.
15. ASTM C1314 – "Compressive Strength of Masonry Prisms"; 2003b. AN
16. International Building Code (IBC) Edition enforced by local jurisdiction.

1.04 QUALITY ASSURANCE

A. Employ and pay for the services of an independent testing laboratory acceptable to the Owner and Architect to perform the specified Source Quality Control.

1.05 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Mix Design: Submit mix designs for each mortar type at least seven days prior to preparation of job mortar and delivery to the site. Include copies of test reports for aggregate and mortar strength.

2. Mortar Samples: Submit samples of manufacturer's standard colors for preliminary selection. If requested, prepare and submit custom-mixed samples to match materials or colors as directed by the Architect. Prepare custom color samples using specified mix design; make 3/8" wide, tool concave smooth. Up to two different custom mortar colors may be selected for brick, in addition to standard gray mortar and colored pointing mortar.

3. Mortar Mixes: Test mortar for consistency, compressive strength and water retentively in accordance with ASTM C780 recommendations for preconstruction testing.

   a. Preconstruction tests will be used to establish optimum mortar proportion and establish control values for construction testing. They are not required to meet the compressive strength requirements of ASTM C270.

4. Test Reports

   a. Submit reports on manufacturer's normal quality control.

   b. Provide report on modified ASTM C67 test for face brick as follows: Test to determine if the exterior face brick will meet the SW grade requirements of ASTM C216. Testing is recommended to document compressive strength, saturation coefficient, dimensions, distortion and potential for efflorescence. For this testing, a total of 15 bricks will be required. Make the samples representative of the whole lot of brick from which they are selected and include specimens representative of the complete range of colors and sizes of the brick in the shipment. Upon completion of testing, cut several of the brick samples and observe the cross section for the presence of stratification.

5. Submit samples of all specified masonry accessories for Architect's review.

6. Provide exterior elevation drawings showing all proposed brick expansion joints and floor plans with proposed block control joint location.

B. Masonry Samples

1. Manufacturer's samples: Preliminary selection of brick type and color has been based upon manufacturer's samples supplied to the Architect prior to bidding. Brick supplied to the site which, in the judgment of the Architect, varies significantly from these samples in color, color range or finish will be rejected.

2. Sample panels: At the site, erect a 2'-0" square panel of each brick type, incorporating the preliminary mortar selection(s) and the full range of brick color to be expected. After review by the Architect, construct

additional sample panels to adjust brick range and mortar color. Do not begin final production and/or delivery of materials until acceptance of preliminary sample panel.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle, transport and store at the job site in a manner that will avoid damage.

B. Protect masonry units from water. Deliver the units to the job cubed on pallets.

C. Deliver and store scored masonry units with cardboard separators to reduce chipping and other damage to block surface and edges.

D. Store materials under cover in dry place; in manner to prevent damage, intrusion of foreign material. During freezing weather protect all masonry units with tarpaulins or other suitable material. Store concrete masonry under covers that will permit circulation of air, prevent excessive moisture absorption; protect against wetting prior to use.

PART 2: PRODUCTS

2.01 MORTAR MATERIALS

A. Portland Cement: ASTM C150, Type I. Use of masonry cement is not permitted.

B. Hydrated Lime: ASTM C207, Type S.

C. Aggregates: ASTM C144.

D. Water: Clean, potable, free of deleterious amounts of acids, alkalies or organic materials.

E. Pre-Mixed Mortar: ASTM C387. Specific property and material requirements of this Section shall govern.

F. Antifreeze Compounds: Not allowed in mortar to lower freezing point.

G. Mortar Colorant: Inert, sunfast, weather resistant, alkali resistant, water insoluble, free of deleterious fillers and extenders. By Solomon Grind-Chem Service, Inc., Euclid, Twin City Concrete Co., Tamms Industries Co. or Prism Pigments.

1. Colors: As selected from Manufacturer’s full range of colors.

2.02 MORTAR MEASURING AND MIXING

A. Measure and mix in accordance with ASTM C270 (Proportion Specifications) and the following:

1. Mix mortar as required for immediate use only and discard any mixed for a period exceeding 2-1/2 hours.

2. Accurately maintain and control the specified proportions of the mortar materials during the entire progress of the work.

3. Thoroughly mix cementitious materials and aggregates with the amount of water to produce satisfactory workability. Machine mix all mortar.

4. Proportion colorant for mortar in accordance with printed instructions by pigment manufacturer to avoid reducing mortar properties, at a rate not to exceed 10 pounds per 94 pound bag of portland cement.

5. Mix pointing mortar with specified admixtures strictly according to manufacturer's printed instruction.

2.03 MORTAR SOURCE QUALITY CONTROL

A. Test proposed aggregate for conformance to ASTM C144 and these specifications.

B. Test each mortar mix design for water retentivity and compressive strength in accordance with ASTM C270.

C. Mix mortar in the laboratory from representative samples of materials to be used in the Work, including selected colorants. Average compressive strength at 28 days shall be as follows:

Mortar Type	Compressive Strength Range
M	2,500 psi - 3,000 psi
S	1,800 psi - 2,200 psi
N	750 psi - 1,100 psi

D. Adjust mix design so as to achieve compatibility with brick to be supplied, considering initial rate of absorption of brick and water retentivity of mortar.

E. Do not start masonry work until Architect has reviewed test reports and accepted mix design.

F. Prepare and test new mix designs if mortar does not meet specifications or if, during the course of the Work, significant changes occur in aggregate or other materials.

G. Use field measuring methods to accurately control mortar mix proportions.

2.04 MASONRY ACCESSORIES

A. Horizontal Wall Reinforcement and Masonry Veneer Anchors: ASTM A153 - Class B2 hot dipped, galvanized, (unless noted otherwise) Hohmann & Barnard or equivalent products by other manufacturers are acceptable.

1. Veneer anchors for steel studs: Hohmann & Barnard: Stainless steel HB-213-2X adjustable veneer anchor with 3/16” dia. hook. Back plate thickness to accommodate no insulation or match insulation thickness.

2. Dovetail Brick Tie: HB-315

B. Brick expansion joint filler or material: HS-NS Closed Cell Neoprene Sponges or equal. Size: thickness to match joint thickness x 3” wide. Constructed of closed cell neoprene.

C. Flashing: Conform to the requirements of Section 07 65 00 Flashings. Color: See Material Finish/Color Schedule on Architectural Drawings.

D. Cavity Wall and Perimeter Insulation: Conform to requirements of Section 07 21 00, Insulation.

E. Cavity Weep/Vent: H&B-QV Quado-Vent. Color as selected from manufacturers full range of available colors.

F. Rope Wicks: Conform to requirements of Section 07 65 00, Flashings.

G. Mortar Net: 90% open weave, 200 denier 100% recycled polyester, dovetail/continuous bottom strip design, thickness to match cavity width x 5'-0" length as manufactured by Mortar Net USA, Ltd.

H. Flashing Termination Bar and Fasteners: Conform to requirements of Section 07 65 00, Flashings.

I. Bond Breaker: No. 15 Building Paper, red rosin kraft paper or 6 mil polyethylene.

2.05 FACE BRICK

A. Contractor shall provide one of the following options for Face Brick #1:

Option 1

1. Manufacturer: Hebron Brick Company
2. Size: Modular
3. Name/Texture: Chocolate/Velour
4. Contact: Illinois Brick Company, Nathan Karaway, 708-912-8544, nkaraway@illinoisbrick.com

Option 2

1. Manufacturer: Glen-Gery Brick
2. Size: Modular
3. Name/Texture: Brown Velour
4. Contact: Contractors Material Inc., Terrence Collins, 847-202-9999, tcollins_cmi@yahoo.com

2.06 SOURCE QUALITY CONTROL

A. Perform tests of each brick type in accordance with ASTM C67 to determine compliance with ASTM C216, Grade SW. Document compressive strength, saturation coefficient, initial rate of absorption, dimensional tolerance and potential for efflorescence.

B. Perform tests of each brick/mortar combination to determine flexural bond strength in accordance with ASTM C1072.

PART 3: EXECUTION

3.01 LAYOUT

A. Unless noted on Drawings as "clear", all dimensions on Drawings are modular, from center to center of vertical joints and from bottom to bottom of horizontal joints.

B. Lay out exposed masonry to achieve joint pattern shown on Drawings. Where not shown, lay out exposed masonry to minimize cutting of units. Where possible, provide full 8" wide units at outside corners, jambs, and other openings.

3.02 MORTAR

A. Mortar proportioning and mixing as specified.

B. Tempering: The consistency of mortar may be adjusted to the satisfaction of the mason. Use mortar within two and one half (2-1/2) hours after mixing.

C. Type: Lay masonry in mortar of the type specified below, as adjusted for compatibility with masonry units.

Kind of Masonry	Mortar Type
Exterior walls, non-load bearing at or below grade.	M
Exterior walls, non-load bearing, above grade; Brick veneer.	S
Interior non-load bearing partition walls.	N

3.03 PRECAUTIONS

A. Cold Weather Requirements

1. Cold weather conditions exist when temperature is 40 degrees F. or below.

2. Keep masonry units dry. Do not use wet or frozen masonry units.

3. Following general rules may be modified as approved by Architect to suit project conditions.

AIR TEMP. (Degrees F.)	CONSTRUCTION REQUIREMENTS
40 - 32	Heat mixing water or sand to produce mortar temperature between 40 degrees F. and 120 degrees F. Heat grout materials when their temperatures are below 32 degrees F. Do not heat water or aggregates used in mortar or grout above 140 degrees F.
32 - 25	Comply with construction requirements above. Heat grout materials so grout is at a temperature between 70 and 120 degrees F. during mixing and placed at a temperature above 70 degrees F. Maintain temperature of mortar on boards above 40 degrees F. Employ windbreaks when wind is in excess of 15 MPH.
25 - 20	Comply with construction requirements above. Heat masonry units so their temperature when laid is not less than 20 degrees F. Heat masonry to a minimum of 40 degrees F. prior to grouting. Utilize sources of heat on both sides of wall under construction.
20 and below	Comply with construction requirements above. Provide enclosure and auxiliary heat to maintain air temperature above 32 degrees F. for 24 hours. Extend time period to 48 hours for grouted masonry.

MEAN DAILY AIR TEMP. (Degrees F.)	PROTECTION REQUIREMENTS
40 - 32	Protect masonry from rain or snow for 24 hours.
32 - 25	Completely cover masonry for 24 hours.
25 - 20	Completely cover masonry with insulating blankets or approved equal protection for 24 hours. Extend time period to 48 hours for grouted masonry.
20 and below	Maintain masonry temperature above 32 degrees F. for 24 hours by enclosure and approved supplementary heat. Extend time period to 48 hours for grouted masonry.

B. Hot Weather Requirements

AIR TEMP (Degrees F.)	PROTECTION REQUIREMENTS
Greater than 110 or 90 with 8 mph wind velocity	Maintain the temperature of mortar and grout below 120°F; flush mixers, mortar transport containers and mortar boards with cool water before they come into contact with mortar ingredients or mortar; maintain mortar consistency by retempering with cool water; and use mortar within 2 hours of initial mixing.

C. Protect facing material against staining; keep top of walls covered with non-staining waterproof coverings when work is not in progress.

D. Where fresh masonry joins partially or totally set masonry, clean, roughen, lightly wet set masonry before new masonry is joined. Make necessary horizontal stop-offs by racking back masonry; do not tooth.

E. Where units are specified to be wetted, uniformly wet units 3 to 4 hours before using.

3.04 LAYING MASONRY UNITS

A. Lay masonry plumb, true to lines. Unless noted on drawings as "clear", all dimensions on drawings are modular, from center to center of vertical joints and from bottom to bottom of horizontal joints.

B. Lay hollow masonry units 4 inches or less in thickness, all solid masonry units in full beds of mortar with full head joints.

C. Lay hollow masonry units exceeding 4 inches in thickness with divided bed, head joints.

D. Avoid over-plumbing, pounding of corner, jambs after setting masonry in position. Where an adjustment must be made after mortar has started to harden, remove mortar, replace with fresh mortar.

E. Lay masonry within one minute of placing mortar.

3.05 BONDING AND ANCHORAGE

A. Anchor abutting or intersecting non-load bearing walls, partitions at vertical intervals of 2 feet with corrugated ties.

B. Where indicated anchor walls, partitions abutting or facing against steel columns, beams with flexible anchors. Unless indicated otherwise, maximum spacing; 16 inches vertically at columns, 16 inches horizontally at beams.

C. Anchor exterior walls, veneer facing against concrete beams, columns, walls with dovetail anchors spaced 16 inches vertically, 16 inches horizontally.

D. Anchor exterior walls parallel to open web joists with prefabricated anchoring and reinforcing assembly with adjustable rectangular ties welded to structural steel as indicated.

E. Bond non-bearing walls, partitions of more than one wythe with wire ties; use at least one tie for each 3½ sq. ft. of wall surface; spaced maximum of 16 inches vertically, 36 inches horizontally, stagger alternate rows. Embed ties in horizontal joints.

F. Anchor veneer to backup with ties spaced 16" horizontally and vertically.

G. Bond bearing walls of more than one wythe as required for non-bearing walls. Fill all collar joints between all wythes with mortar.

3.06 BUILT-IN WORK

A. Consult other trades in advance, make provision for installation of their work in order to avoid cutting, patching. Build-in work specified under other sections as work progresses.

B. Set steel lintels in beds of mortar. Fill door and borrowed light frames solid with grout around jambs, heads of bucks, frames.

C. Flexible Flashing:

1. Apply where concealed wall flashing is indicated; at heads; sills of exterior masonry openings; at exterior wall damp courses; under all precast concrete copings; as otherwise indicated.

2. Flashing Installation: Properly clean and dry backup prior to applying primer as recommended by flashing manufacturer. Lay one layer of flexible flashing on bed joint of brick. Install continuous metal flashing and adhere another layer of flexible flashing over metal and continue up vertical back-up material a minimum of 8 inches. Lap all flashing joints a minimum of 8 inches. Install flashing termination bar at top of flashing.

3. At heads, sills of masonry openings; carry head flashing 6" beyond ends of steel lintels; at heads, sills turn up ends to form pans, with corners folded, not cut.

4. Fully adhere flexible flashing to steel lintels.

5. Apply a bead or trowel coat of mastic along top of termination bar, seams, cuts and penetrations.

D. Where masonry is built around steel columns, wrap columns with 1½" thick batt insulation or No. 15 asphalt-impregnated building paper and remove mortar droppings from around columns.

3.07 RIGID INSULATION

A. Install cavity wall insulation against face of back-up substrate with boards horizontal, tight butted joints. Fasten with adhesive or mechanical fasteners.

3.08 BRICK

A. Clay Masonry Erection, Workmanship: Conform to latest recommended standard specifications for clay masonry as published by the Brick Institute of America (BIA).

B. Moisten brick with absorption rates in excess of 20g/30 sq. in./min. as determined by ASTM C67, so that rate of absorption when laid does not exceed this amount.

C. Finish face joints exposed on exterior walls with metal tool to form concave joint, close hairline cracks, crevices.

D. Remainder of Joints: Cut off flush.

E. Provide continuous vertical 3/8" expansion joints in brick where shown on drawings. Where not shown, or in addition to those shown, provide joints, at a minimum, within two feet of outside corners, at inside corners, above window and door jambs, between dissimilar materials and no more than 20 feet on center elsewhere. Verify location and alignment with Architect.

F. Provide rope wicks as shown on drawings in exterior masonry in vertical joints immediately above all flashing, at base of cavity, veneer walls at top of all cavity walls; use weep vents where shown on drawings.

G. Keep air space within cavity walls clean, free from obstruction. Provide positive means of catching mortar droppings, or cleanouts to remove mortar from base of cavity.

H. Install mortar net so it is snug between insulation and back face of brick. Install in layers if needed to fill cavity.

3.09 POINTING AND CLEANING

A. Point up exposed masonry, fill holes, joints, remove loose mortar, cut out defective joints, repoint with mortar.

B. Thoroughly clean exposed masonry with stiff brushes and water. Before applying any cleaning agent to entire wall, apply to sample wall area or sample panel of approximately 20 sq. ft. in location approved by Architect. Do not proceed with cleaning work until sample area is approved. Use approved cleaning material, method on remaining wall area, including cover of all items that could be damaged (i.e. aluminum, windows, hardware, metal items) prior to using cleaning agents.

C. If stiff brushes, water do not suffice, clean the surface on which no green efflorescence appears with Sure-Klean Vana-Trol as manufactured by Pro So Co., Inc.

D. Remove "problem" stains as follows with the as specified formulations of Pro So Co., Inc., or equal:

1. Green Efflorescence - "Sure-Klean No. 800 Stain Remover".
2. Tar, Asphalt - "Sure-Klean Asphalt & Tar Remover".
3. Ferrous Stains - "Sure-Klean Ferrous Stain Remover".

E. Do not use acid solutions for cleaning masonry units unless specifically approved by Architect.

F. Clean off loose mortar, remove stains from concrete masonry units.

G. Schedule, complete cleaning work as soon as possible; in any event, before Owner's signage work is commenced.

3.10 APPLICATION OF ACOUSTIC SPRAY SYSTEM

A. Install mineral wool backing at depth required per manufacturer's details.

B. Apply acoustic spray to required thickness and overlap onto adjacent surfaces as recommended by manufacturer to achieve specified sound transmission classification.

3.11 MORTAR FIELD QUALITY CONTROL

A. The Owner will employ a testing agency to perform the following:

1. Field test mortar for consistency, water content, mortar aggregate ratio, air content (only for those mixes with entrained air), and compressive strength in accordance with ASTM C780. Make one test for each 2,500 square feet of wall area.

2. Test brick prisms for flexural bond strength in accordance with ASTM C1072. Make one test for each mortar/brick combination.

3. Provide test results to Architect for comparison with laboratory results.

END OF SECTION 04 20 00

SECTION 05 50 00

METAL FABRICATIONS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes: All labor, material necessary to complete all items of miscellaneous metal as listed on the schedule in Part 2 and shown on the Drawings.

1. The design, fabrication, transportation to the project site, and associated operations required to complete miscellaneous metals, including all the various metal items manufactured to more or less standard details in sizes conforming to specific requirements of the project.

2. Decorative metal fence as shown on the Drawings.

B. Related work specified in other sections:

1. Structural Testing and Special Inspection – Section 01 45 33.

2. Steel support brackets for countertops - Section 12 35 13.

3. Overhead Doors – Section 08 36 00

1.03 REFERENCE STANDARDS

A. The following specifications and standards are incorporated by reference. Materials and operations shall comply with requirements of the specified issue of published reference. Where provisions of these Project Specifications are at variance with those reference specifications, the maximum criteria or requirements shall govern.

1. ASTM A36-03a, "Carbon Structural Steel"

2. ASTM A53-02, "Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless"

3. ASTM A123-02, "Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products"

4. ASTM A307-02, "Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength"

5. ASTM A325-02, "Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength"

6. ASTM A500-03, "Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes"

7. ASTM A563-00, "Carbon and Alloy Steel Nuts"

8. ASTM A666-00, "Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar"

9. ASTM A992-02, "Steel for Structural Shapes for Use in Building Framing"

10. ASTM F1554-99, "Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength"

11. AWS D1.1-2002, "Structural Steel Welding Code"

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Shop drawings required for all items. Show all work to be fabricated with all construction details shown in appropriate scale, methods of attachment to other materials, finished dimensions, shop welds and grinding of welds, field assembly joints, etc. Indicate welded connections, including net weld lengths, using standard AWS welding symbols.

2. Calculations: Accompany shop drawings with a complete structural design and analysis prepared and certified by a Professional Engineer (P.E.) licensed in the State in which the project is located. The design and analysis shall show all design loads, reactions, forces or stresses, and structural characteristics of members and connections for the items listed in section 2.01.B. Include a certified letter stating that shop drawings as submitted conform to the requirements on the design calculations.

3. Coordinate work with other suppliers and subcontractors; obtain their approved shop drawing where necessary, or obtain any necessary additional detail information regarding mounting conditions or other aspects of related work.

1.05 PRODUCT PROTECTION

A. Package, handle, deliver and store at the job site in a manner that will avoid damage or deformation. Damaged material will be rejected.

B. Furnish items to be built into concrete, masonry, carpentry, etc. as the work progresses.

1.06 JOB CONDITIONS

A. Verify dimensions in field, as required, for pre-cut or prefabricated items.

B. Examine job conditions and adjoining construction which may affect the acceptability of the work.

PART 2: PRODUCTS

2.01 DESIGN

A. All materials shall be free from defects impairing strength, durability, appearance, and shall be of the best commercial quality for the purposes indicated. Structural properties shall be such to withstand safely all strains and stresses to which they will be normally subjected.

B. Metal railings, stairs, catwalks, ladders, and other items specified in this section shall be designed to resist self-weight and the more stringent of:

1. Superimposed Dead and Live Loads indicated on the Contract Documents, and

2. Loads set forth by the governing Building Code.

C. The maximum Live Load deflection shall be L/360. Deflection determined based on structural section(s) alone.

2.02 MATERIALS

A. Structural Steel: ASTM A36 or A992.

B. Fastenings: Bolts, welds, rivets or other fastenings as required.

C. Anchor Bolts, Nuts: ASTM F1554, Grade 36.

D. Steel Pipe: ASTM A53, Grade B.

E. Steel Tubing: ASTM A500 Grade B.

F. Shop Paint Primer: Manufacturer's standard rust inhibiting primer.

G. Stainless Steel:

1. In all other areas where stainless steel is noted, provide grade 302 or 304, #4 satin finish conforming to ASTM A167 standards.

2. In chlorine environments (swimming pools) provide grade 316L (low carbon) with #4 satin finish conforming to ASTM A167 Standards.

H. Galvanizing: ASTM A123.

I. Expansion and Adhesive Anchors.

1. Wedge Anchors: Hilti "Kwik Bolt II" or Ramset/Redhead "Trubolt" or equal.

2. Heavy Duty Sleeve Anchors: Hilti "HSL" or equal.

3. Adhesive Anchors: Hilti "HVA" or "HIT", Ramset/Redhead "EPCON" or equal.

2.03 GENERAL REQUIREMENTS FOR FABRICATION

A. Weld permanent connections wherever possible; use continuous welds where exposed and grind smooth, straighten members after welding.

B. Perform welding in accordance with AWS D1.1.

C. Perform shop cutting, drilling, fitting and assembly wherever possible. Take field measurements before fabrication when required.

D. Provide all supporting members, fasteners, framing, hangers, bracing, brackets, straps, bolts, angles, etc. required to set, connect the work rigidly and properly to other construction.

E. Install welded end caps at all handrail terminations.

2.04 SHOP COATS PROTECTIVE TREATMENT

A. Clean free of all mill scale, rust and foreign matter by wire brushing, scraping, sandblasting or flame cleaning. Remove grease, oil with solvent. Dust, dirt: Remove with air blast or brush.

B. Apply one shop coat of specified primer to all ferrous metal products, except galvanized. Provide primer for field touch up. Be responsible for quality and adhesion of shop prime finish.

C. Hot-dip galvanize all ferrous metal items exposed to weather in the finish work and shop prime with primer recommended for use on galvanized metal.

2.05 SCHEDULE OF MISCELLANEOUS METAL ITEMS

A. Items listed in this Section are intended only as a guide, but do not relieve responsibility for verifying quantities and inclusion of all similar items. Thoroughly examine all Drawings for items of miscellaneous metal fabrications.

1. Overhead door corner guards.
2. Overhead door frames.
3. Steel pipe bollards.
4. Trench drains.
5. Steel bollards for handicap signs as shown on Civil Drawings.
6. Other miscellaneous metal items shown on Drawings.

PART 3: EXECUTION

3.01 INSTALLATION GENERAL REQUIREMENTS

A. Anchor to concrete and masonry with expansion or adhesive anchors where built-in anchorage is not provided; do not fasten to wood plugs set in masonry.

B. Vertical members set into concrete or masonry: As shown.

C. Bolts, screws, etc., for field connections: Same material, finish as base material.

3.02 FIELD SPLICES, WELDS

A. Perform field welding in accordance with AWS D1.1.

B. Welders shall be certified by AWS.

C. Continuously weld field splices and grind smooth where exposed to view.

D. Fill exposed splice joints with body filler and sand smooth.

E. Touch-up joints, welds with specified primer.

F. Touch-up damaged hot dipped galvanizing with Galvanizing Repair Compound per manufacturer's requirements.

3.03 FIELD QUALITY CONTROL

A. Structural Testing and Special Inspection

1. Comply with the requirements of Section 05 10 00 – Structural Steel Framing

2. The Owner will employ a Special Inspector for the following:

   a. Visual inspect 100% of all fillet welds, for size, length, and quality, per AWS D1.1. Qualifications: Technical II.

END OF SECTION 05 50 00

SECTION 06 10 53

CARPENTRY

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Miscellaneous blocking, sleepers and nailers, shown on Drawings or required.

2. Blocking/sill sealer for anchorage of windows, storefront and entrances.

3. Blocking within gypsum wallboard partitions for support of markerboards, grab bars, toilet accessories, casework, hardware, other wall mounted specialties.

4. Painted wood chair rail where shown on Drawings.

B. Related work specified in other sections:

1. Concrete Formwork - Section 03 30 00

2. Plastic Laminate Casework - Section 12 32 16.

3. Pre-Engineered Wood Building System - Section 13 34 21.

1.03 QUALITY ASSURANCE

A. Lumber Grades: Western Wood Products Association "Product Use Manual".

B. Preservative Treated Lumber: American Wood Preservers Bureau, "LP-2 Pressure Treated with Water-Borne Preservatives".

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Furnish certificates for preservative treated lumber.

2. Submit roofing material manufacturer's current printed instructions for installation of nailers.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Immediately upon delivery to job site, place materials in area protected from weather.

B. Store materials a minimum of 6 in. above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation.

C. Do not store seasoned material in wet or damp portions of building.

D. While unloading, protect sheet materials from corners breaking and damaging surfaces.

1.06 COORDINATION

A. Coordinate blocking for windows, storefront and entrances with Section 08 40 00.

B. Coordinate blocking for miscellaneous specialties with Division 10 suppliers.

C. Coordinate blocking for door stops in gypsum walls with Section 08 71 00.

D. Obtain product data, sizes and anchorage requirements prior to installation of blocking.

PART 2: PRODUCTS

2.01 ROUGH HARDWARE

A. Nails, spikes, screws, bolts and similar items of size and types to rigidly secure members in place or as otherwise indicated.

B. Non-corrosive type fasteners for redwood and preservative treated and fire retardant lumber such as stainless steel or double dipped galvanized.

C. Sill Sealer: Closed-cell plastic foam, ¼" thick, selected from manufacturers' standard widths to suit width of sill members indicated.

2.02 LUMBER

A. Framing, blocking lumber: No. 2 or better, S4S, Douglas Fir-Larch, Hem-Fir or Southern Pine, moisture content not to exceed 19%.

1. Provide preservative-treated lumber for work exposed to moisture or indirect contact with concrete slabs. Preservative-treated lumber is not required for blocking that is protected by roofing membrane, peel and stick flashing or weather barrier.

2. Provide fire-retardant lumber for all interior framing and blocking. Concealed blocking does not require to be fire-retardant lumber in construction types other than Type I and Type II.

2.03 PLYWOOD

A. Meet APA C-D exterior, thickness as shown on Drawings.

1. Provide preservative-treated lumber for work exposed to moisture or indirect contact with concrete slabs, as shown on drawings. Preservative-treated lumber is not required for blocking that is protected by roofing membrane, peel and stick flashing or weather barrier.

2. Provide fire-retardant lumber for all interior framing and blocking. Concealed blocking does not require to be fire-retardant lumber in construction types other than Type I and Type II.

B. Medium Density Overlay (MDO) Plywood: Phenolic Resin finished surface on plugged "B" grade ply over "C" grade inner plys.

PART 3: EXECUTION

3.01 ROUGH CARPENTRY

A. Provide wood nailers of size, shape where indicated, required.

B. Fasten securely to substrate with appropriate fasteners. Use expansion-type anchors at masonry or concrete, self-tapping screws at steel. Use corrosive resistant fasteners for roofing applications or where otherwise exposed to moisture.

C. Install blocking for windows, storefront and entrances according to approved Shop Drawings. Blocking shall be continuous the width or height of rough openings, unless otherwise shown on Drawings. Install sill sealer under windowsill blocking as detailed

D. Install blocking for finish materials, such as windows and sheet metal fascias, with minimum number of joints, plumb, level, true and straight with no distortions. Discard materials which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned.

END OF SECTION 06 10 53

SECTION 07 21 00

INSULATION

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes product specification of the following:

1. Perimeter insulation used primarily on vertical surfaces below grade at foundation walls.
2. Cavity wall insulation.
3. Batt insulation used with interior stud wall construction.
4. Sound batt insulation used to control sound transfer in stud wall construction.
5. Expanding foam insulation as shown on drawings.
6. Vapor barriers used under slab, and in combination with batt insulation in walls.
7. Batt insulation occurring in exterior envelope.
8. Acoustic spray system.

B. Installation of insulation specified in other sections:

1. Cast-in-Place Concrete – Section 03 30 00
2. Unit Masonry – Section 04 20 00
3. Carpentry – Section 06 10 53
4. Aluminum Entrances, Storefronts and Curtainwalls – Section 08 40 00
5. Aluminum Windows – Section 08 51 13
6. Gypsum Board – Section 09 21 16
7. Acoustical Ceilings – Section 09 51 00

C. Related work specified in other sections:

1. Pre-Engineered Wood Building System – Section 13 34 21

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

1. ASTM E 1745-09 Standard Specification for Plastic Water Vapor Retarders used in Contact with Soil or Granular Fill under Concrete Slabs.
2. ASTM E154-99 (2005) Standard Test Methods for Water Vapor Retarders used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover.
3. ASTM E96-05 Standard Test Methods for Water Vapor Transmission of Materials.
4. ASTM E 1643-09 Selection, Design, Installation, and Inspection of Water Retarders used in Contract with Soil or Granular Fill under Concrete Slabs.
5. ASTM F 1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
6. ASTM D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

B. American Concrete Institute (ACI):

1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials. Vapor Retarder component is not less than 10 mils thick.

1.04 SUBMITTALS

A. Submit in accordance to Section 01 33 00 Submittals.

B. Vapor Barriers

1. Manufacturer's product samples and literature.
2. Manufacturer's installation instructions for placement, seaming and pipe boot installation.
3. Third party laboratory test results showing compliance with specified properties.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver material to the site in unopened packages, with identification labels intact.

B. Store under water-resistant cover and protect from weather and direct sunlight.

C. Remove damaged materials from site.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not install rigid insulation (on vertical surfaces with adhesive) when temperature is below 40° F., during rain or wet weather, or when surfaces are wet.

1.07 SCHEDULING

A. Coordinate installation with other trades whose work may be affected or have effect.

PART 2: PRODUCTS

2.01 MATERIALS

A. Rigid Board Insulation: Rigid closed cell extruded polystyrene thermal board insulation.

1. Thermal Resistance: Aged R-value per inch of 5 at 75° F mean temperature per ASTM C518.

2. Water Vapor Permeance: 1.5 maximum per ASTM E96.

3. Water Absorption: 0.3% by volume, maximum per ASTM C272.

a. Perimeter Insulation:

1) Conforming to ASTM C578-95 type IV.
2) Compressive strength: 25 psi per ASTM D1621.

b. Cavity Wall Insulation:

1) Conforming to ASTM C578-95 type IV.
2) Compressive strength: 25 psi per ASTM D1621.

B. Batt Insulation:

1. Unfaced fiberglass batt (used in interior) as manufactured by Certain Teed, Johns Manville, and Owens Corning.

a. Thermal resistance: Minimum R-value of 3.3 per inch per ASTM C518.
b. Conforming to property requirements of ASTM C665, type 1 and ASTM E136.

2. Exterior envelope: Unfaced insulation as manufactured by Roxul, or ThermaFiber produced by combining thermosetting resins with mineral fibers manufactured from glass, slag, wool or rock wool. Fiberglass batts are not considered an equal.

   a. Thermal resistance: Minimum R-value of 4 per inch per ASTM C518.
   b. Conforming to property requirements of ASTM C665, type 1 and ASTM E136.
   c. Moisture resistance: Absorbs less than 1% by volume per ASTM C1104.

C. Sound Batt Insulation: ASTM C665, type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag, wool or rock wool. Fiberglass batts are not considered an equal.

1. Fire resistance-rated assemblies: Comply with mineral-fiber requirements of assembly.
2. Use 2" thick batts at stud cavities, 3" thick elsewhere.

D. Acoustic Spray System:

1. Hilti CP 572 Smoke and Acoustic Spray or equal.

   a. Chemical basis: Acrylic
   b. Curving time: +/- 3 days
   c. Skin-forming time: +/- 15 minutes
   d. Application temperature range: 40ºF to 104 ºF
   e. STC classification per ASTM E90: 56
   f. Flame spread per ASTEM E84-08: Flame spread: 10 and smoke development: 5
   g. Movement capability: Approximately 12.5%
   h. Mold resistant
   i. Backing material: Mineral wool.

E. Expanding Foam Insulation: Dow Chemical Great Stuff Pro or equal one part polyurethane foam sealant.

1. Conform to ASTM C557-93, D6464, CA25-4 and is UL Class 1 (Flame Spread of 15, Smoke of 20).
2. Application temperature range of 25°F to 120°F.
3. Paintable, stainable and sandable.
4. Acoustical Rating: Sound transmission class rating of 69.
5. Minimum R.Value of 4 per inch.

F. Vapor Barriers:

1. Walls: Glass reinforced or laminated polyethylene sheet, minimum perm rating, 0.1 when tested in accordance with ASTM-E96, Procedure A.

   a. Vapor Barrier Tape: Compatible polyethylene self adhesive tape recommended by vapor barrier manufacturer.
   b. Adhesive: Manufacturers vapor-proofing mastic.

2. Under Floor Slabs: Meet requirements of ASTM E1745 Class A.

   a. Materials: Meets Class A, 15 mil minimum thickness, high density polyethylene constructed of 100% virgin high-grade, polyolefin resins conforming to the following properties.

1)	Water Vapor Permeance	ASTM E 96	0.01 perms (US) per ASTM E 1745 Sec. 7.1
2)	Water Vapor Transmission	ASTM E 96	0.004 perms (g/hr-m2)
3)	Water Vapor Barrier	ASTM E 1745	Exceeds Class A (Plastics)
4)	Tensile Strength	ASTM D 882	60 lbs/in.
5)	Puncture Resistance	ASTM D 1709	2200 grams

6)	Life Expectancy	ASTM E 154	Indefinite
7)	Chemical Resistance	ASTM E 154	Unaffected
8)	Peel Adhesion to Concrete	ASTM D 903	8 lbs/in.

3. Vapor Barrier Accessories:

   a. Seam tape and vapor proofing mastic conforming to the following properties and as recommended by vapor barrier manufacturer:

1)	Water Vapor Permeance	ASTM E 96	0.03 Perms
2)	Tensile Strength (lbs/in)	ASTM D 1970	MD-20.09/TD-26.42
3)	Peel Adhesion (lbs/in)	ASTM D 3330	5.55
4)	Total Thickness		6 mil

   b. Pipe boots constructed from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

   c. Mastic to have a water vapor transmission rate per ASTM E 96, 0.3 perms or lower.

   d. Material for conduit/pipe bank sealing (when pipe boots will not work): Granular Seaming Bentonite with the following properties:

      1) Moisture: 9%
      2) PH of 6 percent suspension: PH 9.5
      3) Plate Water Absorption: 900 w+%
      4) Swell Index (ASTM D 5890): 28 ml
      5) Specific Gravity: 2.7
      6) Calcium Oxide (Ca0): 0.70%
      7) Surface Area (N_2 absorption): 20 m^2/gram
      8) Bulk Density (uncompacted): 61 lb/ft^3
      9) Bulk Density (compacted): 68 lb/ft^3

   e. Termination Bar: TB-100 termination bar with sealant ledge, .100" thick x 1" wide extruded aluminum with ¼" x 3/8" slotted holes at 8" o.c. as manufactured by Tru-Fast Corp (1-800-443-9602) or equal. Vapor Barrier manufacturers standard plastic termination bar is also acceptable. Fasteners to be stainless steel or galvanized for compatibility with aluminum.

PART 3: EXECUTION

3.01 INSTALLATION

A. Refer to specific specification sections for installation.

END OF SECTION 07 21 00

SECTION 07 62 13

SHEET METAL FLASHING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Sheet metal flashing and counterflashing shown on Drawings.

2. Prior to installation of finished materials, all flexible flashings shall be observed by the Architect. The Architect shall be given a minimum of 72 hours notice prior to the desired observation time. Any finish materials (i.e., brick, insulation, metal, etc.) installed without observation by the Architect shall be removed and replaced at the Contractor's expense.

B. Related work specified elsewhere:

1. Flexible flashing – Section 07 65 00.

2. Wood blocking, nailers – Section 06 10 53.

3. "Roofing", "Flashings", and "Coping" – Division 7 Roofing Specifications.

4. Aluminum flashing at windows, storefront and curtainwall - Division 8.

5. Sheet metal for mechanical work – Division 23.

1.03 QUALITY ASSURANCE

A. Referenced Standards: Recommended practices as set forth by the Sheet Metal and Air Conditioning Contractors Association, Inc. (SMACNA) in the "Architectural Sheet Metal Manual" are by reference made a part of this work.

B. Perform Work in a manner that will maintain warranties on associated work specified in other sections.

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Shop Drawings: Indicating joint treatment, fastening methods, thickness and finish of materials.

2. Samples: Actual metal samples of each color indicated.

PART 2: PRODUCTS

2.01 GENERAL

A. Provide all accessories, other items essential to completeness of installation, though not indicated, specified. All such items, unless otherwise indicated, specified: Of same kind of material as item to which applied. Nails, screws, bolts: Of types best suited for purpose intended, of composition that is compatible with metal to which it will contact.

B. Type, locations of various kinds, gauges, thickness, finish of Sheet Metal to be used is specified hereinafter, however, where sheet metal is indicated and kind, type of metal is not definitely specified, noted, provide 24 ga. prefinished galvanized steel.

2.02 MATERIALS

A. Sheet Metal (Exposed)

1. Materials manufactured by Firestone Building Products - UNICLAD are specified. Other manufacturers meeting specified requirements are acceptable, subject to approval of color and warranty.

2. Minimum 24 ga. G-90 galvanized steel prefinished with Kynar 500 or Hylar 5000 fluorocarbon coating.

3. Colors: As selected by Architect from manufacturer's full line of available colors.

4. Provide 20 year warranty covering color fade, chalking and film integrity. (Submit per Section 01 78 23)

5. Provide factory applied protective film. Do not remove until after fabrication and installation is complete.

B. Sheet Metal (Concealed): Minimum 22 ga. G-90 hot dipped galvanized steel.

C. Solder: ASTM B32, 50% tin, 50% lead.

D. Elastomeric Sealant: Generic type recommended by manufacturer of metal and other components being sealed.

E. Flexible Flashings: Conform to the requirements of Section 07 65 00/13 "Flashings."

2.03 FABRICATION

A. Accurately form work with brakes straight, true and sharp. Make plain surfaces free from waves and buckles. Match profiles exactly at connections. Bead or return exposed edges for strength and appearance. Provide ribs, cleats and reinforcement necessary to make the sections rigid and substantial. Allow for expansion and contraction.

B. Overlap seams in the direction of flow. Finished width of lock seams and soldered lap seams: Not less than 1". Finished width of unsoldered lap seams: Not less than 3".

C. Locate joints of sheet metal work exposed to view with respect to column centers, mullions, control joints or other architectural features as indicated on the Drawings or as directed by the Architect. Use concealed cover plates. Where appearance is not a factor, sheet metal work may be fabricated in 8 or 10-foot lengths.

D. Generally, joints shall be single locked and soldered or double locked and sealed. Field joints shall be designed to permit expansion. Shop form corner pieces. Internal corners shall be lapped, riveted and sealed. External corners shall be lapped, riveted and sealed where exposed to view and locked and soldered where appearance is not a factor. Locate field joints not less than 12" nor more than 3 feet from actual corner.

E. Fabricate sheet metal to be installed using concealed clips or other concealed fasteners where possible. Form joints and hem edges to conceal uncoated edges of metal. Handle prefinished sheet metal with care to prevent scratching or damaging surface.

PART 3: EXECUTION

3.01 WORKMANSHIP

A. Examine surfaces to be covered by sheet metal. Report any improper defective surfaces to Contractor, Architect in writing. Beginning of Sheet Metal Work over surfaces: Presumed as acceptance of surfaces as satisfactory by Sheet Metal Sub-contractor.

B. Verify field dimensions prior to fabrication.

C. Junctures where sheet metal abuts into adjacent dissimilar materials: Executed in manner that will prevent electrolysis between the two materials.

D. Insure that all work is precisely done, true to line, and free from over bending, burning, deforming, stretching, distortion, waves and buckles.

E. Seal under and around all fasteners which penetrate elastomeric roofing or flashing.

3.02 REPAIR

A. Repair or replace all damaged or defective work.

3.03 CLEANING

A. Clean exposed sheet metal of roofing materials, mortar, hand marks, other foreign materials.

B. Remove protective covering from sheet metal.

C. Touch up minor scratches in finish with matching paint, compatible with specified finish.

END OF SECTION 07 62 13

SECTION 07 65 00

FLASHING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes product specification of the following:

1. Flexible and metal flashing used in masonry, exterior finish materials and exterior openings.

B. Installation of flashings installed in other sections:

1. Unit Masonry – Section 04 20 00.
2. Sheet Metal Flashing – Section 07 62 13.
3. Aluminum Entrances, Storefronts and Curtainwalls – Section 08 40 00
4. Aluminum Windows – Section 08 51 13
5. Louvers – Section 08 91 00.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Product data indicating proposed material conforms to specification.
2. Submit samples of all specified materials for review.

PART 2: PRODUCTS

2.01 MATERIALS

A. Products by WR Grace are specified unless noted otherwise. Equivalent products by Carlisle Coatings and Waterproofing, Miradri, Polyken, WR Meadows are acceptable.

B. Flexible Flashing: Perm-A-Barrier Wall Flashing manufactured of 32 mils of self-adhesive rubberized asphalt integrally bonded to 8 mil of cross-laminated, high-density polyethylene film to provide a min. 40 mil thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:

1. Water Vapor Transmission: ASTM E96, Method B: 2.9 ng/m2sPa (0.05 perms) max.
2. Water Absorption: ASTM D570: max. 0.1% by weight
3. Puncture Resistance: ASTM E154: 356 N (80 lbs.) min.
4. Tear Resistance

    a. Initiation ASTM D1004: min. 58 N (13.0 lbs.) M.D.
    b. Propagation ASTM D1938: min. 40 N (9.0 lbs.) M.D.

5. Lap Adhesion at -4ºC (25ºF): ASTM D1876: 880 N/m (5.0 lbs./in.) of width
6. Low Temperature Flexibility ASTM D1970: Unaffected to -43ºC (-45ºF)

7. Tensile Strength: ASTM D412, Die C Modified: min. 5.5 MPa (800 psi)
8. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: min. 200%.

9. Wall Flashing Accessories:

   a. Surface Conditioner:

      1) Perm-A-Barrier Surface Conditioner: Water based latex liquid for substrate preparation conforming with the following:

         (1.) Flash Point: No flash to boiling point
         (2.) Solvent Type: Water
         (3.) VOC Content: Not to exceed 125 g/L
         (4.) Application Temperature: -4°C (25°F) and above
         (5.) Freeze/Thaw Stability: 5 cycles min.
         (6.) Freezing point (as packaged): -10°C (14°F)

   b. Termination Mastic:

      1) Bituthene® Mastic: Rubberized asphalt-based mastic with 20 g/L max. VOC Content.

   c. Optional Primers:

      1) Bituthene Primer WP-3000: Water-based latex primer with 110 g/L max. VOC Content.

      2) Bituthene Primer B2: Rubber-based primer in solvent with 440 g/L max. VOC Content.

C. Miscellaneous Accessories

1. Metal Flashing: 24 ga. G-90 hot dipped galvanized steel, prefinished with Kynar 500 or Hylar 5000 fluorocarbon coating.

   a. Color: See various technical sections for colors.

   b. Provide 20 year warranty covering color fade, chalking and film integrity.

   c. Provide factory applied protective film. Do not remove until after fabrication and installation is complete.

2. Rope Wicks: 1/4" cotton sash cord.

3. Flashing Termination Bar and Fasteners.

   a. Termination bar: TB-100 termination bar with sealant ledge, .100” thick x 1” wide extruded aluminum with ¼” x 3/8” slotted holes at 8”o.c. as manufactured by Tru-Fast Corp. (800-443-9602) or equal.

   b. Fasteners to be #14 x 1 ¼”stainless steel Crete Flex SS4, hex head with silver stalgard finish as manufactured by ELCO Fastening Systems or equal.

PART 3: EXECUTION

3.01 INSTALLATION OF ACCESSORIES

A. See various technical sections listed in paragraph 1.02.B for installation of flashings.

END OF SECTION 07 65 00

SECTION 07 65 19

WEATHER BARRIER

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes product specification of the following:

1. Fluid applied vapor permeable weather barrier on exterior sheathing behind other exterior finishes. Provide all auxiliary materials including liquid membrane for detailing wall primer, flexible membrane, joint reinforcing strips, transition membranes, substrate patching membrane, and foam sealant for a complete installation.

B. Installation of flashings installed in other sections:

1. Unit Masonry – Section 04 20 00.
2. Gypsum Sheathing – Section 06 16 43.
3. Sheet Metal Flashing – Section 07 62 13.
4. Aluminum Entrances, Storefronts and Curtainwalls – Section 08 40 00.
5. Louvers – Section 08 91 00.
6. Pre-engineered Wood Building System – Section 13 34 21.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of weather barrier.

2. Shop Drawings: Show locations and extent of weather barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

   a. Include details of interfaces with other materials that form part of weather barrier.
   b. Include details of mockups.

3. Samples: Submit representative samples of the following for approval:

   a. Fluid applied membrane
   b. Transition Membrane
   c. Through Wall Flashing

4. Product Certificates: For weather barriers, certifying compatibility of weather barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

5. Qualification Data: For Applicator.

6. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for weather barriers, submit certified test report showing compliance with requirements specified for ASTM E2178.

1.05 PERFORMANCE REQUIREMENTS

A. General: Weather barrier shall be capable of performing as a continuous vapor-impermeable weather barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Weather barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

1.06 REFERENCES

A. The following standards and publications are applicable to the extent referenced in the text. The most recent version of these standards is implied unless otherwise stated.

B. American Society for Testing and Materials (ASTM)

1. C836 Standard Specification for High Solids, Cold Liquid-Applied Elastomeric.
2. D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
3. E96 Test Methods for Water Vapor Transmission of Materials
4. E2178 Standard Test Method for Air Permeance of Building Materials
5. D95 Water absorption
6. E154 Resistance to degradation
7. D412 Standard Test Methods for Rubber Properties in Tension.

1.07 QUALITY ASSURANCE

A. Manufacturer: Weather barrier systems shall be manufactured and marketed by a firm with a minimum of 5 years experience in the production and sales of flashing and weather barriers.

B. Source Limitations: Obtain primary weather-barrier material and through wall flashing through one source from a single manufacturer.

C. Applicator Qualifications: A firm experienced in applying weather barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

D. Mockups: Before beginning installation of weather barrier, provide weather barrier work for exterior wall assembly mockups, incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of weather barrier membrane.

1. Coordinate construction of mockup to permit inspection by Owner's testing agency of weather barrier before external insulation and cladding is installed.
2. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply weather barrier until mockups are approved.

E. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Preinstallation conference shall include the Contractor, installer, Architect, and system manufacturer's field representative. Agenda for meeting shall include but not be limited to the following:

1. Review of submittals.
2. Review of surface preparation, minimum curing period and installation procedures.
3. Review of special details and flashings.

4. Sequence of construction, responsibilities and schedule for subsequent operations.
5. Review of mock-up requirements.
6. Review of inspection, testing, protection and repair procedures.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

B. Do not double-stack pallets of fluid applied membrane components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.

C. Store fluid-applied membrane components above 40°F.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Apply weather barrier within the range of ambient and substrate temperatures recommended by weather barrier manufacturer. Protect substrates from environmental conditions that affect performance of weather barrier. Do not apply weather barrier to a wet substrate or during snow, rain, fog, or mist.

PART 2: PRODUCTS

2.01 MATERIALS

A. Products by Polyguard Products (www.polyguardproducts.com) are specified.

1. Similar products by the following manufacturers are acceptable:

a. TK Products "Airmax" (www.tkproducts.com)
b. BASF – "Enershield" (www.wallsystems.basf.com)

2.02 WEATHER BARRIER (VAPOR-IMPERMEABLE)

A. Fluid-Applied, Fully-Adhered, Vapor-Impermeable Membrane Air Barrier, Basis of Design: Subject to compliance with requirements, provide the following:

1. Single component, elastomeric, thermoplastic rubber: Polyguard AirLok Flex

B. Physical and Performance Properties: Provide products with the following minimum properties:

Property	Test Method	Typical Value
Cured Film Thickness	ASTM D 3767 Method A	0.010 in. nominal
Solids Content	ASTM D 1644	100%
Air Permeance at 75Pa (0.3 in. water) Differential Pressure	ASTM E 2178	<0.0007 cfm/ft^2
Assembly Air Permeance at 75Pa (0.3 in. water) Differential Pressure	ASTM E 2357	0.0008 cfm/ft^2
Water Vapor Permeance	ASTM E 96, Method BW	Less than 0.1 Perms
Pull Adhesion	ASTM D 4541	>100 psi
Elongation	ASTM D 412	500% minimum
Pliability, 180° Bend over 1 in. Mandrel at -23°F	ASTM D 1970	Unaffected
Low Temperature Flexibility and Crack Bridging	ASTM C836	Pass

1/8 in. crack cycling at -15°F		
Extensibility over 1/4 in. crack after heat aging	ASTM C836	Pass

2.03 WEATHER BARRIER (VAPOR-PERMEABLE)

A. Fluid-Applied, Fully-Adhered, Vapor-Permeable Membrane Air Barrier, Basis of Design: Subject to compliance with requirements, provide the following:

1. Single Component, Elastomeric, Rubber: Polyguard AirLok Flex VP

B. Physical and Performance Properties: Provide products with the following minimum properties:

Property	Test Method	Typical Value
Air Permeance	ASTM E 2178-01	≤0.0037 cfm/ft^2 on sheathing @ 70 SF/gal
Membrane Vapor Permeance	ASTM E 96	7.6 Perms
Elongation	ASTM D 412	500% minimum

2.04 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Liquid Membrane for substrate patching, details and terminations.

1. Poly-Wall Hole Filler or Poly-Wall Fiber Flash

   a. Air permeability system: 0.0007 cfm/ft^2 ASTM E2178
   b. Elongation: 275% ASTM D 412
   c. Low Temperature Pliability: -75°F.
   d. UV Rating: 2000 hours no change ASTM G 26.

C. Transition Membrane: Poly-Wall Self-Adhering Flashing. A self-adhesive polymer-modified asphalt laminated to a high-density polyethylene film conforming with the following:

1. Water Vapor Transmission: ASTM E96, Method B: .05 grains/sq.ft./hr./in.
2. Air Permeance: ASTM D 2178-01: .0014 cfm/ft^2
3. Puncture Resistance: ASTM E154: 178 N (40 lbs.) min.
4. Peel and Lap Adhesion ASTM D 1000 8lbs/in width.
5. Tensile Strength: ASTM D412, Die C Modified: min 325 psi
6. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, 600%.

D. Transition Membrane Primer: Poly-Wall Commercial Stretch and Poly-Wall AirLok Flex.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.

3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
4. Verify that masonry joints are tooled and completely filled with mortar.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid-applied air barrier system.

B. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws. Pre-treat all open board joints with liquid membrane or transition membrane.

C. Related Materials: Treat construction joints and install flashing as recommended by manufacturer.

D. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

E. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

F. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

G. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.

H. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

3.03 WEATHER BARRIER MEMBRANE INSTALLATION

A. Apply weather barrier membrane to achieve a continuous air barrier according to weather barrier manufacturer's written instructions.

B. Apply weather barrier membrane within manufacturer's recommended application temperature ranges.

C. Application of Fluid Applied Membrane:

1. Spray, brush or roll to apply a continuous uniform film at min. 40 mils (vapor impermeable) and 32 mils (vapor permeable wet film thickness. Average 10 mil (vapor impermeable) and 19 mil (vapor permeable) dry thickness.

2. Carry membrane into any openings a minimum of 2 in.

3. Seal all brick-ties and other penetrations as work progresses.

D. Do not cover weather barrier until it has been tested and inspected by Owner's testing agency.

E. Correct deficiencies in or remove weather barrier that does not comply with requirements; repair substrates and reapply weather barrier components.

3.04 TRANSITION MEMBRANE INSTALLATION

A. Detailing must be completed prior to 24 hours after application of the Fluid Applied Membrane. Apply transition membrane with a minimum overlap of 3 in. onto each surface at all beams, columns, joints and as indicated in detail drawings.

B. Tie into window and door frames, spandrel panels, roof and floor intersections and changes in substrate.

C. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.05 CLEANING AND PROTECTION

A. Protect weather barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

B. Schedule work to ensure that the weather barrier system is covered as soon as possible after installation. Protect weather barrier system from damage during subsequent operations. If the weather barrier system cannot be covered within 180 days (vapor impermeable) and 365 days (vapor permeable) after installation, apply temporary UV protection such as dark plastic sheet or tarpaulins.

C. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

D. Remove masking materials after installation.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspections: Weather barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of weather barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of weather barrier system has been provided.
3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed, if applicable.
7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Strips and transition strips have been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

C. Tests: Testing to be performed will be determined by Owner's testing agency from among the following tests:

1. Qualitative Testing: Weather barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, smoke pencil with pressurization or depressurization.

D. Remove and replace deficient weather barrier components and retest as specified above.

END OF SECTION 07 65 19

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between, fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. Only tested firestop systems shall be used in specific locations as follows:

1. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

2. Safing slot gaps between edge of floor slabs and curtain walls.

3. Openings between structurally separate sections of wall or floors.

4. Gaps between the top of walls and ceilings or roof assemblies.

5. Expansion joints in walls and floors.

6. Openings and penetrations in fire-rated partitions or walls containing fire doors.

7. Openings around structural members which penetrate floors or walls.

1.04 RELATED WORK OF OTHER SECTIONS

A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:

1. Section 03 30 00 - Cast-In-Place Concrete
2. Section 07 92 00 - Joint Sealers
3. Section 04 20 00 - Masonry Work
4. Section 09 24 /09 23 00 - Lath and Plaster
5. Section 09 21 16 - Gypsum Drywall Systems
6. Division 23 - HVAC
7. Division 21 - Fire Protection
8. Division 22 - Plumbing
9. Division 26 – Electrical
10. Division 27 – Communications
11. Division 28 – Electronic Safety and Security

1.05 REFERENCES

A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"

B. Test Requirements: UL 1479, “Fire Tests of Through-Penetration Firestops”

C. Test Requirements: UL 2079, “Tests for Fire Resistance of Building Joint Systems”

D. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:
   a. Firestop Devices (XHJI)
   b. Fire Resistance Ratings (BXRH)
   c. Through-Penetration Firestop Systems (XHEZ)
   d. Fill, Voids, or Cavity Material (XHHW)
   e. Forming Materials (XHKU)
   f. Joint Systems (XHBN)
   g. Perimeter Fire Containment Systems (XHDG)
2. Alternate Systems: “Omega Point Laboratories Directory” (updated annually).

E. Test Requirements: ASTM E 1966, “Standard Test Method for Fire Resistive Joint Systems”

F. Test Requirements: ASTM E 2307, “Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus”

G. Inspection Requirements: ASTM E 2174, “Standard Practice for On-site Inspection of Installed Fire Stops”

H. ASTM E 84, “Standard Test Method for Surface Burning Characteristics of Building Materials”

I. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

J. International Building Code as modified by local jurisdiction.

K. NFPA 101 - Life Safety Code

L. NFPA 70 - National Electric Code

1.06 QUALITY ASSURANCE

A. A manufacturer's direct representative to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation must meet requirements of ASTM E 814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.07 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions.

2. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in the assembly drawing.

3. Material safety data sheets provided with product delivered to job-site.

4. Documentation from manufacturer that all firestopping installations on-site meet their requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.09 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Firestopping Materials are either "cast-in-place" (integral with concrete placement) or "post installed." Provide cast-in-place firestop devices prior to concrete placement.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ), joint systems (XHBN), and perimeter firestop systems (XHDG) listed in Volume 2 of the UL Fire Resistance Directory: Products specified are by Hilti, Inc., Tulsa, Oklahoma, 800-879-8000/www.us.hilti.com

1. Manufacturers with products which conform to requirements specified herein are acceptable.

2.03 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E 814 or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. L-Rated Systems: Where through-penetration firestop systems are indicated in smoke barriers, provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq. ft. at both ambient temperatures and 400 deg F.

C. Cast-in place firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and cable bundles penetrating concrete floors, the following products are acceptable:

1. HILTI
   a. CP 680 Cast-In Place Firestop Device
      1) Add Aerator adaptor when used in conjunction with aerator ("sovent") system.
   b. CP 682 Cast-In Place Firestop Device for use with noncombustible penetrants

D. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:

1. HILTI
   a. FS-ONE Intumescent Firestop Sealant
   b. CP 604 Self-leveling Firestop Sealant
   c. CP 620 Fire Foam
   d. CP 606 Flexible Firestop Sealant
   e. CP 601s Elastomeric Firestop Sealant

E. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. HILTI
   a. CP 601s Elastomeric Firestop Sealant
   b. CP 606 Flexible Firestop Sealant
   c. FS-ONE Intumescent Firestop Sealant

F. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:

1. HILTI
   a. CP CFS-SP WB Joint Spray
   b. CP 601s Elastomeric Firestop Sealant
   c. CP 606 Flexible Firestop Sealant
   d. CP 604 Self-leveling Firestop Sealant

G. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material.

1. HILTI
   a. CP 777 Speed Plugs
   b. CP 767 Speed Strips

H. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:

1. HILTI
   a. FS-ONE Intumescent Firestop Sealant

I. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:

1. HILTI
   a. FS-ONE Intumescent Firestop Sealant
   b. CP 620 Fire Foam
   c. CP 601s Elastomeric Firestop Sealant
   d. CP 606 Flexible Firestop Sealant

J. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:

1. HILTI
   a. CP 618 Firestop Putty Stick
   b. CP 658T Firestop Plug

K. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:

1. HILTI
   a. CP 617 Firestop Putty Pad

L. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

1. HILTI
   a. CP 643N Firestop Collar
   b. CP 644 Firestop Collar
   c. CP 645/648 Wrap Strips

M. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. HILTI
   a. CP 637 Firestop Mortar
   b. FS 657 FIRE BLOCK
   c. CP 620 Fire Foam
   d. CP 675T Firestop Board

N. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. HILTI
   a. FS 657 FIRE BLOCK
   b. CP 675T Firestop Board

O. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:

1. HILTI
   a. CP CFS-SP WB Joint Spray
   b. CP 601s Elastomeric Firestop Sealant
   c. CP 606 Flexible Firestop Sealant
   d. CP 604 Self-Leveling Firestop Sealant

P. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:

1. HILTI
   a. FS 657 FIRE BLOCK
   b. CP 658T Firestop Plug

Q. For data and communication penetrations in fire and smoke rated assemblies. (Similar products by other manufacturers that allows for ease of re-penetration without the use of sealants or caulking are acceptable.)

1. HILTI
   a. CP 653 2" Speed Sleeve
   b. CP 653 4" Speed Sleeve.

R. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

S. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction joint assembly.

T. Identification Labels

1. Pressure-sensitive, self adhesive, preprinted vinyl labels with the following verbiage:
   a. "Warning: Fireblocking Application – Do Not Disturb. Notify Building Management of Any Damage"
   b. Installing Contractor's name, address and phone number.
   c. Date of installation.
   d. Fireblocking/Stopping product manufacturer's name.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.

2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trades to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or Omega Point Laboratories Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

3. Protect materials from damage on surfaces subjected to traffic.

C. Identification: Install identification labels no greater than 6 feet from penetration or 6 feet on center on continuous firestopping applications.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

E. Manufacturer to inspect sealed penetrations for conformance with appropriate product data information for each contractor installing firestopping on site.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION 07 84 00

SECTION 07 92 00

SEALANTS AND CAULKING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Exterior colored sealants:

1. Joints in masonry.
2. Joints around hollow metal.
3. Miscellaneous joints where "sealant" or "caulk/caulking" is indicated on drawings.
4. Joints around mechanical, electrical and architectural penetrations of exterior.
5. Installation of sealant on masonry quality control panel for color match and adhesion verification by means of an adhesion test.

B. Interior colored sealants:

1. Note: Sealant on materials to be painted will be installed after painting is completed and shall match paint color. A "sacrificial" backer rod shall be installed prior to painting to protect joints from paint over spray. This backer rod may be pushed into the joint or removed prior to installation of final backer rod and sealant.
2. Interior joints around hollow metal, including joint between hollow metal and hard surface flooring.
3. Joints in slabs and at edges where painted, exposed or sealed concrete is shown on Drawings.
4. Miscellaneous joints where "sealants" or "caulk/caulking" is indicated on Drawings.

C. Related work specified in other sections:

1. Sealant for firestopping – Section 07 84 00.

2. Sealant for sheet metal joints – Section 07 62 00.

3. Caulking around windows, storefront and curtainwall – Division 8.

4. Glazing – Section 08 80 00.

5. Acoustical sealant – Section 09 21 16.

6. Sealants at tilework – Section 09 30 00.

7. Sealing at plumbing fixtures and mechanical penetrations through rated walls – Division 21-25.

8. Sealing of electrical penetrations through rated walls – Divisions 26-28.

1.03 REFERENCES

A. ASTM C 920 – Specification for Elastomeric Joint Sealants.

B. ASTM C 1193 – Standard Guide for Use of Joint Sealants.

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods including joint design, surface preparation, and application instructions.
4. Submit manufacturer's test reports indicating test results of adhesion and/or compatibility testing of samples of substrates which either come in contact with or are in close proximity to sealants.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors or samples of custom color matches for Architect's acceptance.

D. Samples of Warranty.

E. Manufactures approval of installer.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications

1. Company specializing in performing work of this section with minimum three years documented experience, minimum three successfully completed projects of similar scope and complexity, and approved by manufacturer.
2. Designate one individual as project foreman who shall be on site at all times during installation.

B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Prepare mock-ups for sealants and for each type of surface using same materials, tools, equipment, and procedures intended for actual surface preparation and application under actual use and environmental conditions. Mock-ups must be complete for 14 days prior to review by Architect.
2. Before installing exterior sealants, field test their adhesion to Project joint substrates as follows:
   a. Conduct field tests for each kind of joint substrate indicated.
   b. Notify Architect seven days in advance of dates and times when test joints will be erected.
   c. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
      1) Test per Field Quality Testing in Part 3 of this Specification.
3. Observe for sealant and surface staining or discoloration.
4. Retain acceptable mock-ups to establish intended standards by which sealants will be judged.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in manufacturers unopened original packaging. Inspect for damage.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1. Store materials in a clean, dry area indoors in accordance with manufacturer's instructions.
2. Store sealants within temperature range in accordance with manufacturer's instructions.
3. Keep containers sealed until ready for use.
4. Do not use materials after manufacturer's use-before date.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1. Do not apply sealants to surfaces that are wet, damp, or contain frost.

2. Do not apply sealants when air or surface temperature is below 40 degrees F.
3. Use caution when applying sealants when air or surface temperature is above 120 degrees F.

1.08 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty for Exterior Sealants: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 EXTERIOR SEALANTS

A. Silicone Sealant: Single Component, Nonsag, Neutral-Curing Silicone joint sealant conforming to ASTM C 920, Type S, Grade NS, Class 100/50. Maximum VOC: 98 g/L

1. Manufacturers/product:
   a. Dow Corning, 790.
   b. GE/Momentive Performance Materials, SilPruf LM SCS 2700.
   c. Pecora, 890 or 890 FTS
   d. Temco Spectrem 1 or Spectrem 4

2. Colors: Custom colors to match material or finish sealant occurs in.

2.02 INTERIOR SEALANTS

A. Polyurethane Sealant: Multi-component, high-performance polyurethane sealant conforming to ASTM C 920, Type M, Grade NS, Class 25. Maximum VOC: 25 g/L.

1. Manufacturers/product:

   a. Pecora, Dynatrol II
   b. SIKA, SIKAFLEX 2-C
   c. BASF MaterSeal NP2
   d. Tremco, Dymeric 240/240FC

2. Colors: Custom colors to match material or finish sealant occurs in.

2.03 ACCESSORIES

A. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

B. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

C. Joint Backing: Round foam rod compatible with sealant; oversized 25 to 50 percent larger than joint width; recommended by sealant manufacturer to suit application.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

E. Masking Tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces.

PART 3: EXECUTION

3.01 EXAMINATION

A. Inspect joints for compliance with requirements for joint configuration, installation tolerance, and other conditions affecting joint sealant performance. Correct unsatisfactory conditions before proceeding.

B. Do not install sealants during use of temporary heaters or until vapors from temporary heaters are flushed from building. Do not install sealant when painting operations are in progress.

3.02 PREPARATION

A. Prepare joints in accordance with ASTM C 1193 and manufacturer's instructions.

B. Clean out joints immediately before installing joint sealants (within 1 to 2 hours of sealant application), in accordance with joint sealant manufacturer's recommendations and the following requirements:

1. Remove from joint substrates foreign material which could interfere with adhesion of joint sealant, including paints other than permanent protective coating tested and approved for sealant adhesion and compatibility by sealant manufacturer, oil, grease, waterproofing, water repellants, water dirt, and frost.

2. Clean porous joint substrates using approved methods such as brushing, grinding, blast cleaning, mechanical abrading, and acid washing as appropriate, or a combination of these methods, to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form-release agents from concrete.

4. Clean metal and other nonporous substrates by using chemical cleaners or other means that neither are harmful to substrates nor leave residues capable of interfering with adhesion of joint sealants.

C. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to area of joint sealer bond; do not allow spillage or migration onto adjoining surfaces. Allow primer to dry before applying sealant.

D. Masking Tape: Use masking tape where required to prevent contamination of adjacent surfaces; remove tape immediately after tooling and before sealants begin to cure without disturbing seal.

3.03 SEALANT INSTALLATION

A. Comply with joint sealant manufacturer's printed installation instructions.

B. Installation of Sealant Backings:

1. Install joint filler to provide support of sealant during application and at position required to produce the cross-sectional shape and depth of installed sealant relative to joint width that allows optimum sealant movement capability.

a. Do not leave gaps between ends of joint fillers.

b. Do not stretch, twist, puncture, or tear joint fillers.

c. Remove fillers which have become wet prior to sealant application and replace with dry materials.

2. Install bond breaker tape when joint depth is to shallow to allow backer rod.

C. Installation of Sealant:

1. Install sealants by proven techniques that result in direct contact with and full wetting of joint substrates by joint sealant, completely filling recesses provided and providing uniform cross-sectional shapes and depths relative to joint widths. Sealant depth to be ½ the width of the joint and 1/3 the width at the center, creating an hourglass shape. Maximum depth of caulk at center to be 3/8". Air pockets or voids are not acceptable.

2. Immediately after sealant application and prior to the skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or which are not approved by sealant manufacturer.

3.04 PROTECTION AND CLEANING

A. Protect joint sealers, during and after curing, from contamination or damage. Cut out and remove damaged or deteriorated sealers and replace with new materials.

B. Clean excess sealants or sealant smears adjacent to joints as work progresses.

3.05 FIELD QUALITY CONTROL

A. Perform adhesion tests on exterior sealant in accordance with manufacturer's instructions and ASTM C1193, Method A, Field-Applied Sealant Joint Hand-Pull Tab.

1. Perform 5 tests for first 1,000 linear feet of applied exterior sealant and 1 test for each 1,000 feet of seal thereafter. If there is less than 1,000 feet, perform 1 test per floor per building elevation minimum.
2. For sealant applied between dissimilar materials, test both sides of joint.

B. Sealants failing adhesion test shall be removed, substrates cleaned, sealants re-installed, and re-testing performed.

C. Maintain test log and submit report to Architect indicating tests, locations, dates, results, and remedial actions.

END OF SECTION 07 92 00

SECTION 08 10 00

STEEL DOORS AND FRAMES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. All hollow metal doors, doorframes and borrowed light frames.

2. Rated doors and frames as scheduled and/or noted on Code Plans.

3. Conduits and boxes in frames for powered hardware.

B. Related work specified in other sections:

1. Finish hardware – Section 08 71 00.

2. Glazing – Section 08 80 00.

3. Painting – Section 09 91 00.

1.03 QUALITY ASSURANCE

A. Provide doors and frames complying with the SDI Standard 100-"Recommended Specifications Standard Steel Doors and Frames" and as herein specified.

B. Obtain hardware templates from hardware supplier (Section 08 71 00) and obtain necessary hardware for factory application.

C. Where noted on Door Schedule, provide nationally recognized testing agency label of proper classification. Label requirements take precedence over conflicting details. Advise the Architect of any conflict before fabricating work on that item is started.

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Coordinate with any special conditions of anchorage. Submit door/opening schedule on shop drawings indicating relationship of door, number of room, number and function of door, such as Corridor A-13 to Lavatory A-14.

2. Shop Drawings: Include the following:

a. Elevations of each door design.
b. Details of doors, including vertical and horizontal edge details and metal thicknesses.
c. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
d. Locations of reinforcement and preparations for hardware.

e. Details of each different wall opening condition.
f. Details of anchorages, joints, field splices, and connections.
g. Details of accessories.
h. Details of molding, removable stops, and glazing.
i. Detail of conduit and preparations for power, signal, and control systems.
j. Rating of doors and frames as noted on door/opening schedule and/or Code Plan.

1.05 PRODUCT PROTECTION

A. Deliver doors and frames in suitable crating or packaging to prevent damage in transit and storage.

B. Storage at jobsite:

1. Store frames on plywood and block at least 4" above plywood, under waterproof cover.
2. Store doors under cover in a dry area with doors set upright with ¼ inch spacers between doors. Keep doors at least 4" above ground.
3. Do not store HM material in a manner that traps excess humidity.
4. Materials that are rusted prior to installation may be rejected.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Approved Manufacturer(s): Steelcraft, Pioneer, Ceco, Curries.

B. Accompany any request for acceptance of alternative manufacturers by descriptive details or brochures demonstrating compliance with specifications, and sample frame corner.

2.02 MATERIALS

A. Steel: Commercial quality, level, cold rolled steel conforming to ASTM A366, free of scale and surface defects. Commercial quality hot rolled and pickled steel conforming to ASTM A569 may be used at contractor's option for interior frames. Where noted, form frames of galvanized steel conforming to ASTM A526 or A527, A60 zinc coating. Gauges are as follows unless otherwise noted:

1. Interior Frames: 16 gauge.

2. Exterior Frames: 14 gauge, galvanized.

3. Flush Doors: 16 gauge galvanized (exterior), 18 gauge (interior).

4. Rough Bucks and Stiffeners: 12 gauge.

5. Miscellaneous Trim: 16 gauge.

B. Rust-Inhibitive Primer

1. Manufacturer's standard rust inhibitive baked-on primer. Provide additional primer for touch-up.

2. Pretreat galvanized metal in accordance with paint manufacturer's recommendations.

2.03 FABRICATION

A. Make hardware mortises and reinforcements according to templates. Provide hinge, lock, door holder and closer hardware reinforcements. Mortise, drill tap for hardware; fabricate grooves, rabbets as necessary for weatherstripping, soundstripping.

B. Fabricate doors to a maximum tolerance of 1/16 inch from a straight edge when laid on face of door in any direction, including diagonal.

C. Attach proper testing agency's labels as indicated on the Drawings. Provide equal labeled frames for labeled doors. Frames with glazing in rated walls must conform to NFPA 252 (hose stream test). Provide intumescent fire and smoke material for fire rated openings as required by door and frame manufacturer to comply with UL 10C, UBC Test 7-2.

D. Clearances: Edge clearances shall be provided as follows:

1. Between doors and frame, at head and jambs - 1/8"

2. At door sills:

where no threshold is used	–	5/8" maximum to finish floor surface
where threshold is used	–	1/4" maximum between door and threshold
where required for hardware operation	–	as recommended by hardware manufacturer

3. Between meeting edges of pairs of doors - 1/8"

2.04 METAL FRAMES

A. Provide custom metal frames of the types and styles indicated on the drawings or schedules and complying with SDI 100 for materials and construction requirements.

B. Provide metal frames for doors, sidelights, borrowed lights, and other openings, as shown on the drawings. Provide thermally broken frames at exterior wall.

C. Miter corners on face of all frames, internally weld face and grind smooth exterior. Die coped frames at mullions and stops. Provide with floor anchors.

D. Provide one removable and one fixed stop at perimeter of openings for glazed frames. Removable stop on secure side.

E. Provide closed metal covers over all hardware cutouts to protect against mortar.

F. Provide integral channel frames, subframes and stiffeners to structure where indicated or required for fastening and stiffening frames.

G. Provide steel spreader temporarily attached to feet of both jambs for welded frames.

H. Provide three factory installed silencers on single door frames at strike jamb; four (two at each head) silencers on double door frames.

I. Hinge reinforcements to have 10 gauge straps welded directly above and below each hinge pocket.

J. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26.

2.05 FLUSH HOLLOW METAL DOOR

A. Provide custom metal doors for the types and styles indicated on the Drawings or schedules and complying with SDI 100 for materials and construction requirements. Fully insulate exterior doors.

B. Close top and bottom edges of all doors with a continuous recessed steel channel not less than 16 ga., full width spot welded to both faces. Provide an additional flush closing channel at top edge for exterior doors. Provide openings to bottom closure of exterior door to permit escape of moisture.

C. Edge profiles to be 1/8" bevel in 2".

D. Provide glass light openings as indicated complete with one fixed stop and one removable stop fastened with flat head Phillips screws not over l0 inches o.c.

E. All doors to have minimum 16-gauge lock reinforcement and either continuous 14-gauge hinge rail or minimum 8-gauge plate hinge reinforcement.

F. All faced edge seams to be continuously wire welded, finished smooth.

2.06 HARDWARE LOCATION

A. Prepare for hardware at mounting heights and locations as recommended by the Builder's Hardware Manufacturing Association.

2.07 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal frames.

2.08 SHOP PAINTING

A. Completely clean all frames by degreasing process, followed by one coat rust inhibitive primer equal to a salt spray test (5% solution) of 70 hours. Thoroughly prime all surfaces without runs, smears, or bare spots, and under and inside all removable stops.

B. Completely clean all doors of impurities and pressure sand to a smooth surface and correct all irregularities with metallic putty sanded smooth. Provide one (1) spray coat of primer, baked on. Thoroughly paint unexposed inside surfaces of exterior doors, fire doors, and other doors occurring in excessive moisture area.

C. Provide vinyl wash pre-treatment of galvanized steel as recommended by shop primer manufacturer.

D. Provide primer for field touch up of rusted areas, splices, connections, welds and abrasions.

PART 3: EXECUTION

3.01 INSTALLATION

A. Prime-Coat Touchup: Prior to erection sand smooth rusted, damaged, connection points and welded areas of prime coat and apply touchup primer.

B. Securely fasten Work in place, without twists, warps, bulges or other unsatisfactory defacing of workmanship. Set plumb, level square to proper elevation true to line and eye. Set clips and other anchors with piston driven fasteners equal to Ramset or drilled-in anchors as approved. Fasten units and trim together with neat, uniform and tight joints.

C. Where field installed hardware is required, provide wood or other suitable filler to avoid drilling and tapping into mortar inside frames.

D. For all attachments including removable stops, use flat head self-tapping screws. Drill and tap in the field for surface mounted closers, brackets, rim exit devices, door holders, and other surface hardware. At horizontal exterior surfaces, set screws with neoprene gaskets or set with caulking compound under screw head and wipe clean.

E. All field splices to be welded and filled with body putty and ground smooth, no exposed screw heads will be accepted. Locate splices where shown on final reviewed shop drawings.

3.02 PROTECTION

A. Protect installed hollow metal work against damage from other construction.

B. Repair or replace all damaged work at no extra cost to Owner.

END OF SECTION 08 10 00

SECTION 08 14 00

WOOD DOORS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Solid core flush wood doors.
2. Rated doors as noted on schedule and/or Code Plan.
3. Factory finishing of wood doors.
4. Factory fitting to frames (prefitting).
5. Factory preparation for hardware (premachining).
6. Glazing, glazing stops and preparation of doors to receive glazing.

B. Related sections:

1. Metal doorframes: Section 08 10 00.
2. Finish hardware: Section 08 71 00.
3. Glazing: Section 08 80 00.

1.03 REFERENCES

A. Most current printing of the noted standards apply.

B. Window and Door Manufacturers Association (WDMA) Industry Standard: WDMA I.S.1A.

C. NFPA 80 Standard for Fire Doors and Other Opening Protectives. National Fire Protection Association.

D. American National Standards Institute (ANSI) A115.W Series.

E. NFPA 252: Standard Methods of Fire Tests of Door Assemblies.

F. How to Store, Handle, Finish, Install and Maintain Wood Doors; National Wood Window and Door Association (NWWDA); undated.

G. International Building Code (IBC) Current Edition.

H. WDMA I.S. 1S: Industry Standard for Architectural Wood flush Doors, Window and Door Manufacturers Association.

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Product Data: Submit door manufacturer's product data for each type of wood door, including details of core and edge construction, and trim for openings.

2. Shop Drawings:

   a. Location and size of each door.

   b. Elevation of each kind of door.

   c. Details of construction.

   d. Location and extent of hardware blocking.

   e. Fire ratings of doors as noted on door/opening schedule and/or Code Plan.

   f. Requirements for factory finishing.

3. Samples:

   a. Beads for glazed openings: Submit 6-inch-long sections of glazing beads for each material, type, and finish required.

1.05 QUALITY ASSURANCE

A. Quality Standards: Provide flush doors complying with the following standards:

1. Manufacturer must be an approved WDMA Door Manufacturer in accordance with WDMA I.S.1A.

B. Fire-Rated Wood Doors:

1. Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies per NFPA 252.

2. Acceptable testing and inspection agencies include:

   a. Underwriters Laboratories, Inc.

   b. Warnock Hersey International, Inc.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect wood doors during transit, storage, and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standard and recommendations of NWWDA I.S. 1, Appendix, "How to Store, Handle, Finish, Install, and Maintain Wood Doors," as well as with manufacturer's instructions.

1. Package doors at factory prior to shipping, using manufacturer's standard method.

B. Identify each door with individual opening numbers using temporary, removable, or concealed markings.

1. Correlate door identification with designation system used on shop drawings.

1.07 WARRANTIES

A. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by manufacturer, installer, and contractor, agreeing to repair or replace defective doors which warp (bow, cup, or twist), which show telegraphing of core construction in face veneers, or which do not conform to tolerance limitations of specified quality standards. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the contractor under the contract documents.

1. Include reinstallation which may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.

2. Warranty shall be in effect during the following period of time after date of substantial completion:

   a. Solid core flush interior doors: Life of installation.

3. Submit per Section 01 78 23.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Manufacturer:

1. Provide products complying with requirements of the contract documents and made by one of the following:

   a. Marshfield – Algoma by Masonite Architectural; www.marshfielddoors.com
   b. Eggers Industries; www.eggersindustries.com
   c. VT Industries; www.vtindustries.com

B. Flush Doors: comply with requirements of WDMA I.S.1A.

C. Fire Rated Doors:

1. Construction: Manufacturer's standard core construction in accordance with testing agency requirements for fire rating indicated, and as specified herein.

2. Edges: Provide manufacturer's standard laminated edge (stile) construction for use with mortise hinges and for indicated fire resistance ratings.

3. Labels: Permanently affixed to hinge stile and in compliance with NFPA 80. For doors with continuous hinges or other hardware which may obscure the label install label at top edge of door.

2.02 SOLID CORE WOOD FACED DOORS

A. Solid Core Door (non-rated):

1. PC-5 WDMA Premium

2. Application: Non-rated interior door.

3. Faces:

   a. Wood Veneer:

      1) Natural maple.

2) Cut: Plain sliced.

4. Construction: 5-ply Standard construction is per WDMA Extra Heavy Duty Performance Levels.

5. Core: Extra heavy duty wood based particleboard, PC. Meet WDMA performance criteria without additional blocking.

B. Solid Core Door (rated):

1. FD-5 WDMA Premium

2. Application: Labeled fire door.

3. Faces and Construction: Same as non-rated door.

4. Core: High-density mineral core laminated to both sides of 3/4" fire retardant plywood.

5. Reinforcing for Hardware: Fire retardant treated top rail and lockblocks for secure anchorage of hardware, without thru bolts as noted in NWWDA I.S. I-A.

6. Provide factory primed rated astragals or metal edges as required by listing agency.

7. Provide intumescent fire and smoke material for fire rated openings as required by door and frame manufacturer to comply with testing requirements of ASTM 252/UL 10C.

   a. Positive Pressure Category “A” type doors required.

8. Door assemblies installed in fire-rated corridor walls or smoke barrier walls shall meet IBC requirements for smoke and draft control as tested in accordance with UL 1784. These door assemblies shall be installed in accordance with NFPA 105.

2.03 GLAZING

A. Glazing Stops:

1. Non-Rated and 20 minute

   a. Wood, of the same species/compatible with door species.

2. Fire-Rated 45 minute or above, manufacturers options:

   a. Flush, wood veneer clad PVC, of same species/compatible to door facing.
   b. Veneer wrapped rolled steel, of same species/compatible to door facing.
   c. Manufacturer to verify compatibility of glazing system with positive pressure requirements.

2.04 FABRICATION

A. Openings: Cut, trim, and seal openings in doors at the factory.

B. Prefitting: Fabricate and trim doors to size at factory to conform to hollow metal frames as shown on approved frame shop drawings and floor finishes as indicated in the finish schedule.

C. Premachining: Make all mortises and cutouts required for hardware at the factory to conform to approved hardware schedules, hardware templates, and door frame shop drawings.

2.05 FACTORY FINISHING

A. Doors to be factory finished to meet or exceed WDMA I.S. 1A TR-6.

PART 3: EXECUTION

3.01 INSPECTION

A. Require installer to examine door frames after their installation, and doors prior to their hanging, for the following purposes:

1. To verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.

2. To verify that doors are free of defects.

B. Obtain installer's written report listing conditions detrimental to compliance with requirements of this section.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Condition doors to average prevailing humidity in installation area prior to hanging.

B. Hardware Installation: Section 08 71 00.

C. Install wood doors in accordance with manufacturer's instructions and referenced standards.

1. Installation of the wood doors, and labeled wood doors shall comply with WDMA I.S.1A-04, Installation and NFPA 80.

2. Dimensional tolerances for hardware cutouts, undercuts, meeting edges, heights and width shall comply with WDMA I.S.1A-04

D. Prefit Doors: Fit to frames and machine for hardware to whatever extent not previously worked at factory as required for fit and uniform clearance at each edge.

E. Shop-Finished Doors: Restore finish on edges of shop-finished doors before installation, if fitting or machining is required at the project site. Touch up any scratched doors to satisfaction of Architect prior to substantial completion or replace doors.

3.03 CLEANING AND ADJUSTMENT

A. Replace doors that are warped, twisted, show through or not true in plane and that do not follow the warranty.

B. Operation: Rehang or replace doors which do not swing or operate freely, as directed by the Architect.

C. Refinish or replace doors damaged during installation, as directed by the Architect.

D. Institute protective measures as recommended and accepted by door manufacturer to ensure that wood doors will be without damage or deterioration at time of substantial completion.

END OF SECTION 08 14 00

SECTION 08 31 00

ACCESS PANELS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes: Wall and ceiling access and fire rated panels as noted on Drawings and specified herein.

B. Provide and install one additional access panel for each type over quantities shown on drawings.

C. Related work specified elsewhere:

1. Openings in gypsum board - Section 09 21 16.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner that will avoid damage.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Nystrom Products are specified, comparable products by others who meet the specification are acceptable.

2.02 UNITS

A. Access Panel #1 (Noted as AP #1 on drawings) "Used in Drywall"

1. Size: 24" x 24"
2. Flange: Drywall bead
3. Door: 14 gauge cold rolled galvanized steel
4. Frame: 16 gauge cold rolled galvanized steel
5. Pan depth: ½"
6. Hinge; Concealed spring button. Concealed pin at fire rated.
7. Latching: Screwdriver cam latch.
8. Finish: Gray powdered primer
9. Fire Rating: As required for panels in rated walls or ceilings. See Code Plan on Architectural Drawings for required rating.

PART 3: EXECUTION

3.01 INSPECTION

A. Verify that openings are correctly dimensioned to receive doors.

3.02 INSTALLATION

A. Install in accordance with manufacturer's current printed recommendations, in locations indicated on architectural reflected ceiling plans and architectural floor plans.

B. Coordinate exact locations to access mechanical/electrical equipment.

C. Attach double layer of gypsum board to recessed ceiling panels in gypsum board ceilings and a single layer of gypsum board and a layer of acoustical tile in areas with acoustical tile glued to gypsum board.

3.03 ADJUST AND CLEAN

A. Adjust latching mechanism to operate smoothly.

B. Leave work area clean and free of debris.

END OF SECTION 08 31 00

SECTION 08 36 00

SECTIONAL METAL OVERHEAD DOORS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes: Furnishing and installing insulated sectional metal overhead doors.

B. Related work in other sections:

1. Doorframes - Section 05 50 00.

2. Electrical rough-in - Division 26.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Shop Drawings: Submit fabrication and erection drawings. Show field verified dimensions, components, details and connections to other construction.

2. Wiring Diagrams: Submit wiring diagrams for operators and controls, for coordination with Division 26.

3. Field verify existing or coordinate with proposed electrical feeder voltage/phase and adjust submittal so motors are compatible.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner that will avoid damage or deformation.

1.05 WARRANTY

A. The overhead door manufacturer shall warrant the overhead doors and operators to be free of defective materials and workmanship for a minimum period of one year from the date of Substantial Completion.

B. In addition, the installed doors shall be warranted against rust penetration of the undamaged paint finish for a minimum period of two years from the date of Substantial Completion.

C. Submit per Section 01 78 23.

PART 2: PRODUCTS

2.01 MANUFACTURER

A. Overhead Doors: Provide products by one of the following: Wayne-Dalton, Crawford, Raynor, or Overhead Door are acceptable.

B. All components for each door to be the product of one manufacturer or items purchased by and approved by the manufacturer, except as noted.

2.02 FABRICATION

A. Construction, Insulated Overhead Doors

1. Door sections: Nominal 2" thick constructed of not less than 27 gauge embossed steel faces permanently laminated to both sides of a high density polyurethane foam core. Section edges: Formed to provide a non-conductive thermal break between the inside and outside steel faces and provide an interlocking profile to insure a weathertight seal with the adjacent panel.

   a. Minimum R-value: 17.5.

2. Galvanized steel end caps: Sufficiently wide to accommodate double-end roller flanges. Seal panel ends with a waterproof mastic before applying. Provide steel reinforcing plates for all intermediate hinge and hardware attachment.

3. Design and installed door and hardware to withstand a minimum wind loading of 20 psf. Provide U-channel or truss-type struts as necessary to eliminate bowing or sagging.

C. Hardware

1. Overhead doors to have 25,000 cycle, oil tempered, helical wound torsion type springs on a solid steel shaft complete with bearing assemblies. Provide blocking inside spring to keep from sagging if necessary.

2. Furnish inclined wedge type track assembly for standard lift operation. Power operated doors shall have 3" track with heavy-duty double-end roller hinges. 3" rollers shall have continuous steel rims with hardened ball bearings in case hardened inner and outer races with long stems.

3. Overhead doors shall have a chain hoist for auxiliary manual operation.

D. Weatherstripping: Furnish weatherstripping to meet or exceed code required air infiltration requirements. Weatherstripping shall, at a minimum, consist of a heavy-duty flap type jamb seal and head seal and U-shaped bottom astragal. Joints between door sections shall have a compressible bulb type gasket. Weatherstripping materials shall be PVC, EPDM or coated Neoprene designed for heavy duty, low temperature, high abrasion applications.

E. Power Operators

1. Operators for overhead doors: Manufacturer's standard industrial duty drawbar type operator with belt or gear reducers and safety clutch. Motor to be ½ HP, 120 volt, single phase of a recognized manufacturer. furnish with starter, limit switch and magnetic braking mechanism to prevent door from coasting.

2. Provide remove disconnects for emergency operation, extended to within 6 feet of floor using 5/32" diameter cable through a minimum of 2 eyelets with a 6" loop at the bottom end.

3. Furnish one replacement set of belts for each operator.

F. Controls: Overhead doors: Controlled by a surface mounted 3-button push control station with momentary contact open, stop and constant contact close.

G. Safety Sensors:

1. Provide reverse edge and photo beam at all overhead doors.

H. Exhaust Port: Provide a carbon monoxide exhaust port in each of the doors.

I. Wiring of controller to motor by this section.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install doors in accordance with reviewed shop drawings and in accordance with manufacturer's current printed instructions.

B. Touch-up mars and abraded spots after installation with factory furnished primer.

C. Adjust doors for proper operation after installation and prior to acceptance of building.

3.02 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain sectional overhead doors. Refer to Section 01 79 00 Demonstration and Training.

END OF SECTION 08 36 00

SECTION 08 40 00

ALUMINUM ENTRANCES, STOREFRONTS AND CURTAINWALLS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section Includes:

1. Aluminum glazed swinging doors.

2. Exterior storefront noted "SF-#" on drawings.

3. Glass

4. Joint sealants in contact with aluminum components.

5. Sealing of the cavity wall at openings in exterior wall.

6. Prior to installation of finished materials, all flexible flashings shall be observed by the Architect. The Architect shall be given a minimum of 72 hours notice prior to the desired observation time. Any finish materials (i.e., brick, insulation, metal, etc.) installed without observation by the Architect shall be removed and replaced at the Contractor's expense.

B. Products installed but not furnished under this Section:

1. Finish hardware - Section 08 71 00.

C. Related Sections:

1. Insulation - Section 07 21 00.
2. Flashings - Section 07 65 00/13.
3. Finish hardware - Section 08 71 00.
4. Joint Sealants - Section 07 92 00.
5. Aluminum Windows - Section 08 51 13.
6. Glazing Section - 08 80 00.

1.03 REFERENCES

A. NAAMM - Metal Finishes Manual, 3rd ed., Jan. 1976.

B. AAMA 501 - Methods of Test for Metal Curtain Walls.

C. AAMA 2605 – Methods of Testing Windows.

D. AAMA 2605 - Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

E. NFRC 500 - Voluntary Test Method for Condensation Resistance of Windows, Doors and Glazed Wall Sections.

F. NFRC 500 - Voluntary Test Method for Thermal Transmittance of Windows, Doors and Glazed Wall Sections.

G. AAMA 606.1 - Voluntary Guide Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.

H. AAMA 607.1 - Voluntary Guide Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.

I. AAMA 608.1 - Voluntary Guide Specifications and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

J. ASTM E 283 - Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors; 1984.

K. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference; 1984.

L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference; 1986.

M. ASTM C 509 - Specification for Cellular Elastomeric Preformed Gasket and Sealing Material.

N. ASTM D 3656 - Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Fiber Yarn.

O. ASTM E 783 - Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

P. ASTM E 1105 - Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform Cyclic Static Pressure Difference.

1.04 PERFORMANCE REQUIREMENTS

A. Exterior Assemblies: Design and fabricate to comply with the performance characteristics listed below.

B. Thermal Movement: Allow for expansion and contraction resulting from ambient temperature range of 120 degrees F (49 degrees C).

C. Condensation Resistance: Where framing systems are "thermal-break" construction, provide units tested for thermal performance in accordance with AAMA 1503-09 showing condensation resistance (CRF) of not less than: 77 for 5500 Series Curtain Wall framing based on an overall depth of 6”.

D. Thermal Transmittance: Provide framing systems which have an overall U-valve (Btu/hr. x sq.ft. x deg. F) at 15 mph exterior wind velocity of not more than values shown in the table below when tested in accordance with NFRC 100 with specified glazing.

	Climate Zone			
	4	**5**	**6**	**7**
Curtainwall/Storefront	0.38	0.38	0.36	0.29
Entrance Door	0.77	0.77	0.77	0.77

E. Air Infiltration Rate

1. Fixed windows/storefront/entrance curtain wall not be more than 0.06 cfm per sq. ft. of window area for an inward test pressure of 6.24 lbf per sq. ft., when tested in accordance with ASTM E 283.

F. Water Penetration: There will be not water penetration, as defined in ASTM E 331, when tested in accordance with ASTM E 331 at an inward test pressure of 15.00 lb per sq. ft.

1.05 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Manufacturer Produced Shop Drawings: Submitted for approval by Architect, prior to fabrication. Indicate installation details, materials used, quantity and size required. Shop drawings to include sizing, type, and locations of all anchors as determined by manufacturer's structural review to assure installation meets specified wind load.
   NOTE: Shop Drawings produced by installer will not be accepted.

2. Samples: (Only required if manufacturer is accepted through prior approval process)

   a. Color: One (1) 12-inch extrusions with specified finish, properly labeled.

   b. Glass: One (1) 12 inch square samples of each glass type indicated, properly labeled.

3. Letter from manufacturer approving contractor to install curtainwall/storefront.

4. Test reports showing compliance with performance requirements.

B. Warranty: Submit per Section 01 78 23.

1.06 PROJECT CONDITIONS

A. Check actual unit opening by accurate field measurement before fabrication. Coordinate fabrication schedule with construction progress to avoid delay of work.

1.07 QUALITY ASSURANCE

A. Manufacturer to be fully responsible for shop drawings, engineering, fabrication and overseeing installation to insure a weather tight installation.

B. Installer Qualifications: Authorized representative of the manufacturer, with not less than five (5) years experience in the fabrication and installation of products similar to those specified under this Section.

C. Warranty:

1. Fabricated products: Manufacturer to provide written warranty agreeing to repair or replace product that fail in materials or factory workmanship within ten (10) years from the date of Substantial Completion.

2. Glass: Provide written warranty of thermal and physical integrity of insulating glass units for ten (10) years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. The following manufacturers/products are approved as noted below with the understanding they will meet the actual products specified: EFCO, Oldcastle BuildingEnvelope, Manko Window Systems, Wausau, Special-Lite.

2.02 MATERIALS - GENERAL

A. Aluminum Members: Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish; ASTM B 221 for extrusions, ASTM B 209 for sheet/plate.

B. Fasteners: Aluminum, nonmagnetic stainless steel, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum components.

1. Do not use exposed fasteners except where unavoidable for application of hardware.
2. Exposed fasteners: Match finish of members and hardware being fastened.

C. Concealed Flashing: Dead-soft stainless steel, 26 gage minimum; or extruded aluminum, 0.062 inch minimum; or an alloy and type selected by manufacturer for compatibility with other components.

D. Exposed Flashing, Sills: .125 inch minimum shop formed aluminum sheet, finish to match window framing.

E. Column covers and panels: .090 inch minimum shop formed aluminum sheet, backed with wall insulation (see Section Insulation 07 21 00 for conformance requirements) laminated with waterproof adhesive, finish to match window framing and be applied after shapes are formed.

F. Brackets and Reinforcements: High-strength aluminum where feasible; otherwise, nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A 123.

G. Concrete/Masonry Inserts: Cast iron, malleable iron, or hot-dip galvanized steel complying with ASTM A 123.

H. Dissimilar Metal Coating: Cold-applied asphalt mastic, zinc chromate paint, or other nonconductive, nonabsorbent material.

I. Glazing Gaskets: Comply with ASTM C 864; style as recommended by manufacturer.

J. Glass and Glazing Accessories: Provide products specified Section 08 80 00.

K. Flexible flashing: Conform to requirements of Section 07 65 00/13.

L. Joint sealants: conform to requirements of Section 07 92 00.
Color: See Material Finish/Color Schedule, on Architectural Drawings.

M. Door Weatherstrip: Silicon treated plastic pile.

2.03 FINISH

A. As selected by Architect from manufacturer's full line of standard colors/finishes.

2.04 ENTRANCE DOORS AND FRAMING

A. Door Model: EFCO Series D518 Durastile – Wide Stile Entrance Door; Oldcastle BuildingEnvelope, Rugged Door; Special-Lite Monumental Door.

1. Stile: Width to accept panic hardware without overhanging stile. (Typically 5" minimum, without including glass stops)
2. Door Material Thickness: 3/16"/.188"
3. Door Thickness: 2"
4. Door (hinge stile): Continuous full height 1¼ x ¼" galv. steel bar stock.
5. Bottom Door Rail: 12"
6. Factory fabricated doors and factory glazed.

B. Isobar Storefront Frame Model (Noted as SF #___ on drawings)

1. Exterior: EFCO 403I thermal storefront; Manko 5450i.

   a. Minimum wall thickness: 0.080” minimum.
   b. Frame profile: 4 ½ minimum depth x 2 1/4” minimum face with 12” sidelite base as detailed.
   c. Frame reinforcing (hinge and latch): Continuous full height 1” x 1 ¼” x 3/16” galvanized steel angle.
   d. Thermal Barrier: Glass reinforced polyamide nylon struts.
   e. Provide adjustable sidelite base as detailed. Horizontals with brake material will not be permitted.

2.05 GLASS

A. Provide products and conform to requirements specified in Section 08 80 00.

2.06 ALUMINUM PANELS

A. Materials

1. Exterior Panels: Flush, minimum 0.125-inch thick laminated to rigid wall insulation (conform to Section 07 21 00, Insulation). Fabricate so panel is glazed into glazing stop and face is flush with outside face of mullion cap.

2. Interior panel, flush, minimum 0.125-inch thick aluminum install with concealed clips so panel is flush with face of adjacent mullion.

2.07 FABRICATION

A. Any dimensions which may vary are indicated on drawings, with maximum and minimum dimensions required to achieve design requirements and coordination with other work. Field verify all opening dimensions.

B. Fabrication: To greatest extent possible, complete fabrication assembly, and finishing at manufacturers plant before shipment to project site. Disassemble components only as necessary for shipment and installation.

1. Maintain accurate relation of planes and angles, with hairline fit of contacting members.

2. Select members for fabrication so that adjacent anodized extruded aluminum members do not have color or texture variation greater than half the range indicated in the submitted samples.

3. Factory-install all hardware except surface-mounted items.

4. Perform fabrication operations, including cutting, fitting, forming, drilling, and grinding of metal work, in manner which prevents damage to exposed finish surfaces.

   a. For hardware, perform these operations prior to application of finishes.

D. Welding: Comply with AWS recommendations to avoid discoloration; grind exposed welds smooth and restore mechanical finish.

E. Reinforcing: Install reinforcing as required for hardware and as necessary for performance requirements, sag resistance, and rigidity; separate dissimilar metals as specified under "Installation."

PART 3: EXECUTION

3.01 PREPARATION

A. Verify and coordinate installation tolerances.

B. Verify that openings are properly prepared, with blocking installed and cavities sealed.

3.02 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation of components. Storefront/curtainwall manufacturer's or designated representative shall be present at both installation of first unit to insure proper installation technique.

B. Install window flexible flashing under all sills and sill flashing. Turn up at ends to form end dams. Lap flashing 4" minimum and seal.

C. Set units plumb, level, and true to line, without warp or rack. Provide proper support and anchor securely in place.

1. Anchorage to allow for normal thermal movement specified building movement and specified wind loads.

D. Separate aluminum exposed to weather from dissimilar metals; coat dissimilar metals that are in drainage cavities using one of the materials specified. Aluminum, stainless steel, zinc, cadmium, and small areas of white bronze are not considered dissimilar from each other.

E. Coat all metals that come into contact with masonry, concrete, and treated wood, using one of the materials specified.

F. Install surface-mounted hardware items, complying with hardware manufacturer's instructions and template requirements.

G. Install joint sealers between framing and adjacent surfaces as indicated, to provide weathertight construction. Comply with requirements of Section 07 92 00 for installation of joint sealers.

H. Install glass as specified in Section 08 80 00 and according to the framing manufacturer's printed instructions.

I. Install aluminum panels and flashing as shown on Drawings.

3.03 ADJUST AND CLEAN

A. Adjust operating hardware to function properly without binding, and to close doors tightly. Ensure that weatherstrip makes contact with door surfaces.

B. Clean completed systems inside and out, promptly after erection and after installation of glass and sealants, taking care to avoid damage to finishes. Remove excess sealants, dirt, and other substances from aluminum surfaces.

C. Clean glass surfaces as specified elsewhere.

END OF SECTION 08 40 00

SECTION 08 71 00

FINISH HARDWARE

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. This Section includes the furnishing and installing of all finish hardware material specified herein, listed in the hardware schedule, or required by the Drawings.

B. Items of hardware include:

1. Finish hardware
2. Aluminum door hardware, except weatherstripping.
3. Thresholds and weatherstrip
4. Cylinders for access panels.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 08 10 00 - Hollow Metal Doors and Frames.

B. Section 08 14 00 - Wood Doors.

C. Section 08 51 00 - Aluminum Entrances.

1.04 REFERENCES

A. Builders' Hardware Manufacturers Assoc., Inc. (BHMA), 60 E. 42nd St., New York, NY 10017.

1. Recommended locations for builders' hardware.

B. American National Standards Institute, Inc. (ANSI), 1430 Broadway, New York, NY 10018.

1. A115.2 - Specifications for standard steel door and frame preparations for bored cylindrical locks for 1-3/8" and 1-3/4" doors.

C. National Fire Protection Association, Inc. (NFPA), Battery March Park, Quincy, MA 02269.

1. NFPA 80 - Standard for fire doors and windows.
2. NFPA 101 - Code for safety to life from fire in buildings and structures.

D. Underwriters Laboratories, Inc. (UL), 333 Pfingsten Road, Northbrook, IL 60062.

1. Building Materials Directory.

E. Builders' Hardware Manufacturers Assoc., Inc. (BHMA), 60 E. 42nd Street, New York, NY 10017.

1. Recommended locations for builders' hardware.

F. Building Codes: International Building Code, Adopted Edition.

1. Include State amendments modifying model codes in jurisdiction where project is constructed.

1.05 QUALITY ASSURANCE

A. Except where specified in the hardware schedule, furnish products of only one manufacturer for each type of hardware.

B. Supplier: Company specializing in the builders' hardware industry.

C. Provide hardware for fire-rated openings conforming to UBC Standard 7-2.

D. Provide hardware for fire-rated openings conforming in compliance with NFPA 80 1995 Edition.

1.06 REGULATORY REQUIREMENTS

A. Furnish hardware listed by UL testing agency for all rated openings in conformance with requirements for the class of opening scheduled.

B. Rating requirements have precedence over this specification where conflict exists.

C. Furnish and install hardware that is in compliance with American with Disabilities Act of 1990 (ADA) technical standards, and current State Building Code.

1.07 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Schedules

a. Immediately after award of the hardware contract, submit a detailed, vertical type hardware schedule and cut sheets for each type of hardware for approval. On existing buildings field verify existing swings and functions prior to submitting schedule.

b. Itemize hardware in the sequence and format established by this specification.

1. List and describe each opening separately; include door number, room designations, degree of swing, and hand.

2. List related details; include dimensions, door and frame material, and other conditions affecting hardware.

3. List all hardware items; include manufacturer's name, quantity, product name, catalog number, size, finish, attachments, and related details where applicable.

c. Submit manufactures cut sheets on each type of hardware proposed.

d. Resubmit the corrected schedule when required.

e. Determine keying requirements by meeting with the Owner coordinated through the Architect, and submit a detailed keying schedule for review; resubmit the corrected schedule when required.

3. Samples: Submit samples of hardware items as may be required by the Architect; identify each sample and indicate the location of subsequent installation in the project.

4. Templates: Furnish a copy of the approved hardware schedule and all pertinent templates or template information to each fabricator of material factory-prepared for the installation of hardware.

5. Include documentation for UL 10C or other approved testing agency stating hardware has passed UBC Standard 7-2.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver hardware to the job site in the manufacturer's original containers that have been marked to correspond with the approved hardware schedule for installation location.

B. Store hardware in dry surroundings and protect against loss and damage.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS/MATERIALS

A. Hinges

1. Butt hinge manufacturers and respective catalog numbers:

	IVES	Hager	Stanley	McKinney	Bommer
a.	5PB1	1279	F179	T2714	5000
b.	5BB1	BB1279	FBB179	TB2714	BB5000
c.	5BB1 630	BB1191	FBB191	TB2314	BB5002
d.	5BB1HW	BB1168	FBB168	T4B3786	BB5004
e.	5BB1HW630	BB1199	FBB199	T4B3386	BB5006

2. Continuous hinges manufacturers and respective catalog numbers:

Markar	Stanley	Ives	McKinney
300 Series	600 Series	700 Series	MCK-300 Series

a. Continuous hinges shall be full height pin and barrel type hinge providing full height door support up to 600 pounds. Edge mount (unless noted otherwise).

b. Hinges shall be constructed of heavy-duty 14-gauge material. The stainless internal pin shall have a diameter of .25 and the exterior barrel diameter of .438.

c. Hinge shall be non-handed with symmetrical templated hole pattern and factory drilled. Hinge must accept a minimum of 21 fasteners on the door and 21 fasteners on the frame.

d. Each knuckle to be 2”, including split nylon bearing at each separation for quiet, smooth, self-lubricating operation.

e. Hinge to be able to carry Warnock Hersey Int. or UL for fire rated doors and frames up to three hours. Note: Fire label for doors and frames should be placed on the header and top rail of rated doors and frames.

f. Provide adjusting screws equal to Markar’s “AdjustaScrew” for continuous hinges specified as HG-305. Adjustment to be able to correct frame fit problems up to 3/8”.

3. When hinges are specified on the hardware schedule, furnish:

   a. Interior openings through 36 inches wide and 60 inches high without a door closer: Two (2) standard-weight, plain bearing hinges #1279 per leaf.

   b. Interior openings through 36 inches wide and 90 inches high without a door closer: Three (3) standard-weight, plain bearing hinges #1279 per leaf.

   c. Interior openings through 36 inches wide and 60 inches high with a door closer: Two (2) standard-weight, ball bearing hinges #BB1279 per leaf.

   d. Interior openings through 36 inches wide and 90 inches high with a door closer: Three (3) standard-weight, ball bearing hinges #BB1279 per leaf.

   e. Interior openings over 36 inches in width and/or 90 inches in height: One (1) continuous hinge per leaf.

   f. Exterior hollow metal or stainless steel openings: One (1) continuous hinge per leaf.

   g. Exterior aluminum openings through 36 inch wide and 90 inches high: Four (4) heavyweight ball bearing hinges #BB1199xNRP per leaf.

   h. Exterior aluminum openings over 36 inches wide in width and/or 90 inches in height: One (1) continuous hinge per leaf.

B. Flush Bolts and Dustproof Strikes

1. Manufacturers and respective catalog numbers:

	Ives	Door Controls	Hager	Rockwood
a.	DP2	80	280X	570
b.	FB31P	842	292D	1842
c.	FB41P	942	291D	1942
d.	FB458	780	282D	550

2. Non-labeled openings: Furnish two flush bolts FB458 for the inactive leaf of pairs of locked or latched doors. Locate centerline of the top bolt not more than 78" from the finished floor. Furnish dustproof strike DP2 for the bottom bolt.

3. Labeled openings: Furnish automatic flush bolt set FB31P or FB41P, as applicable, for the inactive leaf of pairs of doors; furnish dustproof strike DP2 for the bottom bolt.

C. Exit Devices

1. Manufacturers and respective catalog numbers:

Von Duprin	Precision Hardware	Falcon	Sargent	Corbin	Yale
99	APEX 2000 Series	25 Series	80 Series	ED5000 Series	7000 Series

2. Furnish exit device series and functions specified in the hardware schedule.

3. Furnish sex bolt attachments for devices specified for mineral core door application.

4. Furnish reinforced cross bars for door over 40" wide.

5. Furnish rod and latch guards on all surface mounted vertical rod exit device, on bottom rods.

6. Vandal Resistant Lever Design: Von Duprin 996L; Precision Hardware V4900. All exit devices shall be provided with optional trim designs to match other lever and pull designs used on the project.

7. Provide cylinder dogging on all non-rated devices. Provide cylinder to match building system.

8. Provide and install wiring from electric exit device to power supply.

9. Provide all aluminum door leafs with Mullion Stabilizers: Von Duprin #154 or equal by other specified manufacturer.

D. Locks

1. Manufacturers and respective catalog numbers:

Schlage	Sargent	Best	Falcon	Corbin-Russwin	Yale
L9000 03A	8200 LNJ	45H 3H	M Series SG	ML2000 LWA	8700L CRR

2. Furnish lock types and functions specified in the hardware schedule, with the following provisions:

   a. Strikes:

      1) Wrought box type for the inactive leaf of pairs of wood doors, or wood frames.
      2) Lip length sufficient to protect trim, frame or inactive leaf.

3. Furnish knurled lock knobs or lever handles on doors to stairs other than exit stairs, loading platforms, stages, boiler rooms, and other hazardous locations.

4. Lever handles must be cast brass, bronze or stainless steel construction and conform to ASNI A117.1.

5. Provide and install wiring from electric lockset to power supply.

E. Cylinders: Provide cylinders and cores to match Owner's existing keying system.

F. Pulls, Push Plates/Bars, Flush cup pulls

1. Manufacturers and respective catalog numbers:

	Item	Hager	Hiawatha	Burns	Rockwood
a.	Pull	10Q 18"	518B-18"	26C-18"	118
b.	Push Plate (flush doors	30s 8x16	200K	57	70F
c.	Push Plate (6" stile doors)	30s 4x16	200F	54	70C
d.	Pushbar	130s	1081LBP	422	47
e.	Flush Cup Pulls	27p	-	-	BF97

G. Closers

1. Manufacturers and respective catalog numbers:

LCN	Sargent	Norton	Yale	Stanley
4011/4111 EDA	281/281P10	7500 Series	4400 Series	D-4550 Series

2. Where closers are listed in the hardware schedule, furnish series listed above unless other functions/series are specified in the hardware groups.

3. Furnish complete with all mounting brackets, drop plates and special shoes as may be required by the door and frame conditions.

4. Furnish through bolt attachments for closers specified for wood doors.

5. Determine closer size in accordance with manufacturer's recommendations for application on the room side of corridor doors, stair side of stair doors, and interior side of exterior doors.

6. Provide SRI rust inhibitor primer for all closers in pools and corrosive areas.

H. Kick Plates: Where kick plates are specified in the hardware schedule, furnish 16 gauge, .050" plates, with the following dimensions:

1. Width: 2" less than door width.

2. Height: 8" (unless noted different on door schedule.)

3. All kick plates shall be beveled 4 sides and counter sunk.

I. Overhead Stops

1. Manufacturers and respective catalog numbers:

	Glynn-Johnson	Rixson-Firemark
a.	GJ450	10
b.	GJ90	9
c.	GJ100	1

2. Furnish a GJ90 series overhead stop for all doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall and for all doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate.

3. Furnish a GJ90 or GJ100 series overhead holder where listed in the Hardware Schedule.

4. Furnish sex bolt attachments for mineral core door applications, unless solid wood blocking is provided in the door for attachment.

J. Floor and Wall Stops and Holders

1. Manufacturers and respective catalog numbers:

		Ives	Hager	Burns	Rockwood
a.	Wall bumper	WS407CVX	232W	570	407
b.	Wall stop	WS11X	255W	530	475
c.	Floor stop	FS435/FS436	241F/246B	510/525	441U
d.	Wall holder	WS40	326W	533	490
e.	Exterior Floor Stop	FS9			

2. Furnish a WS407CVX series wall stop, as applicable, for each door leaf except where wall bumber WS11X, floor stops FS435/FS436, holders WS20X, wall holder WS40 or overhead stops/holders are specified in the hardware schedule.

3. Where wall stops are not applicable, furnish overhead stops as previously specified within this section of the specification.

K. Thresholds, Weatherstrips and Jamb Gaskets

1. Manufacturers and respective catalog numbers:

		Reese	Pemko	National Guard	Zero
a.	Saddle threshold	S205A	171A	425E	8655
b.	Half saddle threshold	S245A	229A	325 Alum	1675
c.	Bumper seal threshold	S483AV	2005AV	896 Alum (Vinyl)	65A
d.	Weatherstrip	755A	2891APK	700NA	429
e.	Astragral weatherstrip	804	Pair 309	185	8193
f.	Sweep	964C	18061CP	B606A	8192
g.	Head and Jamb Gasket	797	S88	5050	188
h.	Drip	R201	346	16	142
i.	Jamb sound seal	F499	350CSR	1038	770
j.	Auto door bottom	F521	430CPKL	420	361

2. Where specified in the hardware groups, furnish the above products unless otherwise details in groups.

3. Furnish 5050 head/jamb gaskets and NGP 9605 edge stile astragals for pairs, at all fire labeled doors whether listed in group or not. *Reese and Pemko equivalents approved based on passing UL 10C, UBC test Standard 7-2.

4. Coordinate with door manufacturer the intumescent fire and smoke material for fire rated openings as required by door and frame manufacturer to comply with UL 10C, UBC test 7-2.

5. When "threshold" appears within a hardware group provide the following:

   a. At aluminum entrances on new buildings provide a half saddle threshold.
   b. At aluminum entrances on existing buildings provide a saddle threshold.
   c. At interior door ways provide a saddle threshold.
   d. At exterior doorways from occupied rooms and HM or FRP exit only doors provide a bumper seal threshold.
   e. At exterior HM or FRP doors to receiving areas, loading docks and boiler rooms provide a saddle threshold.

2.02 ACCESSORIES AND ATTACHMENTS

A. Furnish all necessary hardware accessories such as wood or machine screws, bolts, nuts, anchors, toggle bolts, and other fasteners, each of the type, size, material and finish for its intended purpose and each according to the material to which the hardware is being applied.

2.03 FINISH AND BASE METALS

A. Finish and Base Metal:

Butt Hinges- Exterior	US32D on stainless steel
Butt Hinges-Interior	US26D on steel
Flush Bolts	US26D on brass or bronze
Exit Devices	US26D on brass or bronze
Locks	US26D on brass or bronze
Pulls And Push Plates/Bars	US32S on stainless steel
Coordinators	USP on steel
Closers	Sprayed AL on cast iron or aluminum
Protective Plates	US32D on stainless Steel
Overhead Stops	US32D on stainless steel
Wall Stops	US26D on brass, bronze, or steel
Thresholds	Mill aluminum
Weatherships and Sweep Strips	Clear anodized aluminum
Miscellaneous	US26D on brass or bronze

2.05 KEYING

A. Change key and masterkey all lock cylinders as directed by the Architect.

B. Furnish two change keys for each lock, six masterkeys for each masterkey set, and two removable core control keys.

C. Stamp keys with file key number and "Do Not Copy."

D. Ship masterkeys and control keys to the Owner via registered mail.

E. Permanent cylinder cores shall be installed by the contractor under the supervision of an owner's representative.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install hardware in accordance with manufacturer's recommendations / instructions, and the adopted Building Code.

B. Install hardware on UL labeled openings in accordance with manufacturer's requirements, so as to maintain the label.

C. Install hardware mountable weatherstipping continuous throughout opening prior to installation of other hardware.

D. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work.

E. Remove, cover or protect hardware after fitting until paint or other finish is applied; permanently install hardware after finishing operations are complete.

F. Install closers on the room side of corridor doors, stair side of stairways, and interior side of exterior doors.

G. Mounting heights:

1. Install hardware at mounting heights conforming to the recommended mounting locations of the Builders' Hardware Manufacturing Association, and the adopted Building Code.

2. Install wall stops WS11X, wall holders WS20X, and magnetic holders to strike near top of doors, but not more than 78" from the finished floor line; install wall stops WS407CVX to engage knobs, levers or pulls.

H. Install pulls at 40" to top of pull and push bars at 36" above finished floor. Off set pull on exterior door rails to allow access to cylinders.

I. Deliver to the Owner one complete set of installation and adjustment instructions, and tools as furnished with the hardware.

J. Before hardware installation, general contractor/construction manager shall coordinate a hardware installation seminar to be conducted on the rough-in of electrical boxes for hardware and the installation of hardware, specifically of locksets, closers/accessibility closers, exit devices, hardware, mountable weatherstrip and overhead stops. Manufacturer's representative of the above products to present seminar. Seminar to be held at the job site and attended by installers of hardware (including low voltage hardware) for aluminum, hollow metal and wood doors. Training to include use of installation manuals, hardware schedule, templates and physical product samples. The architect needs to be informed of the meeting and contractor is to distribute meeting minutes on issues raised at seminar.

K. Install per door and/or frame manufacturer's supplemental "S" label instructions on fire rated openings.

3.02 ADJUSTING AND CLEANING

A. At final completion, adjust and test all hardware for function, performance, building code compliance and leave in good operating condition. Panic Hardware device manufacturer's representative to inspect panic hardware installation and provide a report to contractor and architect on items that need correction.

B. Clean all hardware to restore the original finish.

3.03 PROTECTION

A. Protect the finished installation until acceptance of the project.

B. Provide final adjustment or cleaning where necessary.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative(s) to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. At a minimum, provide the following training:

1.	Miscellaneous hardware	1 hour
2.	Exit devices	2 hours
3.	Locks	1 hour
4.	Closers	1 hour
5.	Electromagnetic locks	2 hours
6.	Accessibility closers	2 hours

Refer to Section 01 79 00 Demonstration and Training.

3.05 HARDWARE SCHEDULE

<u>HW SET 1</u>

Door Number A101
Each Opening to receive:

Qty.	Type	Description	Finish	MFR.
1 ea.	Continuous hinge	780-224HD	CLR	HGR
1 ea.	*Rim Exit Device	4501 Rim	US26D	HGR
1 ea.	Cylinder	3902 IC	US26D	HGR
1 ea.	Electric Strike	4800	US32D	TRINE
1 ea.	Final Keyed Core	Best by Owner's Locksmith	US26D	Best
1 ea.	Closer	5100 HDCS	ALM	HGR
1 ea.	Threshold	By Alum. Door Supplier	MIL	
1 set	Weatherstripping	By Alum Door Supplier	MIL	
1 ea.	Door Sweep	By Alum Door Supplier	MIL	

Access control will be added at a future date. Card Reader by others. Electric Strike is surface applied and can be replace a standard strike at a future date. Wiring for future access control should be included in this stage of construction.

HW SET 2

Door Number A104
Each Opening to receive:

Qty.	Type	Description	Finish	MFR.
1 ea.	Continuous hinge	780-224HD	CLR	HGR
1 ea.	*Rim Exit Device	4501 Rim	US26D	HGR
1 ea.	Exit Trim	45CE WTN	US26D	HGR
1 ea.	Cylinder	3902 IC	US26D	HGR
1 ea.	Final Keyed Core	Best by Owners's Locksmith	US26D	HGR
1 ea.	Closer	5100 HDHOCS	ALM	HGR
1 ea.	Threshold	By Alum Door Supplier	MIL	
1 set	Weather stripping	By Alum Door Supplier	MIL	
1 ea.	Door Sweep	By Alum Door Supplier	MIL	

HW SET 3

Door Number A110A, A102
Each Opening to receive:

Qty.	Type	Description	Finish	MFG.
3 ea.	Hinges	BB1279 4.5" x 4.5"	US26D	HGR
1 ea.	Mortise Passage Lock		US26D	BEST
1 ea.	Final Keyed Core	Owner's Locksmith	US26D	
1 ea.	Closer	4040XP CUSH	AL	LCN
3 ea.	Silencers	307D	GREY	HGR

HW SET 4

Door Number A106, A107, A108
Each Opening to receive:

Qty.	Type	Description	Finish	MFG.
3 ea.	Hinges	BB1279 4.5" x 4.5"	US26D	HGR
1 ea.	Mortise Classroom Lock	45H7R (Pat.) 3R	US26D	BEST
1 ea.	Final Keyed Core	Owner's Locksmith	US26D	
1 ea.	Kick Plate	194S	US32D	HGR
3 ea.	Silencers	307D	GREY	HGR

HW SET 5

Door Number A105, A109
Each Opening to receive:

Qty.	Type	Description	Finish	MFG.
3 ea.	Hinges	BB1279 4.5" x 4.5"	US26D	HGR
1 ea.	Mortise Storeroom Lock	45H7D (Pat.) 3R	US26D	BEST
1 ea.	Final Keyed Core	Owner's Locksmith	US26D	
1 ea.	Closer	4040XP	AL	LCN
1 ea.	Kick Plate	194S	US32D	HGR
1 ea.	Wall Stop	232W	US32D	HGR
3 ea.	Silencers	307D	GREY	HGR

HW SET 6

Door Number A111, A112, A113, A114, A115, A116
Each Opening to receive:

Qty.	Type	Description	Finish	MFG.
3 ea.	Hinges	BB1279 4.5” x 4.5”	US26D	HGR
1 ea.	Mortise Privacy Set	45H0L	US26D	BEST
1 ea.	Closer	4040XP	AL	LCN
1 ea.	Mop Plate	194S	US32D	HGR
1 ea.	Wall Stop	232W	US32D	HGR
3 ea.	Silencers	307D	GREY	HGR

HW SET 7

Door Number A110B
Each Opening to receive:

Qty.	Type	Description	Finish	MFG.
1 ea.	Continious hinge	780-224HD	CLR	HGR
1 ea.	Rim Exit Device	4501 Rim	US26D	HGR
1 ea.	Exit Trim	45NL WTN	US26D	HGR
1 ea.	Cylinder	3902 IC	US26D	HGR
1 ea.	Final Keyed Core	Best by Owner’s Locksmith	US26D	Best
1 ea.	Closer	5100 HD	ALM	HGR
1 ea.	Threshold	412S	MIL	HGR
1 ea.	Weather stripping	881S 36” x 84”	MIL	HGR
1 ea.	Door Sweep	770SN	MIL	HGR
1 ea.	Drip Edge Guard	810S	MIL	HGR

END OF SECTION 08 71 00

SECTION 08 80 00

GLAZING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Interior Glazing
   a. Safety glass in locations indentified in Part 3.
   b. Clear glass in HM doors and frames.
2. Exterior Insulated Glazing
   a. Safety glass in locations identified in Part 3.
   b. Clear glass in aluminum doors.
   c. Clear glass in storefront.

B. Related work specified in other sections:

1. Steel doors and frames - Section 08 10 00.
2. Wood doors - Section 08 14 00.
3. Aluminum Entrances, Storefronts and Curtainwalls - Section 08 40 00.

1.03 QUALITY ASSURANCE

A. Reference Specification: Glazing Manual by Flat Glass Marketing Association.

B. Materials: Conform in all respects to the "Safety Standard for Architectural Glazing Materials" (16CFR 1201) issued by the Consumer Product Safety Commission and Chapter 24 of the International Building Code.

C. Insulating glass units to be CBA rated with the Insulating Glass Certification Council (IGCC) in accordance with ASTM Specifications E-773 and E-774.

1.04 SUBMITTALS

A. Submit per Section 01 33 00.

1. Manufacturer's recommended installation instructions.

2. Samples for each type glass specified.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner that will avoid damage. Reject scratched glass.

1.06 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

   1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

   1. Warranty Period: 10 years from date of Substantial Completion.

C. Submit per Section 01 78 23.

PART 2: PRODUCTS

2.01 MANUFACTURERS/FABRICATORS

A. Glass Manufacturers and/or Coating Manufacturers: Vitro Architectural Glass, www.vitroglazings.com; Guardian Industries, www.sunguardglass.com; Old Castle Building Products, www.oldcastlebe.com; Pilkington North America, Inc., www.pilkington.com; Viracon, www.viracon.com;

B. Safety Glass Manufacturers: SAFTI First, www.safti.com. Comparable products as manufactured by Technical Glass Products, www.fireglass.com; Vetrotech Saint-Gobain, www.vetrotechusa.com are acceptable. School Guard Glass (SGG), www.schoolguardglass.com; Global Security Glazing Secur-tem 3, www.security-glazing.com.

C. Interlayer Manufacturers: Solutia/Saflex, www.saflex.com or equal.

D. Glass Product Fabricators: As certified by glass manufacturers and/or coating manufacturers.

2.02 INTERIOR GLAZING

A. Clear:

   1. Clear Float Glass, ¼" thick.

B. Safety:

   1. Clear heat-tempered float glass, ¼" thick.

2.03 EXTERIOR GLAZING

A. Low-E glass to be solar control (MSVD coating process).

B. For locations requiring safety glazing, provide heat-tempered glass for inboard and outboard lites, unless laminated glazing is called out on drawings or specified.

C. Clear Insulated Glass: (Type EC1)

1. 1” overall thickness insulated glass.

   a. Exterior glass ply/coating: ¼” clear, Vitro Solarban 60 or Guardian SN68; Low-E on Surface #2.
   b. Spacer: Warm edge.
   c. Airspace: ½” argon filled.
   d. Silicone: Black
   e. Interior glass ply: ¼” clear.

2. Performance Requirements:

   a. Transmittance
      1) Visible Light 70%
      2) Solar Energy 34%
      3) Ultra-Violet 18%

   b. Reflectance
      1) Visible Light Exterior 11%
      2) Visible Light Interior 12%
      3) Solar Energy 28%

   c. ASHRAE U-Value
      1) Summer Daytime 0.22 Btu
      2) Winter Nighttime 0.24 Btu

   d. Shading Coefficient 0.44

   e. Relative Heat Gain 91.7 Btu/hr x Sq.Ft.

   f. Solar Factor (SHGC) 0.39

   g. LSG 1.79

3. For units requiring “Safety Glazing” per Part 3 of Specification, provide “safety” glass plys. Specified under interior glazing.

2.04 ACCESSORIES

A. Glazing Sealant: Two-part silicone similar to Dow Corning 982 Insulating Glass Sealant. Glazer is responsible to verify compatibility to primary seal material.

B. Setting Blocks: 70-90 Shore "A" durometer, sized to accommodate size of glass used, compatible with glazing sealant.

C. Spacers: Warm edge spacer, compatible with sealant used. Maximum “U” value at glass edge: 0.272.

D. Primer - Sealers, Cleaners: As recommended by glass manufacturer.

PART 3: EXECUTION

3.01 INSPECTION

A. Check that glazing channels are free of burrs, irregularities, and debris.

B. Check that glass is free of edge damage or face imperfections.

C. Do not proceed with installation until conditions are satisfactory.

3.02 PREPARATION

A. Field Measurements:

1. Measure size of frame to receive glass.
2. Compute actual glass size, allowing for edge clearances.

B. Preparation of Surfaces:

1. Remove protective coatings from surfaces to be glazed.
2. Clean glass and glazing surfaces, to remove dust, oil and contaminants. Wipe dry.

3.03 SAFETY GLAZING

A. Install safety glazing at the following locations and/or as required by local building codes.

1. Doors and adjacent glazing.
   a. In doors when glass is wider than 2 15/16".
   b. Glass within 24" of vertical door edges and to a point 60" above the floor.

2. Individual fixed or operable panels when any of the following conditions are met:
   a. Individual panes 9 square feet and greater.
   b. Glass within 18" of the floor.
   c. When exposed individual pane is greater than 36" above the floor, except when a horizontal mullion is detailed between 34" and 38" above the floor.
   d. Walking surfaces within 36 inches horizontally of the pane of glazing.

3. Stairs, landings and ramps.

   a. In guards or railings adjacent to stairs, landings and ramps.
   b. Glazing adjacent to stairways, landings and ramps within 36" horizontally of walking surface and less than 60" above pane of adjacent walking surface.
   c. Glazing adjacent to bottom tread of stairways within 60" horizontally and less than 60" above the nose of the tread, unless the glass is protected by a guardrail and the glass is greater than 18" of the guardrail.

3.04 INSTALLATION

A. Install glass in accordance with glass manufacturer's current printed instructions.

3.05 CLEANING

A. Remove excess glazing compound from installed glass.

B. Remove labels from glass surface as soon as installed.

C. Wash and polish both faces of glass.

D. Remove debris from work site.

3.06 PROTECTION OF COMPLETED WORK

A. Attach crossed streamers away from glass face.

B. Do not apply markers to glass surface.

C. Replace damaged glass.

END OF SECTION 08 80 00

SECTION 08 91 00

LOUVERS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Pre-finished aluminum exterior wall louvers.

2. Prior to installation of finished materials, all flexible flashings shall be observed by the Architect. The Architect shall be given a minimum of 72 hours notice prior to the desired observation time. Any finish materials (i.e., brick, insulation, metal, etc.) installed without observation by the Architect shall be removed and replaced at the Contractor's expense.

B. Related work specified in other sections:

1. Metal coping – Section 07 62 00.

2. Flashings – Section 07 65 00/13.

3. Caulking and sealants – Section 07 92 00.

4. Mechanical connections to louvers – Division 23.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Product Data: Submit product data sheet for specified products.

   a. Performance Certificates: Submit performance certification, if not include in product data.

2. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, flexible flashings, accessories, finish colors, patterns and textures.

   a. Include information necessary for fabrication and installation of louvers. Indicate materials, sizes, thickness, fastening and profiles.

3. Quality Assurance Submittals: Submit the following:

   a. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

      1) Submit certified test results from an approved testing laboratory showing that the louvers proposed meet the criteria specified herein.

   b. Certificates: Product certificate signed by manufacturer certifying materials comply with specified performance characteristics and criteria, and physical requirements.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner which will avoid damage or deformation. Damaged louvers including nicks, scratches and blemishes will be rejected.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings.

PART 2: PRODUCTS

2.01 LOUVERS

A. Manufacturer: Products by Industrial Louvers, Inc., www.industriallouvers.com, 763-972-2981 are specified. Other manufacturers noted subject to conformance with specification are acceptable: Airline Products The Airolite Co., Co., All-Lite Architectural Products, American Warming and Ventilating, Arrow United Industries, Cesco Products, Commercial Air Products, Construction Specialties, Inc., Ruskin Manufacturing Co., Safe-air/Dowco.

2.02 WALL LOUVERS

A. Model: 458XP

1. Frame:

    a. Frame Depth: 4 inches.
    b. Material: Extruded aluminum, 6063-T6
    c. Wall Thickness: 0.081 inch, nominal

2. Blades:

    a. Style: Drainable
    b. Material: Extruded aluminum, 6063-T6
    c. Wall Thickness: 0.081 inch, nominal
    d. Angle: 35/45 degrees
    e. Centers: 3.875 inches, nominal

3. Performance Data:

    a. Performance Ratings: Product must be licensed to bear the AMCA Certified Ratings Seal for Water and Air Performance.
        1) Based on testing 48 inches by 48 inches size unit in accordance with AMCA 500-L.
    b. Free Area: 53.4% (8.54 sq.ft)
    c. Water Penetration: Maximum of .01 ounces at an air flow of 1062.8 FPM
    d. Static Pressure Loss: Not more than .15 inch of water gauge at an air flow of 854 FPM free area velocity.

4. Louver Accessories:

    a. Exterior Aluminum Sill: Provide sill flashing of same material and finish as louvers where indicated on the drawings.

    b. Louver Screens: Provide framed removable, re-wire-able screens for exterior louvers.

        1) Bird Screen:

            a) Aluminum, 1/2 inch by 0.063 inch expanded, flattened.

2.03 MATERIALS

A. Aluminum Sheet: ASTM B209 Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer to provide required finish.

B. Aluminum Extrusions: ASTM B221, Alloy 6063.

C. Fastenings: Provide stainless steel screws and fasteners for aluminum louvers and zinc-coated or stainless steel screws and fasteners for steel louvers. Provide other accessories as required for complete and proper installation.

2.04 FABRICATION

A. Fabrication Requirements:

1. Performance: Fabricate as required for optimum performance with respect to water penetration, strength, durability and uniform appearance.

2. Size:
   a. Fabricate louvers in masonry walls to outside dimensions indicated, with allowance of 3/8" on each side for sealant joints.
   b. Verify sizes with final HVAC shop drawings, including detail dimensions of ductwork, dampers or other fittings abutting louvers.

3. Field Measurements: Verify size, location and placement of louver units prior to fabrication.

4. Shop Assembly:
   a. Fabricate to minimize field adjustments, splicing, mechanical joints and field assembly of units.
   b. Preassemble units in shop to greatest possible and disassemble as necessary for shipping and handling.
   c. Clearly mark units for reassembly and coordinated installation.

5. Accessories: Include supports, anchorages and accessories required for complete assembly.

6. Vertical Mullions: Provide vertical mullions of type and spacing indicated but not further apart than recommended by the manufacturer.

7. Horizontal Mullions: Provide horizontal mullions at horizontal joints between louver units except where continuous vertical assemblies are indicated.

8. Connections: Join frame and blade members to one another by welding, except where field bolted connections between frame members are made necessary by size of louvers.

9. Spacing: Maintain equal blade spacing to produce uniform appearance.

2.05 FACTORY FINISHES

A. Finish/Colors: As selected by Architect from manufacturer's full line of available colors.

PART 3: EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Louver Installation:

1. Louvers shall be installed in accordance with manufacturers approved shop drawings and as shown. Provide all necessary fastenings and anchors required to complete installation.

2. Form tight joints within work of this Section. Fit exposed connections accurately.

3. Protect metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces, which shall be in contact with concrete, masonry or dissimilar metals.

3.04 PROTECTION AND CLEANING

A. Protect louvers and finish from damage by other trades.

B. Repair damaged louvers or replace.

END OF SECTION 08 91 00

SECTION 09 21 16

GYPSUM BOARD

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Non load bearing interior metal stud framing for drywall.
2. Gypsum wallboard and joint system.
3. Installation of acoustic spray system at top of walls and penetrations (sealing of mech/elec penetrations is specified in Div 21-28) as noted on drawing.
4. Mold and moisture resistant gypsum board at inside face of exterior walls.
5. Sound batt insulation and acoustic sealant at gypsum board.
6. Gypsum tile backer board as a substrate for ceramic wall tile.

B. Related work specified in other sections:

1. Insulation - Section 07 21 00.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. UL listings for gypsum board partitions for proposed products.
2. UL listings for shaft wall assemblies proposed.
3. Samples of mold and moisture resistant gypsum board.
4. Samples of gypsum tile backer board.
5. Samples of abuse-resistant gypsum board.
6. Samples of high impact-resistant gypsum board.
7. Tackwall: Samples of trim reveal and board. Product data on adhesives.

1.04 QUALITY ASSURANCE

A. Referenced Specifications: Current Gypsum Associates publications (www.gypsum.org).

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling

1. Deliver materials to the project site with manufacturer's labels intact and legible.

2. Handle materials with care to prevent damage.

3. Deliver fire-rated materials bearing testing agency label and required fire classification numbers.

4. The plastic packaging used to wrap gypsum panel products for shipment is intended to provide temporary protection from moisture exposure during transit only and is not intended to provide protection during storage after delivery. Such plastic packaging shall be removed immediately upon receipt of the shipment.

   a. Failure to remove protective plastic shipping covers can result in condensation which can lead to damage, including mold.

B. Storage

1. Store materials inside under cover, stack flat, properly supported on a level surface, all in same direction, off of floor. Gypsum panel products to be fully protected from weather, direct sunlight exposure and condensation.

2. Avoid overloading floor system

3. Store adhesives in dry area; provide protection against freezing at all times.

4. Steel framing and related accessories shall be stored and handled in accordance with AISI's "Code of Standard Practice".

1.06 JOB CONDITIONS

A. Environmental Conditions

1. Do not install gypsum board products at temperatures below 40°F for mechanical installation and 50°F for adhesive installation, unless approved by manufacturer.

2. Measure temperature and humidity on a daily basis during taping operations. Re-application of taping compound shall not occur sooner than shown on the table in Gypsum Association Brochure GA-236.

3. Temperature: During cold weather, in areas receiving wallboard installation, maintain temperature range between 55°0 F to 90° F for 48 hours before, and during gypsum board and joint treatment application. Maintain specified temperature range until joint treatment is completely dry.

4. Ventilation

   a. Provide ventilation during and following adhesives and joint treatment applications.

   b. Use temporary air circulators in enclosed areas lacking natural ventilation.

   c. Under slow drying conditions, allow additional drying time between coats of joint treatment.

   d. Protect installed materials from drafts during hot, dry weather.

B. Protect adjacent surfaces against damage and stains.

1.07 JOB COORDINATION

A. Coordinate Work with installation of metal framing and electrical work.

B. Coordinate framing and blocking for wall mounted accessories with Section 06 10 53.

PART 2: PRODUCTS

2.01 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. General: Complying with ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

2.02 GYPSUM BOARD

A. Standard

1. Panel Physical Characteristics.

    a. Core: Regular
    b. Surface Paper: 100% recycled content paper on front, back and long edges.
    c. Long Edges: Tapered; square edge acceptable at areas with Level 1 finish.
    d. Thickness: As noted on drawings.
    e. Panel shall comply with requirements of ASTM C 1396 Standard Specification for Gypsum Board.

B. Fire-Resistance Rated.

1. Type X, Panel Physical Characteristics

    a. Core: Fire-resistant rated gypsum core.
    b. Surface Paper: 100% recycled content paper on front, back and long edges.
    c. Long Edges: Tapered; square edge acceptable at areas with Level 1 finish.
    d. Thickness: 5/8”
    e. Panel shall comply with Type X requirements of ASTM C 1396 Standard Specification for Gypsum Board.

2. Type C, Panel Physical Characteristics

    a. Core: Fire-resistant rated gypsum core.
    b. Surface Paper: 100% recycled content paper on front, back and long edges.
    c. Long Edges: Tapered; square edge acceptable at areas with Level 1 finish.
    d. Thickness: 1/2”
    e. Panel shall comply with Type C requirements of ASTM C 1396 Standard Specification for Gypsum Board.

C. Mold and Moisture Resistant

1. Panel Physical Characteristics

    a. Core: Moisture resistant (moisture and fire-resistant rated at Type X).
    b. Surface Paper: Coated fiberglass mat on face, back and long edges.
    c. Long Edges: Tapered; square edge acceptable at areas with Level 1 finish.

d. Thickness: As noted on drawings. (5/8" at fire-resistant applications)
e. Humidified Deflection: Not more than ¼" when tested in accordance with ASTM C473 and C1658.
f. Water Absorption: Less than 5% of weight when tested in accordance with C1396M and C1658.
g. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273

D. Gypsum Tile Backer Board:

1. Panel Physical Characteristics

a. Core: Moisture resistant (moisture and fire-resistant rated at Type X).
b. Surface Paper: Coated fiberglass mat on face, back and long edges.
c. Long Edges: Tapered; square edge acceptable at areas with Level 1 finish.
d. Thickness: As noted on drawings. (5/8" at fire-resistant applications)
e. Humidified Deflection: Not more than ¼" when tested in accordance with ASTM C473 and C1178.
f. Water Absorption: Less than 5% of weight when tested in accordance with C1396M and C1178.
g. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273
h. Permeance: Not more than 1.0 perms when tested in accordance with ASTM E96.

E. Metal Framing:

1. Protective Coating: ASTM C 645/C, 645M G40 (Z120) or equivalent corrosion resistance.

a. Metal studs and runners.
1) Metal Thickness
a) 20 gauge or ProSTUD 20 gauge equivalent.
b) 25 gauge or ProSTUD 25 gauge equivalent.
2) Size: 1 5/8", 2 ½", 3 5/8", 4" or 6" deep as noted on drawings.

b. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

c. Fire Stop Track: Top runner designed to allow partition head to move while maintaining integrity of assembly fire-resistance rating. Thickness not less than indicated for studs, and of width to accommodate depth of studs.

d. Hat-Shaped, Rigid Furring Channels
1) Base Metal Thickness: 0.0179 inch.
2) Depth: 7/8" or 1 ½" as noted on drawings.

e. Resilient Furring Channels: ½" deep, steel members designed to reduce sound transmission.

f. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1 ¼", wall attachment flange of 7/8", minimum bare metal thickness of 0.0179 inch and depth required to fit insulation thickness.

g. Radius Framing: Steel sheet runner for non-structural curves, bends, variable radii and arches. Design to provide higher strength capacity than conventional lighter gauge material by using a work-hardened steel base strip.
1) Base Metal Thickness and Size: Match studs.

h. Flat Strap and Backing Plate Sheet: For blocking or bracing.
1) Base Metal Thickness: 20 gauge.
2) Width: 6 inch.

i. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power and other properties required to fasten steel framing and furring member securely to substrates involved; comply with recommendations of gypsum board manufacturers for application indicated.

j. Ceiling Suspension Systems. Use one of the following systems:
   1) Metal studs with depth required to handle span.
   2) 1 ½" cold rolled steel channels, 8 gauge annealed hanger wire and furring channels.
   3) Direct-hung system composed of 8 gauge hanger wire, main beams and interlocking cross furring members as manufactured by:
      a) Armstrong World Industries, "Furring Systems/Drywall".
      b) Chicago Metallic Corp. "Drywall Furring 640/Drywall Furring 660".
      c) USG Interiors, Inc. "Drywall Suspension Systems".

F. Accessories:

1. Trim: ASTM C 1047.

   a. Material: Galvanized or aluminum-coated steel sheet, rolled zinc.
   b. Shapes:
      1) Cornerbead.
      2) L-C Bead: J-shaped; exposed long flange receives joint compound.
      3) L-Bead: L-shaped: exposed long flange receives joint compound.
      4) Off-angle or splayed cornerbead.
      5) V-shaped Control Joint protected with plastic tape.

2. Acoustical sealant conforming to ASTM C 919.

3. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

   a. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
   b. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

4. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

   a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR, 59, Subpart D (EPA Method 24).

5. Sound Batt Insulation and Rigid Wall Insulation: Conform to requirements of Section 07 21 00.

6. Joint Treatment Materials:

   a. General: Comply with ASTM C 475/C 475M.
   b. Joint Tape:
      1) Interior Gypsum Wallboard: 2 1/16" wide paper reinforcing tape.
      2) Glass-Mat Gypsum Wallboard: 2" wide self adhering fiberglass tape.
      3) Tile Backing Panels: As recommended by panel manufacturer.
   c. Joint Compound for Interior Gypsum Wallboard: Drying type pre-mixed vinyl base compound and/or drying type pre-mixed vinyl base topping compound.
   d. Joint compound for glass-mat gypsum wallboard: As recommended by wallboard manufacturer.

7. Acoustic spray system: Conform to the requirements of Section 07 21 00 Insulation.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates to which gypsum board construction attaches or abuts, installed hollow metal frames, cast-in anchors and structural framing with installer present for compliance with requirements for installation tolerances and other conditions affecting performance of gypsum board assemblies specified in this section.

   1. Do not proceed with installation until satisfactory conditions have been corrected.

3.02 INSTALLATION OF STEEL FRAMING, GENERAL

A. Steel framing installation standard: Comply with ASTM C 754.

B. Metal Stud Schedule

   1. Use 25 gauge metal studs or equivalent on partitions up to 12’-0” high and soffits.
   2. Use 20 gauge or equivalent metal studs on:
      a. Metal stud partitions over 12’-0” high.
      b. Metal stud ceilings.
      c. Double studs at each door and borrowed light jamb and head.

C. Install supplementary framing, blocking and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, door bumpers, furnishings and similar construction to comply with details indicated and with recommendations of gypsum board manufacturer.

D. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement, at location indicated below to comply with details shown on drawings.

   1. Where suspended ceiling assemblies abut building structure horizontally at ceiling perimeters or penetrations of ceiling.

   2. Where partitions and wall framing abut overhead structure.
      a. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.

E. Do not bridge building expansion and control joints with steel framing or furring members, independently frame both sides of joints with framing or furring members or as indicated.

3.03 INSTALLATION OF STEEL FRAMING FOR CEILINGS AND SOFFITS

A. Suspend ceiling hangers from building structural members and as follows:

   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum not part of supporting structural or ceiling suspension system.

      a. Splay hangers only where required to miss obstruction s and offset resulting horizontal forces by bracing, counter splaying or other equally effective means.

   2. Where widths of ducts and other construction within ceiling plenum produce hanger spacing that interfere with the location of hangers at spacing required to support standard suspension system members, install supplemental suspension system members and hangers in form of trapezes or equivalent devices.

      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

3. Secure wire hangers to structure, by looping or wire tying, directly to supporting structure, including intermediate framing members. Attach to inserts, eye screws, or other devices appropriate for structure to which hangers are attached as well as for type of hanger involved in manner that will not cause deterioration or failure, due to age, corrosion or elevated temperatures.

4. Do not attach hangers to metal roof deck or metal deck tabs.

5. Do not connect or suspend steel framing from ducts, pipes or conduits.

B. Keep hangers and braces 2 inches clear of ducts, pipes and conduits.

C. Wire-tie or clip furring members to main runners and to other structural supports.

D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension system abuts vertical surfaces. Mechanically join main beam and cross furring members to each other and butt cut to fit wall track.

3.04 INSTALLATION OF STEEL FRAMING FOR WALLS AND PARTITIONS

A. Install runners (tracks) at floors, ceilings and structural walls and columns where gypsum board stud system abuts other construction.

1. Use proprietary tracks for non-rated and fire rated walls and partitions.
2. Install studs full height for all partitions unless noted otherwise.
3. Where studs are installed directly against masonry or concrete walls, set studs in acoustical sealant.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surface does not vary more than 1/8” from plane of faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at or just above suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

1. Cut studs ½ inch short of full height to provide perimeter relief.
2. For STC-rated or fire-resistance rated partitions that extend full height, install framing around structural members, as required to support gypsum board closures needed to make partitions continuous from floor to underside of structure above.
3. Install bridging/spacing bar.

D. Brace partition framing, not extending full height to structure above, with studs same size and thickness as partition framing. Provide bracing at:

1. 6’-0” o.c. intervals along length of partitions.
2. Not less than 6’-0” from partition ends and corners.
3. Door and window openings.

E. Terminate partition framing at suspended ceiling where indicated.

F. Install metal studs and furring in sizes and at spacings indicated.

1. Single and Multi Layer Construction: Space studs 16 inches o.c., unless otherwise indicated.

G. Install metal studs with flanges in same direction and leading edge or end of gypsum board panel can be attached to open (unsupported) edges of stud flanges first.

H. Frame door openings to comply with details indicated, with GA-219 and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to

frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

I. Frame openings other than door openings to comply with details indicated, or if none indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

1. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

3.05 APPLICATION OF GYPSUM BOARD

A. Install the following gypsum board types as follows:

1. Regular type: All non-rated areas unless noted differently below.
2. Type X or C: As required to meet fire-resistant rated assemblies.
3. Mold and Moisture Resistant: All gypsum board on the interior face of an insulated stud exterior wall. (Note: Gypsum Board on furred masonry walls can be regular type.)

B. Gypsum Board Application and Finishing Standards: Comply with ASTM C 480 and GA-216.

C. Install sound attenuation insulation blankets where indicated, prior to gypsum board, unless readily installed after board has been installed on one side.

D. Single-Layer Application: Install gypsum wallboard as follows:

1. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.

2. On partitions/walls apply gypsum board vertically (parallel to framing), unless otherwise indicated or required by fire resistance rated assembly, and provide sheet lengths which will minimize end joints.
   a. On partitions/walls 8’-1” or less in height, apply gypsum board horizontally (perpendicular to framing); use maximum length sheets possible to minimize end joints.
   b. At stairwells and other high walls, install gypsum board horizontal, unless otherwise indicated or required for fire resistance rating.
   c. On Z-furring, apply gypsum panels vertically (parallel to framing). Locate edge joints over furring member.

E. Double-Layer Application: Install gypsum backing board for base layer and exposed gypsum board for face layer.

1. On ceilings apply base layer prior to application of base layer on walls/partitions; apply face layer in same sequence. Offset joints between layers minimum one stud space. Apply base layers at right angles to supports, unless otherwise indicated.

2. On partitions/walls apply base layer and face layer vertically (parallel to framing) with joints of base layer over supports and face layer joints offset minimum one stud space with base layer joints.

F. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for light at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.

G. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints.

1. Position boards so like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends.
2. Do not place tapered edges against cut edges or ends.

3. Gypsum panel product joints shall be located so that no joint will align with the edge of an opening unless control joints are to be installed at these locations.
4. Joints on opposite sides of a partition shall not occur on the same stud.
5. In single layer gypsum panel products systems, end joints parallel to and on the same side of framing members shall be staggered between alternate courses of gypsum panel products and from joints on the opposite side of the framing members.
6. In multi-layer gypsum panel product systems, end joints parallel to and on the same side of framing members shall be staggered between alternate courses of gypsum panel products.
7. Base layer end joints parallel to and on one side of framing shall be staggered from base layer end joints on the opposite side of the framing members.
8. Install ceiling boards across framing in manner to minimize end-butt joints, and avoid end joints in central area of each ceiling. Stagger end joints at least 24 inches.

H. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors and doors over 32 inches wide except where full grout is shown. Apply spot grout at each jamb anchor clip just before inserting board into frame.

I. Form control joints and expansion joints at locations indicated or as recommended, with space between edges of boards, prepared to receive trim accessories.

1. Where a control joints occurs in an acoustical or fire-rated system, blocking shall be provide behind the control joint by using a backing material such as 5/8" type X gypsum panel product, or other tested equivalent.

J. Cover both faces of metal stud partition framing with gypsum board in concealed spaces (above ceiling, etc.), except in chase walls which are braced internally.

1. Except where concealed application is indicated or required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq.ft. area, and may be limited to not less than 75 percent of full coverage.
2. Fit gypsum board around ducts, pipes and conduits.

K. Isolate perimeters of non-load-bearing drywall partitions at structural abutments. Provide ¼ to ½ inch space to accept trim edge.

L. Where STC-rated gypsum board assemblies are indicated or drawings indicate acoustical sealant, seal construction at perimeters, behind control and expansion joints, openings, and other penetrations with a continuous bead of acoustical sealant. Include a bead of sealant at both faces of partitions.

1. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim and closing off sound flanking paths around or through gypsum board assemblies, including partitions extending above ceilings.
2. Where resilient furring channels are used over steel framing, the screws used to attach the gypsum panel product to the furring channels shall not contact the framing.

M. Gypsum panel products applied to walls shall be applied with the bottom edge spaced a minimum of 1/8 inch and maximum of ¼ inch above the floor.

N. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

O. Wall Tile Substrates: For substrates scheduled to receive ceramic or porcelain tile, comply with the following:

1. Install gypsum tile backer board panels to comply with manufacturer's installation instructions at locations scheduled to receive wall tile. Install with ¼" open space where panels abut other construction.

3.06 METHODS OF GYPSUM BOARD FASTENING

A. Fastener lengths shall be at least 1 1/8” long for ½” gypsum panels and 1 ¼” long for 5/8” gypsum panels used for metal framing.

B. Screws shall be spaced not more than 12 in. o.c. for ceilings and 16 in. o.c. for walls where the framing members are 16 in. o.c. Screws shall be spaced not more than 12 in. o.c. for both ceilings and walls where framing members are 24 in. o.c.

C. Fasteners at gypsum panel product edges or ends shall be located not less than 3/8” from the edge or end. Fasteners at edges or ends in a perpendicular application shall be located not more than 1 in. from the edge or end. Perimeter attachment into partition top and bottom plates is neither required nor recommended except where fire ratings, structural performance requirements, or other special conditions require such attachment.

D. While diving fasteners, gypsum panel products shall be held in firm contact with framing members or underlaying support. Application of fasteners shall proceed from the center or field of the gypsum panel product toward the ends and edges, or shall begin along one edge and proceed toward the other edge.

E. To provide a more flat surface at joints, attach gypsum board to steel studs so leading edge or end of each board is attached to open (unsupported) edge of stud flanges first.

F. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.

G. Screws shall be driven so that screw heads are slightly below the gypsum panel product surface without breaking the face paper, fracturing the core, or stripping the framing member around the screw shank.

H. Double-Layer Fastening Methods: Apply base layer of gypsum board and face layer to base layer as follows:

1. Fasten base layer with screws and face layer with adhesive and supplementary fasteners, except where otherwise required for fire-resistance rated assemblies.

3.07 INSTALLATION OF DRYWALL TRIM ACCESSORIES

A. General: Where feasible, use same fasteners to anchor trim accessory flanges as required to fasten gypsum board to supports. Otherwise, fasten flanges to comply with manufacturer’s recommendations.

B. Install corner beads at external corners.

C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound except where “U” bead (semi-finishing type) is indicated.

1. Install “J” bead where drywall construction is tightly butted to other construction and back flange can be attached to framing or supporting substrate.
2. Install “L” bead where edge trim can only be installed after gypsum board is installed.

D. Install control joints at locations as follows:

1. At ceilings, 50’-0” o.c. each way maximum and/or where shown on drawings. At corners and at tee intersections of soffits that change directions.
2. At walls, 30’-0” o.c. maximum, and/or where shown on drawings.
3. Full height door frames shall be considered equivalent to a control joint.

3.08 FINISHING OF GYPSUM WALL BOARD

A. General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim and control joints; penetrations; fastener heads, surface defects and elsewhere as required to prepare work for decoration.

B. Prefill open joints using setting-type joint compound.

C. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.

D. Glass-Mat Water Resistant Backer Board: Comply with glass mat backer board manufacturer's recommendations.

E. Water or additive shall not be added to joint compound unless recommended by manufacturer. See quality assurance for application temperature and drying times.

F. Levels of Gypsum Board Finishing per Gypsum Association GA-214 and as note herein:

1. Level 1/Fire Taping: All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Tape and fasteners need not be covered.

    a. For use in plenum areas above ceilings, gypsum board not scheduled for paint or wallcovering, gypsum board concealed from view in the finished work, except as noted in level 2.

2. Level 2: All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.

    a. For use on areas that are a substrate for tile or wood paneling.

3. Level 3: All joints and interior angles shall have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free to tool marks and ridges.

    a. For use on surfaces of mechanical and electrical spaces scheduled to receive paint.

4. Level 4: All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. When necessary, sand between coats and following final coat to provide smooth surface ready for decoration.

    a. For use on all walls scheduled for paint or wallcovering except those areas noted under Level 3 and 5.

5. Level 5: All joints and interior angles shall have tape embedded in joint compound and two separate coats for joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges. When necessary, sand between coats and following final coat to provide smooth surface ready for decoration.

    a. For use on all ceilings; walls and/or soffits under skylights and clerestories, and as noted on drawings. Note: when Level 5 finish is used, it shall extend to nearest inside or outside corner.

3.09 FINISHING ADJUSTMENT

A. Screw Pop

1. Repair nail pop by driving new screw approximately 1-1/2 inches away and reseat screw.

2. When face paper is punctured drive new screw approximately 1-1/2 inches from defective fastening and remove defective fastening.

3. Fill damaged surface with compound in coats specified by required finish level.

B. Ridging

1. Sand ridges to reinforcing tape without cutting through tape.

2. Fill concave areas on both sides of ridge with topping compound.

3. After fill is dry, blend in topping compound over repaired area.

C. Fill cracks with compound and finish smooth and flush.

D. Application of acoustic spray system

1. Install mineral wood backing at depth required per manufacturer's details.

2. Apply acoustic spray to required thickness and overlap onto adjacent surfaces as recommended by manufacturer to achieve specified sound transmission classification.

3.10 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Protect installed products from damage from weather, condensation, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 21 16

SECTION 09 30 00

TILE

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Mortar bed installations in showers on drawings with floor drains over depressed substrates.

2. Ceramic tile on walls and floors.

3. Caulking of joints in tile on inside corners of tiled rooms and sealing of joints in tile.

B. Related work specified in other sections:

1. Drywall substrates - Section 09 21 16.

1.03 SUBMITTALS

A. Submit in accordance to Section 01 33 00:

1. Submit samples for colors on 12" x 12" panels in duplicate for each tile specified for Architect's selection and approval.

2. Submit two (2) samples each for each different trim piece required for this project.

3. Furnish Master Grade Certificates to Architect for all tile, indicating compliance with TCA 137.1-76.

4. Submit product information on grout and samples indicating color range anticipated, texture.

5. Submit samples of sealant that match grout color.

6. Submit installation system manufacturer qualifications, installer qualifications, and laboratory confirmation of installation materials as outlined in Quality Assurance.

1.04 REFERENCE SPECIFICATIONS

A. The latest edition of following specifications and standards are incorporated by reference.

1. Tile Council of North America, Inc., Handbook for Ceramic Tile Installation (TCNA).

2. American National Standard Specifications for the installation of ceramic tile (ANSI).

B. Maintain a copy of publications in the Contractor's office, available for reference.

1.05 QUALITY ASSURANCE

A. Installation System Manufacturer (single source responsibility): Company specializing in adhesives, mortars, grouts and other installation materials with ten (10) years minimum experience and ISO 9001 certification. Obtain installation materials from single source manufacturer to insure consistent quality and full compatibility.

B. Submit laboratory confirmation of adhesives, mortars, grouts and other installation materials:

1. Identify proper usage of specified materials using positive analytical method.
2. Identify compatibility of specified materials using positive analytical method.
3. Identify proper color matching of specified materials using a positive analytical method.

C. Installer qualifications: company specializing in installation of ceramic tile, mosaics, pavers, trim units and thresholds with five (5) years documented experience with installations of similar scope, materials and design.

1.06 MOCK-UPS

A. Provide mock-up of each type/style/finish/size/color of ceramic tile, mosaics, pavers, trim unit and threshold, along with respective installation adhesives, mortars, grouts and other installation materials. Mock may be part of final installation if accepted.

1.07 PRE-INSTALLATION CONFERENCE

A. Pre-installation conference: at least three weeks prior to commencing the work attend a meeting at the jobsite to discuss conformance with requirements of specification and job site conditions. Representatives of Owner, Architect, General Contractor or Construction Manager, Tile Subcontractor, Tile Manufacturer, Installation System Manufacturer and any other parties who are involved in the scope of this installation must attend the meeting.

1.08 WARRANTY

A. The manufacturer of adhesives, mortars, grouts, and other installation materials shall provide a written twenty-five (25) year warranty, which covers materials and labor; reference Manufacturer Warranty Data Sheet for complete details and requirements.

B. For exterior facades over steel or wood framing, the manufacturer of adhesives, mortars, grouts and other installation materials shall provide a written ten (10) year warranty, which covers replacement of Manufacturer products only – reference Warranty Data Sheet for complete details and requirements.

1.09 PRODUCT HANDLING, DELIVERY AND STORAGE

A. Package, handle, deliver and store at the job site in original unbroken containers in a manner that will avoid damage or contamination. All containers shall bear grade seals, manufacturer's name, size, color and quantity.

B. Reject any tiles that are cracked or broken.

1.10 JOB CONDITIONS

A. Set and grout tile when ambient temperature is at least 50° F. and rising.

PART 2: PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Manufacturers listed in this specification are approved under the following conditions:

1. A manufacturer listed in both the specification and the Material Finish/Color Schedule, on Architectural Drawings is not required to submit a pre-bid approval.

2. Manufacturers listed in this specification, but not in the Material Finish/Color Schedule, on Architectural Drawings shall submit color samples for pre-bid approval by addendum. Refer to Section 01 25 00.
3. When no colors are listed in the Material Finish/Color Schedule, on Architectural Drawings, any manufacturer listed in this specification are not required to submit a pre-bid approval.

2.02 CERAMIC FLOOR TILE

A. Manufacturers: Products by Dal-Tile are specified. Products by Crossville, U.S. Ceramic, American Olean and Florida Tile are acceptable.

B. Ceramic Floor Tile 2" x 2".

1. Colors: See Material Finish/Color Schedule, on Architectural Drawings.

2. Patterns: Provide as shown on drawings.

C. Base: Dal-Tile MB5A 2” x 2” base without bullnose and MB5B 2” x 2” base with bullnose top.

2.03 CERAMIC WALL TILE

A. Manufacturer: Products by Dal-Tile, American Olean, US Ceramics, and Florida Tile are acceptable, subject to color match approval by the Architect prior to bidding.

B. 4-1/4" x 4-1/4" glossy and trim pieces.

1. Colors: See Material Finish/Color Schedule, on Architectural Drawings.

2. Patterns: Provide as shown on drawings.

2.04 SETTING MATERIALS

A. Manufacturers: Products and systems by Bostik Construction Products are specified. Equivalent products and systems by Ardex, Mapei, Bonsal, H.B. Fuller, Laticrete, Custom Building Products, and American Olean are acceptable subject to approval of submittals.

B. Tile Setting Systems:

1. Setting bed for tile on concrete slabs-on-grade, mortar bed, or masonry walls: Acrylic latex modified thin set meeting ANSI A118.4 and ANSI A118.11, Bostik “ReFlex” (TCNA F111 or F113).

2. Setting bed for tile on floors of showers, toilet rooms and locker rooms on above grade locations: Waterproofing membrane and setting adhesive, Bostik “UltraSet Advanced” or “Gold Plus” single step application. (TCNA F121 or F122).

3. Setting bed for tile on existing gypsum board based substrates: Bostik “Ultra Set Advanced”. Use “Stonewall” for any tile over 24” in either direction (TCNA W242).

4. Setting bed for tile on fiberglass faced or tile backer board: Bostik “ReFlex” at dry areas or “ReFlex” with “Gold Plus” at wet areas such as showers, toilet rooms, locker rooms (TCNA W242).

5. Setting tile over existing glazed tile/painted concrete block: Bostik “Tile Mate Premium” mixed with Flex Elastic (TCNA TR713)

   a. Dry Areas: Organic adhesive OR non-sag mortar (ANSI 118.4) “Stonewall”.
   b. Wet Areas: Only non-sag (ANSI 118.4) “Stonewall”.

6. Setting bed for tile on concrete slab-on-grade in large format tile (>24" in any direction): "Stone Wall".

C. Mortar Bed: Mixture of portland cement and sand, roughly in proportions of 1:5 with latex polymer as the liquid portion of the mixture.

1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.

2. Reinforcing: Galvanized, welded wire fabric, 2 by 2 inches by 0.062 inch diameter; comply with ASTM A 185 and ASTM A82 except for minimum wire size.

D. Grout

1. For glazed ceramic and mosaic tile: Acrylic latex modified grout meeting ANSI A118.7, "Bostik" Ceramic Tile Grout" mixed with Bostik "Multi-Purpose Acrylic Latex Grout Additive".
   a. Color: As selected by Architect from manufacturer's full line of available colors.

2.05 MISCELLANEOUS MATERIALS

A. Sealant: One component silicone, color to match tile grout.

B. Silicone sealer for tile joints: "Grout Sealer" at manufactured by Aqua Mix, Inc.

C. Cleaners: As manufactured by Hillyard Chemical Company or American Olean.

D. Provide leveling system for tiles over 24" in any dimension as recommended by tile manufacturer.

E. Thresholds: Solid polymer made from homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without precoated finish. Sizes as detailed on drawings. Colors as selected by Architect to match field color of tile.

F. Metal Trim for Tile: As manufactured by Schluter Systems, LP or equal. Material: Brushed Aluminum.

1. CT Corner Trim: (For use at outside corners of tile to tile and terminations of ceramic/porcelain tile to other materials). RONDEC profile RO x tile height x AE.
   a. Provide, splice connectors, end caps, inside and outside corners as warranted by application.

2. CT Transition Strip:
   a. Carpet to Ceramic/Porcelain Tile Transition: RENO-ETK x Tile Height.
   a. Resilient Tile to Ceramic/Porcelain Tile Transition: RENO-EBU x Tile Height.

2.06 EXTRA STOCK

A. Furnish 1% of each type/shape//color of tile used on this project to Owner as maintenance stock.

PART 3: EXECUTION

3.01 EXAMINATION OF SURFACES

A. Inspect surfaces to which tile is to be applied. Commencement of work implies acceptance of surface and assumption of responsibility for satisfactory results.

3.02 MORTAR BEDS

A. Mix and install mortar, cleavage membrane and reinforcing per ANSI A108.B, sloping top of mortar bed with a constant slope from walls to floor drains.

B. Allow mortar bed to fully cure prior to commencing with tile work.

3.03 SETTING BEDS

A. Use systems identified in “Setting Materials” in Part 2 of this specification.

3.04 TILE INSTALLATION

A. General

1. Installation and workmanship shall be in accordance with ANSI Specifications and as specified herein. The printed instructions of the tile manufacturer and the manufacturer of proprietary mortars and grouts shall be followed where applicable.

2. Before commencing work, establish field pattern and border line locations and center the work symmetrically so that no tile need be cut to less than half size. Cut tile at base so top of base is level around entire room. Joints in wall tile shall be aligned vertically and horizontally; staggered joints will not be accepted. Rub exposed edges smooth.

3. Do not install any cracked or chipped tiles.

B. Movement Joints

1. Install joints to control the effects of substrate movement on tile finishes.
2. Construct joints in tile work according to movement joint details” EJ171” as published in TCNA “Handbook for Ceramic Tile Installation.”
3. Locate movement joints at the following locations:

   a. Interior: 20’ to 25’ maximum in each direction.
   b. Exterior and Interior tile work exposed to direct sunlight or moisture: 8’ to 12’ maximum in each direction.
   c. Where tile work abuts restraining surfaces including but not limited to perimeter walls, dissimilar floors, curbs, columns, pipes, ceilings, inside corners of abutting walls, and where changes occur in backing materials.
   d. All expansion, control, construction, cold and seismic joints in the structure. Expansion joints in tile work must match width of joint in building structure.

C. Crack isolation membrane: Install over minor cracks and non-structural slab joints to prevent transmission of cracking to tile. Strictly follow membrane and mortar manufacturers' printed instructions.

D. Waterproofing membrane: Install per manufacturers printed instructions, including two wet on wet applications at 20-30 mils thick. Full bonding to metal and PVC.

1. Perform 24-hour flood testing. Repeat application as required until flood test passes.

E. Install thresholds at transition from ceramic tile floors to other flooring materials and as shown on drawings.

F. Remove concrete curing compound with shot blasting or other appropriate mechanical means and vacuum floor on installations without mortar bed.

3.05 CLEANING, PATCHING, PROTECTION, SEALING

A. After completion, clean all work, point open joints and replace defective work.

B. Cleaning and Sealing

1. Ceramic Porcelain Tile Walls, Floors and Base: Clean with water, rinse and allow to dry. Apply one coat of silicone sealer. Wipe excess sealer from face of tile.

C. Protection

1. Floors: Close off workspaces to traffic during installation and at least 48 hours after completion of work.

2. Finished tile floors: Covered with clean building paper before foot traffic is permitted on them. Place board walkways on floors that are to be continuously used as passageways by workmen. Protect tiled vertical outside corners with board corner strips in areas used as passageways by workmen.

3. Remove protection just prior to substantial completion and re-clean tile as necessary.

END OF SECTION 09 30 00

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Lay-in acoustic ceilings.

B. Related work specified in other sections:

1. Mechanical penetration of ceilings - Divisions 21-25.

2. Electrical penetration of ceilings - Divisions 26-28.

1.03 SUBMITTALS

A. Submit Shop Drawings indicating installation layouts in accordance with Section 01 33 00.

B. Submit samples of all acoustical and suspension materials to Architect for approval.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unopened, protective packaging, with manufacturer's labels indicating brand name, pattern, size, thickness and fire rating as applicable, legible and intact.

B. Store materials in original protective packaging to prevent soiling, physical damage or wetting.

C. Store cartons open at each end to stabilize moisture content and temperature.

D. Do not begin installation until sufficient materials to complete a room are received.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Complete installation of dampening materials before beginning work.

B. Maintain humidity of 65% - 75% in area where acoustical materials are to be installed, 25 hours before, during, and after installation.

C. Maintain a uniform temperature in the range of 55 F. to 70 F. prior to, during, and after installation of materials.

PART 2: PRODUCTS

2.01 ACOUSTICAL MATERIALS

A. Products specified are as follows:

1. Armstrong, www.armstrong.com
2. USG, www.usg.com

B. ACT 2: Square edge, 5/8” thick, sag and abuse resistant, anti-microbial, low VOC, lay-in tile. Provide 24” x 24” tile.

1. Minimum NRC: 0.50
2. Minimum CAC: 30
3. Minimum LR: 0.86
4. Minimum Recycled Content: 33%
5. Armstrong “Tundra Humigard” #301
6. USG “Touchstone ClimaPlus” #5893

C. Furnish extra materials equal to 1% of each type of acoustical material supplied. Provide materials in new, unopened cartons labeled as to contents.

2.02 SUSPENSION SYSTEMS

A. Systems specified are by Chicago Metallic. Equivalent systems by USG or Armstrong are acceptable.

B. Suspension System for Non-Rated Lay-In Panels (except locations listed below): 200 Intermediate Duty Snap-Grid System, standard white finish.

C. Systems for use in kitchens, kitchen serving areas, toilets and locker rooms to be 1830 intermediate duty hot dipped galvanized capped with white aluminum capping.

D. Perimeter treatment components for all systems to be 0.020 inch thick hot dipped galvanized steel, 15/16” wide x ¾” high. Edges to be hemmed. Finished identical to main runners and cross tees.

PART 3: EXECUTION

3.01 CONDITION OF SURFACES

A. Examine surfaces scheduled to receive suspended or directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of work.

B. Mark access provisions as to size and location before beginning installation.

3.02 REQUIREMENTS FOR ALL MECHANICAL SUSPENSION SYSTEMS

A. Grid layout in each space, area located symmetrically in room, space. Coordinate work with other trades so that lighting fixtures, grilles, other ceiling fixtures work to grid layout.

B. Do not use universal splices or other types whose use would obstruct passage of recessed lighting fixtures through grid openings, or make untenable their reposition upon flanges of beams.

C. Support suspension system from structure above, not from ductwork, equipment or piping.

D. Space hangers not more than 6" from ends, not more than 4'-0" o.c. Between ends of main runners, provide extra hangers as required to support other work resting in or on ceiling.

E. Provide additional tee supports, hangers and cut tiles to support and fit to all sides of light fixtures, linear diffusers and other ceiling penetrations. Coordinate with mechanical and electrical drawings.

3.03 ACOUSTICAL MATERIALS

A. Install ceiling panels and tiles using clean gloves, to avoid soiling materials.

B. Install lay-in panels snugly against support system without damaging panels.

C. Field rabbit edges of panels where field-cut to match shadow-line profile.

D. Adjust any sags or twists which develop in the ceiling systems and replace any part which is damaged or faulty.

E. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings and suspension members; comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

F. Replace any damaged tile just prior to substantial completion.

END OF SECTION 09 51 00

SECTION 09 65 00

RESILIENT FLOORING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Vinyl base.

B. Related work specified in other sections:

1. Concrete Substrates – Section 03 30 00

1.03 SUBMITTALS

A. Submit per Section 01 78 23.

1. Submit full line of color samples for materials to be furnished for Architect's review and selection.

2. Provide manufacturer's recommended maintenance data and instructions prior to completion of work.

B. Specified warranties from manufacturer. Submit per Section 01 78 23.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened containers with labels indicating brand names, colors and patterns, and quality designations legible and intact.

B. Do not open containers or remove markings until materials are inspected and accepted.

C. Store and protect accepted materials in accordance with manufacturer's directions and recommendations.

D. Unless otherwise directed, store materials in original containers at not less than 70° F. for not less than 24 hours immediately before installation.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature in space to receive tile between 70° F. and 90° F. for not less than 48 hours before and 48 hours after installation.

B. Maintain minimum temperature of 65° F. thereafter.

PART 2: PRODUCTS

2.01 VINYL BASE

A. Manufacturer: Products by Johnsonite are specified. VPI, Armstrong, Burke, Roppe, Tarkett are acceptable.

B. Base: 1/8" thick x 4" high, solid vinyl. Straight base at carpet, coved base at other surfaces.

C. Color: See Material Finish/Color Schedule, on Architectural Drawings.

2.02 EXTRA STOCK

A. Furnish 1% of each type/color of flooring, trim used in this project to Owner as maintenance stock.

PART 3: EXECUTION

3.01 PREPARATION

A. Correct adverse conditions of any type before starting any installation.

3.02 ACCESSORIES

A. Apply coved base at all locations.

B. Install non-slip strips on ramps, vestibules 6” o.c.

END OF SECTION 09 65 00

SECTION 09 67 10

DECORATIVE QUARTZ FLOORING

PART 1: GENERAL

1.01 APPLICABLE DOCUMENTS

A. Bidding Requirements, Conditions of the Contract and pertinent portions of Sections in Division One of these Specifications apply to the Work of this Section.

1.02 SUMMARY

A. Section includes:

1. Coating systems for concrete apparatus bay floors; including coved base.

1.03 REFERNENCES

A. ASTM D 16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.

B. ASTM D 4259 – Standard Practice for Abrading Concrete.

C. ASTM D 4263 - Indicating Moisture in Concrete by the Plastic Sheet Method.

D. ASTM F 1869 - Measuring Moisture Vapor Emission Rate of Concrete Sub floor Using Anhydrous Calcium Chloride.

E. International Concrete Repair Institute (ICRI) Guideline No. 03732 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

F. SSPC-SP 13/NACE 6 - Surface Preparation of Concrete.

1.04 DEFINITIONS

A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.

B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.05 SUBMITTALS

A. Comply with Section 01 33 00 – Submittals.

B. Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.

C. Color Samples: Submit manufacturer’s color samples showing full range of standard colors.

D. Manufacturer’s Quality Assurance: Submit manufacturer’s certification that coatings comply with specified requirements and are suitable for intended application.

E. Applicator's Quality Assurance: Submit list of a minimum of 5 completed projects of similar size and complexity to this Work. Include for each project:

1. Project name and location.
2. Name of owner.
3. Name of contractor.
4. Name of architect.
5. Name of coating manufacturer.
6. Approximate area of coatings applied.
7. Date of completion.

F. Warranty: Submit manufacturer's standard 2 year floor coating warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Specialize in manufacture of coatings with a minimum of 5 years successful experience.
2. Able to demonstrate successful performance on comparable projects.
3. Single Source Responsibility: Coatings and coating application accessories shall be products of a single manufacturer.

B. Applicator's Qualifications:

1. Experienced in application of specified coatings for a minimum of 5 years on projects of similar size and complexity to this Work.
2. Applicator's Personnel: Employ persons trained for application of specified coatings.

C. Mock-Ups: Prepare 10 foot x 10 foot mock-up for each coating system specified using same materials, tools, equipment, and procedures intended for actual surface preparation and application. Obtain Architect's approval of mock-ups. Retain mock-ups to establish intended standards by which coating systems will be reviewed.

D. Pre-Installation Conference: Convene a pre-installation meeting 2 weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Contractor, Architect, applicator, and manufacturer's representative. Review the following:

1. Environmental requirements.
2. Protection of surfaces not scheduled to be coated.
3. Surface preparation.
4. Application.
5. Repair.
6. Field quality control.
7. Cleaning.
8. Protection of coating systems.
9. One-year inspection.
10. Coordination with other work.

1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

1. Coating or material name.
2. Manufacturer.
3. Color name and number.

4. Batch or lot number.
5. Date of manufacture.
6. Mixing and thinning instructions.

B. Storage:

1. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
2. Keep containers sealed until ready for use.
3. Do not use materials beyond manufacturer's shelf life limits.

C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Weather:

1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.

B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.

C. Dust and Contaminants:

1. Schedule coating work to avoid excessive dust and airborne contaminants.
2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2: PRODUCTS

2.01 PRODUCT DESCRIPTION

A. Manufacturer: Products specified are by Tnemec Company, Inc.. Equivalent products by Sonneborn and General Polymers are acceptable. Other equivalent products subject to approval by Architect prior to bidding.

B. Product: Laminate quartz flooring system for concrete floors – aggressive environment.

1. Heavy Abuse, Decorative Quartz, Frequently Wet, Heavy Vehicular Traffic: (Apparatus Bays, Turn-Out Gear Room, Storage Room, etc. as indicated on drawings).

a. System Type: Epoxy/Polyurethane.
b. Surface Preparation: Shot Blast or Mech. Abrade (CSP 4-6).
c. Primer: Series 201 Epoxoprime at 200 to 250 square feet per gallon.
d. Intermediate Coat: Series 222 Deco-Tread, (double broadcast or slurry broadcast) DFT 1/8 inch.
e. Epoxy Grout Coat: Series 284 Deco-Clear at 80 to 100 square feet per gallon.
f. Chemical Resistant Urethane Finish Coat: Series 295 Clear CRU at 325 to 350 square feet per gallon.
g. Total System Thickness: 1/8-inch system.
h. Finish Color: As selected by Architect from manufacturer's entire standard color selection.

C. Color/Texture: See Material Finish/Color Schedule, Sections 1-4 of Details of Construction.

D. Physical Properties:

1.	Hardness @ 24 hours Shore D ASTM D 2240	72.3
2.	Compressive Strength ASTM C 579	15,567 psi
3.	Tensile Strength ASTM C 307	2,100 psi
4.	Abrasion Resistance ASTM D 4060, CS-17 Wheel	65.2 mgs lost
5.	Flexural Strength ASTM C 580 ASTM D 790	 4,550 psi 127,876 psi
6.	Adhesion	400 psi
7.	ACI 503R	100% concrete failure
8.	Flammability ASTM D 635	Self-Extinguishing over concrete

2.02 ACCESSORIES

A. Coating Application Accessories:

1. Accessories required for application of specified coatings in accordance with manufacturer's instructions, including thinners.
2. Products of coating manufacturer.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which coating systems are to be applied. Notify Architect of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.02 PROTECTION OF SURFACES NOT TO BE COATED

A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.

B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.03 SURFACE PREPARATION OF CONCRETE FLOORS

A. Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

C. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.

D. Allow concrete to cure for a minimum of 28 days before coating.

E. Level protrusions and mortar spatter.

3.04 APPLICATION

A. Apply coatings in accordance with manufacturer's instructions.

B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.

C. Keep containers closed when not in use to avoid contamination.

D. Do not use mixed coatings beyond pot life limits.

E. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.

F. Uniformly apply coatings at spreading rate required to achieve specified DFT.

G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

H. Install a 4" Rolled radius cove base where directed in accordance with the CSM's written instructions and as indicated on Drawing No. TFS-15.

I. Fill all cracks and recessed joints, including control and construction joints per the methods outlined below for each specific area. When filled, joint should be flush with the floor surface.

3.05 REPAIR

A. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces affected by installation not scheduled to be coated.

B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.

C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.06 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.07 CLEANING

A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.08 PROTECTION OF COATING SYSTEMS

A. Protect surfaces of coating systems from damage during construction.

3.09 ONE-YEAR INSPECTION

A. Owner will set date for one-year inspection of coating systems.

B. Inspection shall be attended by Owner, Contractor, Architect, and manufacturer's representative.

C. Repair deficiencies in coating systems as determined by Architect in accordance with manufacturer's instructions.

END OF SECTION 09 67 10

SECTION 09 91 00

PAINTING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Field finish all materials scheduled and/or specified for paint, trim, stain or seal. Including but not limited to:

   a. Concrete floors
   b. Steel
   c. Galvanized metal
   d. Wood
   e. Gypsum Board
   f. Rated partition identification.

B. Related work specified in other sections:

1. Finishing of wood doors - Section 08 14 00.

2. Shop finishing - Applicable Sections.

3. Colored sealants – Section 07 92 00

1.03 SUBMITTALS

A. Provide three (3) copies of a schedule detailing each substrate in the same order as the schedules used in Part 2 of this section. Include the following:

1. The specific products to be used for each coat.

2. Documentation that the manufacturer has reviewed and approved each painting system.

3. Data pages for all products listed, highlight the following:

   a. Type of resin.
   b. Dry Film Thickness.
   c. Volume Solids.
   d. Units of Sheen.
   e. VOC content and chemical components.
   f. Other performance or descriptive data required by Part 2 of this section.
   g. If this information is not on the data page provide the information in a letter of certification from the manufacturer. Attach the letter to the appropriate data page.

B. Submit three (3) drawdowns of each product and color combination. Drawdowns shall be applied using a 4 mil WFT drawdown bar on Leneta form WD plain white coated cards size 3-7/8” x 6”.

1. Label each card with the following:

   a. Job name.
   b. Date.

c. Product name.
d. Product number.
e. Color number as stated in the material finish/color schedule.
f. Name, address, and phone number of the supplying facility.
g. Surface material product is to be applied onto.

C. Do not deliver material to site until having received written approval of submitted information and samples.

D. Complete sample area on project as selected by Architect on each type surface and with each type of paint system specified. Do not proceed further with application until receiving acceptance of each sample area by Architect. Accepted areas will serve as standard of quality for entire project.

1.04 EXAMINATION OF DOCUMENTS

A. Examine the specifications for the work of other trade contractors and to become familiar with their work. All surfaces that are left unfinished by the requirements of other specifications to be finished by this section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store materials not is use, in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg. F.

1. Maintain containers in clean condition, free for foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.06 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

C. Do not apply coatings during cold, rainy or frosty weather.

D. Do not apply to surfaces, which are exposed to hot sun.

1.07 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in “MPI Approved Products List.”

2. Preparation and Workmanship: Comply with requirements in “MPI Architectural Painting Specification Manual” for products and paint systems indicated.

PART 2: PRODUCTS

2.01 PAINTING SYSTEMS

A. Painting systems for normal applications are specified using the products of Sherwin-Williams Co. (S-W), PPG Paints [Glidden Professional: (GP); DEVOE COATINGS: (DC); (Sika)] (PPG) and Benjamin Moore & Co.: (BM) to establish standards of quality, except as noted.

1. Other manufacturers can submit for approval through the pre-bid process defined in Section 01 25 00 Substitutions and Product options.

a. For approval, submit data sheets for each paint type with volume solids and VOC’s highlighted to indicate they meet or exceed products specified in Part 2.

C. Use the materials of the same manufacturer for each system.

D. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Flat Paints, Coatings, and Primers VOC content of not more than 50 g/L.
2. Non-flat Paints, Coatings and Primers: VOC content of not more than 150 g/L.
3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Floor Coatings: VOC not more than 100 g/L.
5. Shellacs, Clear: VOC not more than 730 g/L.
6. Shellacs, Pigmented: VOC not more than 550 g/L.

E. For color selection see Material Finish/Color Schedule, on Architectural Drawings.

2.02 PRIMERS (INTERIOR AND EXTERIOR)

A. 100% Acrylic Exterior Wood Primer:

1. Minimum Volume Solids: 34%.
2. Maximum VOC: 150 g/L
   a. S-W Exterior Latex Wood Primer B80W41.
   b. GP Hydrosealer Exterior Primer/Sealer 6001-1200.
   c. PPG Speedhide Exterior Acrylic Wood Primer, 6-609.
   d. BM Fresh Start High hiding All Purpose Primer N046.

B. 100% Acrylic Interior Primer:

1. Shall be certifiable for use on gypsum drywall or wood, and paint.
2. Minimum Volume Solids: 35%.
3. Maximum VOC: 150 g/L
   a. S-W Multi Purpose Latex Primer / Seal B51W8020
   b. GP Gripper Interior/Exterior Primer Sealer 3210-1200.
   c. PPG Seal Grip Int/Ext. Acrylic Universal Primer/Sealer, 17-921.
   d. BM Fresh Start High Hiding All Purpose Primer N046.

C. Rust-inhibitive Waterborne Acrylic Primer:

1. Minimum Volume Solids: 37%.
2. Maximum VOC: 250 g/L
   a. S-W DTM Acrylic Primer/Finish B66W1.
   b. DC Devflex 4020PF Direct to Metal Primer and Flat Finish.
   c. PPG Pitt-Tech Int/Ext Primer DTM, 90-712.
   d. BM Corotech Waterborne DTM Metal Primer/Finish V110.

2.03 EXTERIOR FINISH PAINTS

A. 100% Acrylic Exterior Satin Coating:
1. Minimum Volume Solids: 29%.
2. Maximum VOC: 150 g/L
3. Sheen: 10-20 units at 60 degrees.
   a. S-W A-100 Exterior Latex Satin A82 series.
   b. GP Ultra-Hide 150 Exterior Satin Paint 2412V series.
   c. PPG Speedhide Exterior Satin 6-2045XI.
   d. BM Ultra Spec Exterior Satin N448.

B. Non-blocking, 100% Acrylic Exterior Gloss Coating:

1. Minimum Volume Solids: 34%.
2. Maximum VOC: 150 g/L
3. Sheen: 70-90 units at 60 degrees.
   a. S-W Super Paint Exterior High Gloss Latex Enamel A85 Series.
   b. GP Ultra-Hide Interior/Exterior Gloss Paint 3028N.
   c. PPG Manor Hall Interior/Exterior Gloss Acrylic Latex, 52-110.
   d. BM Ultra Spec Exterior Gloss N449.

2.04 INTERIOR FINISH PAINTS

A. Vinyl Acrylic Interior Eggshell Finish:

1. Minimum Volume Soilds: 35%.
2. Maximum VOC: 0 g/L
   a. S-W ProMar 200 0 VOC Interior Latex Eg-Shel, B20-2600 Series.
   b. GP No VOC Interior Eggshell, 1411.
   c. PPG Speedhide Interior Eggshell 6-4310XI.
   d. BM Ultra Spec 500 Interior Eggshell 538.

B. Vinyl Acrylic Interior Flat Finish:

1. Minimum Volume Solids: 32%.
2. Maximum VOC: 0 g/L
3. Sheen: 0-8 units at 85 degrees.
   a. S-W ProMar 200 0 VOC Interior Latex, B30-2600 Series.
   e. GP No VOC Interior Flat 150, 1209
   b. PPG Speedhide Interior Flat 6-4110XI.
   c. BM Ultra Spec 500 Interior Flat 536.

C. 100%, Modified Acrylic, Interior Semi-Gloss Coating:

1. Minimum Volume Solids: 33%.
2. Maximum VOC: 150 g/L
   a. S-W Pro Industrial Pre-Catalyzed Epoxy.
   b. DC Devflex 4216HP Water-Borne Acrylic or
      GP Lifemaster Oil Interior/Exterior Semi-Gloss Paint 1506.
   c. PPG PITT-GLAZE WB1 Interior Semi-Gloss Pre-Catalyzed Water-Borne Acrylic Epoxy.
   d. BM Corotech WB Pre-Cat Epoxy Coating Semi-Gloss V341.

D. 100% Acrylic, Waterborne Eg-Shel Dryfall:

1. Minimum Volume Solids: 30%.
2. Maximum VOC: 150 g/L
3. Sheen: 0-8 units at 85 degrees.
   a. S-W Waterborne Acrylic Dryfall B42W2.
   b. GP Waterbased Interior Eggshell Dry Fall 1482-1200.
   c. PPG Speedhide Super Tech Flat-Eggshell 0-5 @60&85 Dry Fall, 6-725XI.
   d. BM Super Spec Sweep Up Flat Sheen 6@85, 153.

E. Two-component Polyamide Epoxy:

1. Minimum Volume Solids: 50%.
2. Maximum VOC: 450 g/L

3. Sheen: 75-90 units at 60 degrees.
   a. S-W Tile-Clad High Solids Epoxy B62 Series.
   b. DC Tru-Glaze 4508 HIPAC Epoxy Gloss Coating.
   c. PPG Aquapon 35 Polyamide Epoxy Gloss, 95-1.
   d. BM Corotech Polyamide Epoxy Coating Gloss V400-62.

F. Paint for Concrete Floors:

1. Floor Crack Filler
   a. Minimum Volume Solids: 100%, mixed.
   b. Maximum VOC: 10 g/L, mixed
      1) S-W Armorseal Crack Filler B58AQ2/B60VQ2
      2) Sika Sikadur Injection Gel Standard Set.
      3) PPG Megaseal CF Epoxy Crack Filler, 99-114.

2. Water Based Epoxy Floor Primer:
   a. Minimum Volume Solids: 39%, mixed.
   b. Maximum VOC: 50 g/L, mixed.
      1) S-W Armorseal 8100 Water Based Epoxy Floor Coating B70 Series.
      2) Sika Sikafloor 207 General Service Epoxy Binder Coating
      3) PPG Megaseal WBPC Waterborne epoxy primer/sealer, 99-128.

2. Slip Resistant:
   a. S-W H&C Shark Grip-Slip Resistant Additive.
   b. Aluminum Oxide Non Slip Abrasive Additive.
   c. PPG Megaseal AS Anti-Slip Non-Sparking Natural Pumice Additive.

3. Water Based Epoxy Floor Coating:
   a. Minimum Volume Solids: 39%, mixed.
   b. Maximum VOC: 50 g/L, mixed.
      1) S-W Armorseal 8100 Water Based Epoxy Floor Coating B70 Series.
      2) Sika Sikafloor 215 Clear Epoxy Topcoat (with Epoxy Color Additive).
      3) PPG Megaseal SL Self-leveling Epoxy Floor Coating, 99-126.
      4) Color(s): Gray.

2.05 EXTRA STOCK

A. Provide left over paint with Owner for touch-up purposes. At completion of project, provide one complete set of drawdowns in each maintenance manual with a schedule noting the locations each paint color was used. Refer to Section 01 78 39.

PART 3: EXECUTION

3.01 PREPARATION OF SURFACES

A. General

1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

2. Do not start work until preparation specified in surface Section is completed.

3. Ensure surfaces are dry and adequately protected from dampness.

4. Thoroughly clean surfaces free of loose, rough and foreign substances which will affect adhesion or appearance of applied coats.

5. Remove mildew and neutralize surface.

6. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting.

   a. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
   b. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

7. Complete repainting or refinishing will be required if coats are applied over improperly prepared surfaces.

B. Wood

1. Hand sandpaper to smooth surface. Sand direction of grain, taking care not to mar character of details and sharp edges. Remove sanding dust.

2. After first coat is dry, thoroughly coat, with shellac (suitably reduced with alcohol for flowing consistency) or known sealer, knots, pitch pockets and resinous sapwood areas.

3. After first coat is dry, fill nail holes, cracks and defects with colored putty tinted to match stain or paint.

C. Gypsum Board:

1. Fill minor irregularities with patching material and sand to smooth level surfaces taking care not to raise nap of paper.

D. Plaster

1. Fill cracks, holes or imperfections with patching plaster and smooth off to match adjoining surfaces. Do not sandpaper.

2. In case of high alkali or lime conditions, neutralize with solution recommended by paint manufacturer.

3. Do not paint until moisture content of surface is 12% or below, except as may be required by paint manufacturer.

E. Formed and Precast Concrete

1. Remove all traces of form oil, dirt, laitance, loose cement and leftover residue from precast manufacturing process per paint manufacturer's recommendations.

2. Do not paint until moisture content of surface is 15% or below except as may be required by paint manufacturer.

3. Previously painted surfaces must be free of grease, oil, wax or any other contaminants and loose or flaking paint. Clean concrete of oil and grease with detergent, hot water and vigorous scrubbing. All loose and peeling paint must be scraped or sand blasted back to sound adhesion.

F. Masonry

1. Do not paint until moisture content of surface is 15% or below except as may be required by paint manufacturer.

2. After prime coat is dry, fill remaining small holes, cracks and other defects with Swedish putty made by mixing dry spackle with prime paint.

G. Ferrous or Galvanized Metal

1. Remove dirt and grease with mineral spirits or solvent recommended by paint manufacturer and clean cloths.

2. If prime coat is not smooth, sand to bare metal, reprime. Touch up scratched or abraided primer.

H. Aluminum:

1. Remove dirt and grease with mineral spirits or solvent recommended by paint manufacturer and clean cloths.

I. Concrete Floors:

1. To receive paint or non-slip paint: Shotblast floor to resemble 100 grit sandpaper. Torch fiber reinforcing exposed after shot blasting. Fill cracks, voids, bug holes, gouges or divots with Crack Filler.

3.02 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent
2. Masonry: 12 percent
3. Wood: 15 percent
4. Gypsum Board: 12 percent
5. Plaster: 12 percent

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

E. Conditions

1. Do no work when surface, coating product, air temperature, humidity or dewpoint does not meet requirements of PROJECT CONDITIONS in Part 1 of this specification.

2. Do no interior work until building is properly enclosed.

3. Do work under adequate illumination and dust-free conditions.

3.03 APPLICATION

A. Methods: Paint may be applied by brush, roller or spray methods except where particular method will produce unsatisfactory results. Where spray method is used on concrete block, follow with roller to work paint into voids.

B. Materials: Do not open containers until required for use. Stir materials thoroughly and keep at uniform consistency during application.

C. Coats

1. Number specified is minimum. Provide sufficient number of coats to provide even, consistent, opaque coverage of substrate.

2. Touch up suction spots between coats.

3. Refinish surfaces affected by refitting work.

4. Tint prime and under coats of paint approximately 1/2 to 3/4 depth of final color.

5. Touch up suction and "hot" spots in plaster and concrete after application or first coat and before second coat.

6. Do not apply next coat until previous is thoroughly dry.

7. Provide final coat which is solid and even in color; free from runs, laps, sags, brush marks, air bubbles and excessive roller stipple and worked into crevices, joint and similar areas.

8. Do not paint sealant / sealant joints.

3.04 SCHEDULE OF EXTERIOR WORK

A. General: Do not paint brick, stucco, precast concrete, prefinished aluminum, sealant (unless scheduled to receive paint).

1. New Work: Paint or finish all other new, unfinished, primed and factory painted surfaces, including all rooftop mechanical equipment, screen louvers, wall louvers (not factory-finished), miscellaneous metals, steel lintels and prefinished metal copings (color to match brick) occurring in brick as detailed.

B. Concrete, Stucco, Concrete Masonry Units, Fluted Block and Restored Masonry (except soffits):

1. 1st Coat (New Surfaces): 100% Acrylic Exterior Masonry Primer.
   a. Minimum DFT: 8 mils.
2. 2nd and 3rd Coat: 100% Acrylic Exterior Satin Coating.
   a. Minimum DFT: 1.1 mils per coat.

C. Zinc-coated Metal – Flashing, Decking, and Exposed Mechanical Including Rooftop Mechanical:

1. Touch-up: Rust-inhibitive Waterborne Acrylic Primer.
   a. DFT: 2.5-5.0 mils.
2. 2nd and 3rd Coat: 100% Acrylic Exterior Satin Coating.
   a. Minimum DFT: 1.3 mils per coat.

D. Zinc-coated Metal – Doors, Frames and Handrails:

1. Touch-up: Rust-inhibitive Waterborne Acrylic Primer.
   a. DFT: 2.5-5.0 mils.
2. 2nd and 3rd Coat: Non-blocking, 100% Acrylic Exterior Gloss Coating.
   a. Minimum DFT: 1.3 mils per coat.

E. Aluminum – Mill Finish (scheduled to be painted):

1. 1st Coat (New Surfaces): Rust-inhibitive Waterborne Acrylic Primer.
   a. DFT: 2.5-5.0 mils.
2. 2nd and 3rd Coat: Non-blocking, 100% Acrylic Exterior Gloss Coating.
   a. Minimum DFT: 1.3 mils per coat.

F. Wood – Painted, Wood, Plywood.
   1. 1st Coat (New Surfaces): 100% Acrylic Exterior Wood Primer
      c. Minimum DFT: 1.4 mils
   1. 1st Coat (Existing Surfaces): Existing Painted Surface Primer.
      a. Minimum DFT: 0.9 mils.
   2. 2nd and 3rd Coat: 100% Acrylic Exterior Satin Coating
      a. Minimum DFT: 1.3 mils per coat

3.05 SCHEDULE OF INTERIOR WORK

A. General

1. Paint complete all surfaces noted with a "PT" on Room Finish Schedule.

   a. New Work: In rooms with surfaces not scheduled for paint on Room Finish Schedule, paint hollow metal doors and frames, metal stairs and railings as occur.

2. Provide specified finish on exposed surfaces including, but not limited to the following:

   a. Prime coated mechanical units, piping, pipe covering, sprinkler piping, interior duct surfaces visible behind grilles, tanks without factory finish, radiation covers, cabinet unit heaters, exposed ductwork, louvers and grilles.

   b. Electrical panel box covers and surface raceways (over factory finish), conduits and boxes and all factory primed electrical equipment. (Except in maintenance, service and electrical rooms).

   c. Hollow metal doors and frames, steel stairs, ladders and railings, catwalks and safety mesh grilles, access panels, prime painted hardware, painted astragals and vision lite kits on doors, coiling grilles and doors (unless factory finished), metal supports for counters and exposed miscellaneous metals.

3. Do not paint sealant.

4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

5. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

6. Partition Identification

   a. Place identification on all partitions indicated on Code Drawings as having a required fire or smoke rating.

   b. Identification shall be as follows:

      1) Rating (i.e. 2 HR Fire Wall; Smoketight; 2 HR Fire Barrier): Same as indicated on Code Drawing Legend.
      2) Location: With-in 15 feet at the end of each wall and a maximum of 30 feet on center, both sides of partitions, above ceiling line and below access floors.
         a) Place above access panels in hard ceilings.
      3) Style of Lettering: 3 inches high, Arial Bold style, painted with aid of stencils.
      4) Color: Red.

B. Gypsum Drywall – Wall (not scheduled for epoxy):

   1. 1st Coat (New Surfaces): 100% Acrylic Interior Primer.
      a. Minimum DFT: 1.5 mils.
   2. 2nd and 3rd Coat: Vinyl Acrylic Interior Eggshell Finish.
      a. Minimum DFT: 1.5 per coat.

C. Gypsum Drywall – Soffits/Ceilings (not scheduled for epoxy):

1. 1st Coat (New Surfaces): 100% Acrylic Interior Primer.
   a. Minimum DFT: 1.5 mils.
2. 2nd and 3rd Coat: Vinyl Acrylic Interior Flat Finish.
   a. Minimum DFT: 1.4 per coat.

D. Exposed Overhead Work:

1. Touch-up: Rust-inhibitive Waterborne Acrylic Primer.
   a. DFT: 2.0-5.0 mils.
2. 2nd Coat: 100% Acrylic, Waterborne Eg-Shel Dryfall.
   a. DFT: 2.1-4.5 mils.

E. Concrete Floors (scheduled to receive paint)

1. Apply Floor Crack Filler as needed.
2. First Coat: Water Based Epoxy Floor Primer.
   a. Minimum DFT: 2.0-3.0 mils.
3. Second Coat: Water Based Epoxy Floor Coating with color additive.
   a. Minimum DFT: 6.5-7.5 mils.
4. Third Coat: Water Based Epoxy Floor Coating.
   a. Minimum DFT: 6.5-7.5 mils.
   b. Slip Resistant: 3.2 oz per gallon. (Verify with Owner before proceeding).

3.06 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.07 FIELD QUALITY CONTROL

A. Testing and Painting Application: Owner reserves the right to test DFT of painted surfaces.

1. If testing discovers that DFT of installed paint does not meet specification, the Contractor will pay for initial and final testing and recoat surfaces until testing agency confirms specification is met.

END OF SECTION 09 91 00

SECTION 10 28 13

TOILET ACCESSORIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes:

1. Toilet accessories where shown on the Drawings and specified herein.

B. Related work specified in other sections:

1. Blocking - Section 06 10 53.

1.03 SUBMITTALS

A. Brochure: Submit brochure and schedule of materials in accordance with Section 01 33 00.

B. Submit a sample of each item dispensed by each type dispensing accessory machine or accessory to Construction Manager.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver items in manufacturer's original unopened protective packaging.

B. Store materials in original protective packaging to prevent soiling, physical damage, or wetting.

C. Handle so as to prevent damage to finished surfaces.

D. Protection:

1. Maintain protective covers on all units until installation is complete.

2. Remove protective covers at final clean-up of installation.

PART 2: PRODUCTS

2.01 MANUFACTURER

A. The products of Bobrick are specified, comparable products of Bradley are acceptable. All units and trim stainless steel, #4 finish.

2.02 ACCESSORIES

A. Grab Bars (Field verify sizes)

1. G.B. No. 1: B-6806 x 42" horizontal and B-6806 x 18" vertical.

2. G.B. No. 2: B-6806 x 36".

3. G.B. No. 3: B-6806 x 18".

4. G.B. No. 4: B-6806 x 24".

5. G.B. No. 5: B-6861 'L' shaped 16" x 31".

6. G.B. No. 6: B-68616 'L' shaped 24" x 36".

B. Toilet Paper Holders "TPH": B-274.

C. Mirrors

1. M No. 1: B-290 2436.

D. Paper Towel Dispenser "PTD" (Surface mounted): Supplied by Owner, installed by Contractor.

E. Shelf and Mop Holder, Janitor Closet: B-239 x 34, with 4 hooks and 3 mop holders.

F. Coat Hook: B-677

G. Towel Bar: B-6806 x length as shown on drawings.

H. Soap Dish: B-680

I. Toiletry Shelf: B-295 (5" x 24"). Install in each toilet compartment.

J. Shower Seat:

a. #1: B-5181 Reversible folding 'L' shaped seat.

b. #2: B-5191 Rectangular folding seat.

K. Shower Curtain Rod and Shower Curtain

1. Shower Curtain Rod: B-6107 by lengths shown.

2. Shower Curtain: B-204-2 with B-204-1 curtain hooks, provide quantity as needed for length of curtain.

L. Soap Dispensers (SD).: Supplied by Owner, installed by Contractor.

M. Keys to Locked Accessories: Manufacturer's standard, keyed alike.

N. Mounting Kits: Provided with each unit shall suit wall construction.

O. Dispensing Accessories: Fully loaded and in operating condition at time of completion.

PART 3: EXECUTION

3.01 INSPECTION

A. Check opening scheduled to receive recessed units for correct dimensions, plumbness of blocking or frames, preparation that would affect installation of accessories.

B. Check areas to receive surface mounted units for conditions that would affect quality and execution of work.

C. Verify spacing of plumbing fixtures and toilet partitions that affect installation of accessories.

D. Coordinate blocking requirements with Section 06 10 53, prior to enclosure of walls.

E. Do not begin installation of washroom accessories until openings and surfaces are acceptable.

3.02 INSTALLATION

A. Drill holes according to manufacturer's mounting templates or printed instructions.

B. Mount recessed accessories into wall openings with wood screws through cabinet side into wood blocking, or sheet metal screws into metal frames.

C. Mount surface mounted accessories to back up with toggle bolts, plumb and align.

D. Anchor grab bars to through-wall anchor plates.

3.03 ADJUST AND CLEAN

A. Adjust accessories for proper operation.

B. After completion of installation, clean and polish all exposed surfaces.

C. Deliver keys and instruction sheets to Owner's Representative.

END OF SECTION 10 28 13

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes: All fire extinguishers, cabinets, and brackets and fire blanket as specified and shown on drawings.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Brochure: Submit brochure of materials and installation details.

2. Shop Drawing to indicate location and quantities of all products.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner that will avoid damage. Damaged equipment will be rejected.

PART 2: PRODUCTS

2.01 MANUFACTURER

A. All equipment is specified from the line of J. L. Industries; comparable equipment of Elkhard Brass Mfg. Co., General, Noris, Larsen and Badger are acceptable.

2.02 FIRE EXTINGUISHERS AND CABINETS

A. Provide a UL rated fire extinguisher, cabinet or bracket when "FE" is shown on the drawings per the following table:

Application	Wall Material and/or Rating	Cabinet or Bracket Model	Fire Extinguisher Model
Public Occupied Space	Gypsum board, masonry & concrete non-rated walls.	1027 V10, semi-recessed with 3" return	Cosmic 10E, 4A-60BC
Public Occupied Space Food Preparation Areas	Gypsum board, masonry & concrete non-rated walls.	2027 V10, semi-recessed with 3" return	Saturn 15 Class K
Public Occupied Space	2 hr and under fire-rated gypsum board, masonry & concrete walls	1027 V10, semi-recessed with 3" return and Fire-FX rated tub	Cosmic 10E, 4A-60BC

(cabinet carries rating)

Application	Wall Material and/or Rating	Cabinet or Bracket Model	Fire Extinguisher Model
Public Occupied Space	Over 2 hr gypsum board, masonry & concrete walls (wall carries rating)	1027 V10, semi-recessed with 3” return	Cosmic 10E, 4A-60BC
Public Occupied Wood, Metal and Auto Shops	All types	Surface mounted bracket MB818.	Cosmic 5E, 2A-10BC
Non-public Occupied Space (i.e., boiler rooms and mechanical rooms, electrical and data rooms, receiving areas, storage rooms, elevator equipment rooms)	All types	Surface mounted bracket MB818.	Cosmic 5E, 2A-10BC

B. Cabinets shall be clear anodized aluminum with vertical narrow acrylic glazing and black vertical letters stating “FIRE EXTINGUISHER.”

PART 3: EXECUTION

3.01 INSTALLATION

A. Install level and plumb, true to line and in accord with approved installation details.

B. Unless otherwise shown, install 40 lbs. or less extinguishers 4'-6" from floor to top of cabinet, or to nearest horizontal masonry joint, but not higher than 5’-0”. For extinguishers greater than 40 lbs., install top of cabinet no higher than 3’-6”.

C. Check extinguishers for proper charge, operation.

D. Remove and replace damaged, defective or under charged units.

END OF SECTION 10 44 00

SECTION 10 57 13

COAT RACKS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SCOPE

A. Section includes:

1. Coat racks as shown on drawings.

B. Related work specified in other sections:

1. Wood Blocking - Section 06 10 53.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

1. Product data for each type of accessory specified, with installation instructions for each unit built-in or connected to other construction. Include methods of installation for each type of substrate.

2. Shop drawings showing installation and exact length of units required.

3. Samples for initial selection purposes consisting of manufacturer's standard size samples showing full range of colors.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, and lot number. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity; laid flat, blocked off ground to prevent sagging and warping.

B. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1.05 SEQUENCE AND SCHEDULING

A. Sequence accessory installation with other work to minimize possibility of damage and soiling during remainder of construction period.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Magnuson Group, Woodridge, IL, www.magnusongroup.com or equal.

2.02 COAT RACKS

A. WK01 Series hook style wall racks. Lengths as shown on drawings. Color as selected from manufacturer's full range of designer colors.

B. Adjustable brackets.

C. Fasteners: Screws, bolts or other exposed devices of same material as accessory unit.

PART 3: EXECUTION

3.01 INSTALLATION

A. Verify that materials are those specified before installing.

B. Install accessories after other finishing operations, including painting, have been completed.

C. Wall-Mounted Accessory Units: Install accessories complying with manufacturer's printed instruction, using fasteners as recommended by manufacturer as appropriate to substrate.

D. Clean and polish exposed surfaces, using materials and methods recommended by the manufacturer.

3.02 PROTECTION

A. Protect accessories against damage during remainder of construction period, complying with manufacturer's directions.

B. Installed work shall be in true line, level, plumb, in correct relation to adjoining work, and exact height required above floor.

C. Prior to Substantial Completion of this work, test the installation for proper operation, and make ready for operation by the Owner.

END OF SECTION 10 57 13

SECTION 10 75 00

FLAGPOLE

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Section includes: Flagpoles on concrete base as detailed.

B. Related work specified in other sections:

1. Concrete base is in Section 03 30 00.

1.03 SUBMITTALS

A. Shop Drawings: Submitted for approval by Architect, prior to fabrication. Indicate general layout, dimensions, finishes, foundation and base, jointing, anchoring and support systems, trucks, finials, base collar. Refer to Submittals Section for submittal requirements.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with heavy kraft paper, wood strip and steel band or polyethylene wrap and pack in tube prior to shipment.

B. Deliver flagpole in original wrappings and in single piece.

C. Store flagpole, in original wrappings, in area protected from weather, moisture, and damage.

D. Handle flagpole so as to prevent damage or soiling.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Product by Concord Industries specified. Products by American Flagpole-Division of Kearney-National, Inc., Eder Flag Pole Company, Morgan Francis Co., Pole-Tech Co., or Morgan Products are acceptable.

2.02 MATERIALS

A. Model: Sentry concealed halyard system. Metal: Seamless extruded aluminum tubing, 6063-T6 alloy, heat treated and age hardened, mechanical finish, internal type lanyard.

B. Type: Cone tapered, ground set with FC-11 flash collar finished to match pole sized to accommodate butt diameter of flagpole. 30' high. 6" outside diameter at base, 3 1/2" outside diameter at top.

C. 16 gauge galvanized Foundation Sleeve, Support Plate, 3/4" diameter x 18" Lightning Arrestor Spike.

D. Fittings: Include 14 gauge spun gold anodized aluminum 5" ball finial, cast aluminum revolving non-fouling truck assembly, one set #10 5/16 inch white waterproof polypropylene halyards, two chrome swivel snaps per halyard. One 3½" neoprene coated counterweight, and one beaded nylon retainer ring. One internally mounted cam-action cleat with integral sheave, factory mounted.

PART 3: PRODUCTS

3.01 INSPECTION

A. Inspect foundations for proper depth and size of sleeve.

3.02 PREPARATION

A. Paint portions of flagpole below grade with heavy coat of bituminous paint.

3.03 INSTALLATION

A. Install flagpoles, base assemblies, and fittings in compliance with acceptable final shop drawings and manufacturer's instructions.

B. Provide positive lightning ground for each flagpole installation.

3.04 TEST AND ADJUST

A. Check and adjust installed fittings for smooth operation of halyards.

END OF SECTION 10 75 00

SECTION 12 32 16

PLASTIC LAMINATE CASEWORK

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. Work includes:

1. Plastic laminate casework, including countertops, hardware and accessories.
2. Plastic laminate lockers with plastic drip pan.

B. Related work specified in other sections:

1. Blocking and Grounds – Section 06 10 53.
2. Sinks, Fittings – Division 22.

1.03 REFERENCES/DEFINITIONS

A. Current edition of the Quality Standards of the Architectural Woodwork Institute (AWI) apply, and are by reference a part of this Specification.

B. Identification of casework components and related products by surface visibility.

1. Open Interiors: Any open storage unit without solid door or drawer fronts, units with full glass insert doors and/or acrylic doors, and units with sliding solid doors.
2. Closed Interiors: Any closed storage unit behind solid door or drawer fronts.
3. Exposed Ends: Any storage unit exterior side surface that is visible after installation.
4. Other Exposed Surfaces: Faces of doors and drawers when closed, and tops of cabinets less than 72 inches above furnished floor.
5. Semi-Exposed Surfaces: Interior surfaces which are visible, bottoms of wall cabinets and tops of cabinets 72 inches or more above finished floor.
6. Concealed Surfaces: Any surface not visible after installation.

1.04 QUALITY ASSURANCE

A. Manufacturer: Minimum of 5 years experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this project.

B. Manufacturer: Provide products certified as meeting or exceeding ANSI-A 161.1-2000 testing standards.

C. Single Source Manufacturer: Casework, countertops and architectural millwork products must all be engineered and built by a single source manufacturer in order to ensure consistency and quality for these related products. Splitting casework, countertops and/or architectural millwork between multiple manufacturers will not be permitted.

1.05 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00, indicate the following:

1. Casework: Elevations and locations of each assembly. Indicate dimensions, thicknesses, surfacing materials, drawers, doors and door swings, sections of typical and special cases. Indicate core materials, edge treatments and construction.

2. Work Surfaces: Plans and locations of each work surface. Indicate dimensions. Indicate locations and sizes of all openings including those for sinks. Indicate provisions for securing work surfaces to cases, windowsills.

B. Submit manufacturer's product data for stock items.

C. Provide samples of base cabinet, wall cabinet, hardware, plastic laminate and edging if requested by Architect.

1.06 PRODUCT HANDLING, STORAGE AND DELIVERY

A. Deliver, store and handle work to prevent damage, staining and disfigurement. Do not store woodwork in wet or damp areas. Jobsite storage areas shall be enclosed, dry, and ventilated.

1.07 WARRANTY

A. All materials to be guaranteed for a period of 5 years from manufacturer's defects and workmanship. Submit in accordance to Section 01 78 23.

PART 2: PRODUCTS

2.01 MANUFACTURER

A. Manufacturers who are AWI members are acceptable with minor deviations from these specifications.

2.02 MATERIALS

A. Lumber and Plywood

1. Plywood for cabinet bases: 3/4" water resistant A-C interior fir plywood with #3 glue.

2. Core Materials:

a. Particleboard up to 7/8 inch thick: Industrial Grade average 45-pound density particleboard, ANSI A 208.1-2009, M-2 requirements.
b. Particleboard 1 inch thick and thicker: Industrial Grade average 45 pound density particle board, ANSI A 208.1-2009, M-2 requirements.
c. Medium Density Fiberboard ¼ inch thick: Average 54-pound density grade, ANSI A208.2-2009 requirements.
d. MR Moisture Resistant Particleboard: Average 45-pound density particleboard, ANSI A208.1 1-2009, M-2 requirements.

2. Cabinet Body Core:

a. Core material shall be formaldehyde free.

3. Hardboard: Tempered hardboard, smooth both sides, minimum 1/4" thick. Meet requirements of Commercial Standard CS-251 and Federal Specifications LLL-B-00810.

4. Plywood for sub-base: Preservative treated exterior grade plywood, ¾" thick.

B. Plastic Laminate:

1. Plastic laminate manufacturers listed below are approved under the following conditions:

a. A manufacturer listed in both the specification and the Material Finish/Color Schedule, on Architectural Drawings is not required to submit a pre-bid approval.
b. Manufacturers listed in this specification, but not in the Material Finish/Color Schedule, on Architectural Drawings shall submit color samples for pre-bid approval by addendum. Refer to Section 01 25 00.
c. When no colors are listed in the Material Finish/Color Schedule, on Architectural Drawings, any manufacturer listed in this specification are not required to submit a pre-bid approval.

2. Products by Wilsonart, Formica, Westinghouse, Pionite and Nevamar are acceptable. Architect reserves the right to select from any of the above manufacturer's if a specific color is not noted in the material finish/color schedule.

3. Decorative Laminates: GREENGUARD Indoor Air Quality Certified

   a. High-pressure decorative laminate VGS (.028), NEMA Test LD 3-2005.
   b. High-pressure decorative laminate HGS (.048), NEMA Test LD 3-2005.
   c. High-pressure decorative laminate HGP (.039), NEMA Test LD 3-2005.
   d. High-pressure cabinet liner CLS (.020), NEMA Test LD 3-2005.
   e. High-pressure backer BKH (.048), (.039), (.028), NEMA Test LD3-2005.
   f. Thermally fused melamine TFM laminate, NEMA Test LD 3-2005 (TFM allowed on casework interiors only.)

4. Color: See Material Finish/Color Schedule, on Architectural Drawings.

C. Edging

1. Counter tops, backsplashes and exposed shelving, cabinet doors and drawers: 3MM PVC. Color: See Material Finish/Color Schedule, on Architectural Drawings.

2. Cabinet body and shelf/shelving edges: 1MM PVC, color matched to drawer/door/shelf face.

D. Hardware

1. Hinges

   a. Five knuckle, epoxy powder coated, institutional grade, 2-3/4 inch overlay type with hospital tip. 0.095 inch thick. ANSI-BHMA standard A156.9, Grade 1.
      1) Doors 48 inches and over in height have 3 hinges per door.
      2) Magnetic door catch with maximum 5 pound pull provided, attached with screws and slotted for adjustment.

2. Pulls: Wire design, 4 inches in chrome coat powder finish.

3. Drawer Slides:

   a. Regular, kneespace and pencil: 100-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature.

   b. Paper storage and file: Full extension, 150-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature.

4. Adjustable Shelf Supports:

   a. Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on 32 mm centers. Each shelf support has 2 integral support pins, 5mm diameter, to interface pre-drilled holes, and to prevent accidental rotation of support. The support automatically adapts to ¾ inch or 1 inch thick shelving and provides non-tip feature for shelving. Supports may be filed fixed if desired. Structural load to 1200 pounds (300 pounds per support) without failure.

5. Locks:

   a. Removable core, disc tumbler, cam style lock with strike. Lock for sliding ¾ inch thick doors is a disc type plunger lock, sliding door type with strike. Lock for sliding glass/acrylic doors is a ratchet type sliding showcase lock.

   b. Elbow catch or chain bolt used to secure inactive door on all locked cabinets.

E. Miscellaneous Materials

1. Coat Hooks

a. Wall mounted:

1. Single coat hooks: LH-365 or Ives 581 satin aluminum.

2. Double coat hooks: LH-366 or Ives 405 satin aluminum.

b. Ceiling or bottom of shelf mounted:

1. Double coat hooks: Ives 580 satin aluminum.

2. Support Members:

a. Countertop support brackets: Epoxy powder coated, 11 gauge steel with integral cleat mount opening and wire management opening.
b. Undercounter support frames: Epoxy powder coated.
c. Legs: Epoxy powder coated.

3. Tote Trays/Drip Pans:

a. Heavy-duty vacuum0formed polypropylene plastic with full top rim and pull. Trays are ivory color, equipped with label holder. Size: 10-1/2" W x 3-1/2" H x 19" D.

b. Tote tray/supply cabinets equipped with injection molded polycarbonate; continuous side rail support glide. Each side rail support glide is adjustable with integral support pins to interface 32mm pre-drilled holes.

c. Locker drip pan model sized to fit snugly in bottom of locker.

2.03 FABRICATION

A. Fabricate casework, countertops and related products to dimensions, profiles, and details shown.

B. All casework panel components must go through a supplemental sizing process after cutting, producing a panel precisely finished in size and square to within 0.010 inches, ensuring strict dimensional quality and structural integrity in the final fabricated product.

C. Cabinet Body Construction:

1. Tops and bottoms are glued and doweled to cabinet sides and internal cabinet components such as fixed horizontals, rails, and verticals. Minimum 6 dowels each joint for 24 inch deep cabinets and a minimum of 4 dowels each joint for 24 inch deep cabinets and a minimum of 4 dowels each joint for 12 inch deep cabinets. (Mechanical or metal hardware fasteners joining cabinet top and bottom panels to the sides will not be accepted.)

a. Tops, bottoms, and sides of all cabinets are particleboard core.

2. Cabinet backs: ¼ inch thick medium density fiberboard panel fully captured by the cabinet top, bottom, and side panels. Finish to match cabinet interior. ¾ inch x 4 inch particleboard rails will be placed behind the back panel at the top and bottom, and doweled to the sides utilizing 10mm hardwood fluted dowels. A third intermediate rail will be included on all cabinets taller than 56 inches. Utilize hot melt glue to further secure back and increase overall strength.

a. Exposed back on fixed or movable cabinets: ¾ inch thick particleboard with the exterior surface finished in VGS laminate as selected.

3. Fixed base and tall units have an individual factory-applied base, constructed of ¾ inch thick plywood. Base is 102mm (nominal 4 inch) high unless otherwise indicated on the drawings.

4. Base units, except sink base units: Full sub-top glued and doweled to cabinet sides. (Mechanical or metal hardware fasteners joining cabinet sub-top panel to the sides will not be accepted.)

    a. Sink base units are provided with open top and a stretcher at the front, attached to the sides. Back to be split removable access panel.

5. Side panels and vertical dividers shall receive adjustable shelf hardware at 32mm line boring centers. Mount door hinges, drawer slides, and pull-out shelves in the line boring for consistent alignment.

6. Exposed and semi exposed edges.

    a. Edging: 1mm PVC machine applied.

7. Adjustable Shelves in Cabinets

    a. Core: Particleboard.

    b. Core Thickness: ¾ inch up to 30 inches wide, 1 inch over 30 inches wide.

    c. Edge: 1mm PVC on Front Edge Only.

8. Interior finish, units with open interiors:

    a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with high-pressure decorative VFS laminate. Use of TFM on exposed ends will not be permitted.

9. Interior finish, units with closed interiors:

    a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with TFM Thermally Fused Melamine laminate.

10. Exposed ends:

    a. Faced with high-pressure decorative VFS laminate. Use of TFM on exposed ends will not be permitted.

11. Wall unit bottom:

    a. Faced with thermally fused melamine laminate.

12. Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), are not permitted.

D. Drawers:

1. Sides, back and sub front: Minimum ½ inch thick particleboard laminated with TFM Thermally Fused Melamine doweled and glued into sides. Top edge banded with 1mm PVC.

2. Drawer bottom: Minimum ½ inch thick particleboard laminated with TFM Thermally Fused Melamine, screwed directly to the bottom edges of drawer box.

3. Paper storage drawers: Minimum ¾ inch thick particleboard sides, back, and sub front laminated with TFM Thermally Fused Melamine. Minimum ½ inch thick particleboard drawer bottoms screwed directly to the bottom edges of the drawer box. Provide PVC angle retaining bar at the rear of the drawer.

E. Door/Drawer Fronts:

1. Core: ¾ inch thick particleboard.

2. High-pressure decorative VGS laminate exterior, balanced with high-pressure cabinet liner CLS. Use of TFM on exterior or interior surfaces of door/drawer fronts will not be permitted.

3. Edges: 3mm PVC, machine applied, external edges and outside corners machine profiled to 1/8 inch radius.

4. Provide double doors in opening in excess of 24 inches wide.

5. Paper storage drawers to be fitted with full width hood at back.

F. Miscellaneous Shelving (not in Cabinets):

1. Core material: 1 inch thick particleboard.

2. High-pressure decorative VGS laminate on both faces.

3. Edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.

4. Vertical and Horizontal Dividers:

a. Tempered hardboard 1/4" thick, smooth both faces. Secured in cabinet with molded plastic clips.

b. Melamine laminated core 3/4" thickness. Secured in cabinet with molded plastic clips or dowels.

2.04 PLASTIC LAMINATE COUNTERTOPS

A. Core:

1. All countertops except at sink elevations: 1-1/18 inch thick ANSI A208. 1-1993 M-2 particleboard.

2. Countertops at sink elevations: 1-1/18 inch thick ANSI A208.1-1993 M-3 moisture resistant (MR) particleboard.

B. Surface: High-pressure decorative HGS/HGP laminate with balanced backer sheeting.

C. Edges, including applied backsplash: 3mm PVC, exposed edges and corners machine profiled to 1/8 inch radius.

D. All countertop joints must be dy fit at the factory to check for consistency in color from one panel to the other and overall finished panel thickness, resulting in a high quality product easy to install.

PART 3: EXECUTION

3.01 COORDINATION

A. Coordinate work of this Section with related work of other sections as necessary to obtain proper installation of all items.

B. Verify site dimensions of cabinet locations in building prior to fabrication. Notify General Contractor or Construction Manager in writing if unsatisfactory conditions are discovered. Proceed only when unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Storage and Protection: Casework shall be protected in transit. Store under cover in a ventilated building not exposed to extreme temperature and humidity changes. Do not store or install casework in building until concrete, masonry and plasterwork is dry.

B. Workmen: Install casework conditioned to average prevailing humidity under the supervision of the manufacturer's representative with factory-trained mechanics authorized by manufacturer.

C. Workmanship

1. Erect casework straight, level and plumb and securely anchor in place. Scribe and closely fit to adjacent work. Cut and fit work around pipes, ducts, etc.

2. Install all items complete and adjust all moving parts to operate smoothly.

3. Leave surface clean and free from defects at time of final acceptance.

D. Clean up:

1. Remove all cartons, debris, sawdust, scraps, etc. and leave spaces clean.

2. Clean cabinets inside and out. Wipe off fingerprints, pencil marks, and surface soil. Clean inside of sawdust and construction debris.

END OF SECTION 12 32 16

SECTION 13 34 21

PRE-ENGINEERED WOOD BUILDING SYSTEM

PART 1: GENERAL

1.01 APPLICABLE DOCUMENTS

A. Bidding Requirements, Conditions of the Contract and pertinent portions of Sections in Division 1 of these Specifications, apply to Work of this Section.

1.02 SUMMARY

A. Section includes:

1. Furnish and install the following:
   a. Factory pre-engineered and field fabricated timber column structure.
   b. Prefinished metal roofing panels, vents, soffits, gutters and downspouts.
   c. Prefinished metal siding panels.
   d. Prefinished interior liner panels.
   e. Skylights (see Alternate No. 2).
   f. Weather barrier, insulation and vapor barrier.
   g. Exterior sectional metal overhead doors and exterior hollow metal doors and door frames.
   h. Exterior aluminum clad windows and glazing.
   i. Sealants at joints or transitions between materials as recommended by the manufacturer.
   j. Other miscellaneous materials as typically recommended by the building manufacturer for a complete and weather-tight structure.
2. **Contractor option:** Bidder may propose alternative pre-engineered building systems (wood or steel) to Architect prior to bidding in accordance with Section 01 25 00 Substitutions and Production Options. Proposals shall demonstrate ability to conform to the building design and specficiations.

B. Related work specified in other sections:

1. Section 08 10 00 – Steel Doors and Frames

2. Section 08 36 00 – Sectional Metal Overhead Doors

3. Section 08 40 00 – Aluminum Storefronts and entrances

4. Section 08 71 00 – Finish Hardware

4. Division 26 - Electrical Installation of Outlet and Lights.

1.03 DEFINITIONS AND ABBREVIATIONS

A. Drawings: Contract documents prepared by the Architect.

B. Erection Drawings: Detailed project drawings prepared by the building manufacturer.

C. Primary Framing: Pre-fabricated wood columns and pre-fabricated wood trusses including corner and endwall columns and trusses with required fasteners.

D. Secondary Framing: Wood purlins, girts, splashplank, and bracing.

E. SYP: Southern Yellow Pine

F. PSF: Pine-Spruce-Fir

1.04 REFERENCE STANDARDS

A. Preservative Treated Lumber

1. American Wood Protection Association (AWPA)
   a. Commodity Specification C2 (2001), Preservative Treatment By Pressure Processes
   b. Use Category System U1, User Specification for Treated Wood
   c. UC4A (Important Structural – Ground Contact)
   d. UC4B (Structural Support – Ground Contact)
   e. Items treated under AWPA standards shall bear the quality mark of an independent testing agency or service

2. International Code Council Evaluation Service (ICC-ES)
   a. Items treated under ICC-ES reports shall meet or exceed the applicable standard and shall bear the quality mark of an independent testing agency or service.

3. Federal Specification TT-W-571-J.

B. Framing Lumber
   1. Lumber Grading Rules and Wood Species
      a. National Design Specification for Wood Construction, current edition
      b. Northeastern Lumber Manufacturer's Association, Inc. (NELMA)
      c. Southern Pine Inspection Bureau (SPIB)
      d. West Coast Lumber Inspection Bureau (WCLIB)
      e. Western Wood Products Association (WWPA)

C. Wood Trusses
   1. All lumber used in the design of wood trusses shall be kiln dried to maximum 19% moisture content and graded in accordance with the current grading rules. Design stresses allowed are those listed in the current editions of the respective Lumber Association's grading rules.
   2. The design of wood members shall be in accordance with the formulas published in the 2001 edition of the "National Design Specification for Wood Construction".
   3. Light metal toothed connector plates and joint design shall conform to specifications as set forth in the 2002 edition of Truss Plate Institute's (TPI) "Design Specification for Metal Plate Connected Wood Trusses".
      a. Connector plates shall be fabricated in accordance with applicable ICC-ES standards.
   4. Truss members and joints shall be designed in accordance with TPI-2002.
   5. Comply with TPI "Quality Standard for Metal Plate Connected Wood Trusses".

1.05 REGULATORY REQUIREMENTS

A. Building Code: International Building Code (IBC), 2006 Edition with amendments as required by local jurisdiction.

B. Energy Code: International Energy Conservation Code (IECC), 2015 Edition with amendments as required by local jurisdiction.

C. Contractor shall be responsible for compliance with all applicable building codes and ordinances covering the work.

D. Contractor shall cooperate with authorities having jurisdiction and provide data as requested.

1.06 DESIGN LOADS

A. Design loads shall be per the Building Code indicated under Regulatory Requirements and shall govern in all cases, unless more stringent requirements are included herein.

B. The basic design loads shall include dead, live and wind loads.

C. Vertical Live Loads:

1. Roof shall be designed for a vertical live load of 30 psf.

2. Vertical live load to be in addition to the applicable dead loads and shall be applied to the horizontal projection of the roof.

3. Roof covering, purlins and primary framing member shall be designed for drifting snow and/or sliding snow. Comply with AF&PA "National Design Specification for Wood Construction" (NDS). Drifting and/or sliding snow load shall be a minimum of 60 psf.

D. Wind Loads: The wind load on the structure shall be 20 psf velocity pressure proportioned and applied as horizontal and uplift forces. Comply with AF&PA "National Design Specification for Wood Construction" (NDS).

E. Auxiliary (additional collateral) Loads: Other superimposed dynamic and/or static loads shall be considered as part of the design requirement and combined with the normal design (live and/or wind) loads as prescribed hereafter. The roof framing shall be designed for an auxiliary load of 10 psf to accommodate lighting and electrical distribution systems, overhead doors.

F. Combination of Loads: The combining of normal loads and auxiliary loads for design purposes shall be as prescribed and recommended by the AF&PA "National Design Specification for Wood Construction" (NDS), most recent edition.

G. Perform calculations using diaphragm design analysis. Incorporate bracing as required if building exceeds diaphragm requirements.

1. Comply with AF&PA "National Design Specification for Wood Construction (NDS)."

2. Trusses:

a. Limit deflection for live or snow loads to L/240 for trusses.

b. Comply with appropriate NDS and Truss Plate Institute (TPI) standards.

3. Limit story drift to H/240 for a 10-year wind.

H. Plywood or Oriented Strand Board Sheathing: Comply with APA "Plywood Design Specification."

I. Expansion/Contraction Provisions: Design clip attachment system to allow for expansion and contraction of metal roofing, due to seasonal temperature variations, without detrimental effect to the roof panels.

J. Veneer Masonry Provisions: At areas to receive veneer masonry provide additional supplemental framing members as necessary to limit deflection to l/600 of the span for supporting members.

1.07 SUBMITTALS

A. Reference Section 01 33 00–Submittal Procedures.

B. Submit the following items:

1. Product Data: Include manufacturer's specifications and installation instructions for building components and accessories.

2. Structural Engineer Certification: Letter signed by a Structural Engineer, registered to practice in the state of Illinois verifying compliance with specified Design Requirements. Letter must reference specific dead loads, live loads, wind loads, tributary area load reductions (if applicable) collateral loads, seismic loads, end use categories, and governing building code including edition and load applications.

3. Shop Drawings: Provide four (4) complete sets bearing the seal of a Structural Engineer registered in the State of Illinois. Shop Drawings will be submitted to the authorities having jurisdiction for procurement of building permit(s) The sets shall include:

   a. Complete and detailed shop drawings for concrete footings and foundations, showing all required dimensions, elevations and reinforcing.
   b. Complete and detailed shop and erection drawings for pre-engineered wood building system, showing size and location of each part and component, certifying that the building design meets specified roof and wind loading requirements.
   c. Final rough opening dimensions, coordinated as required with products to be provided under this Specification Section and other Specifications.
   d. Calculations demonstrating compliance with attic venting Building Code requirements.
   e. Truss design drawings, engineering analysis and design data indicating the following:
      1) Slope, depth, span and spacings of trusses
      2) Heel bearing height
      3) Design loading, including live loads, dead loads and concentrated loads.
      4) Axial forces and bending moments of each member.
      5) Design analysis of each joint demonstrating that proper plates have been applied.
      6) Basic plate design values and adjustments to lumber and plate design values for conditions of use.
      7) Plate type, thickness of gauge and size
      8) Lumber size, species and grade for each member
   f. Other information as required by the authorities having jurisdiction to obtain building permit(s).

4. Energy Efficiency: Submit COMcheck report for building envelope demonstrating compliance with Energy Code indicated under Regulatory Requirements.

5. Samples: Standard material samples for all materials requiring color selection. Color charts are not acceptable for selections of materials.

6. Quality Assurance/Control Submittals:

   a. Written Statements/Certificates:

      1) Manufacturer qualifications.
      2) Dealer qualifications.
      3) Installer qualifications.
      4) Manufacturer's third-party truss inspection program.

1.08 QUALITY ASSURANCE

A. All members are to be fabricated in accordance with standard industry practice and to meet Reference Standards and Regulatory Requirements included within these specifications.

B. Structure and structural components shall be designed under direct supervision of a Professional/Structural Engineer registered to practice in the State of Illinois.

C. Contractor shall be responsible for all materials and products provided the Contractor, whether furnished directly by the Contractor or by subcontractor(s) hired by the Contractor.

D. Qualifications:

   1. Manufacturer Qualifications: Minimum ten (10) years experience in producing pre-engineered wood buildings of the type specified.

   2. Dealer Qualifications: Must be authorized by the manufacturer; state date of Manufacturer authorization granted and expiration of same if any.

   3. Installer Qualifications: Minimum one year experience in erection of pre-engineered wood buildings of the type specified and approved by the Manufacturer.

E. Wood Trusses:

1. Manufacturer shall have a third party inspection program to verify compliance with requirements of TPI.

2. Trusses are to be stamped with inspection agency identification.

3. Trusses are to be plant-fabricated, using mechanical or hydraulic fixtures as required to bring members into contact. Plates are to be installed in accordance with manufacturer's instructions.

1.09 FIELD COORDINATION AND MEASUREMENTS

A. Contractor shall coordinate with Others to ensure work by Others is acceptable for installation of products and materials specified under this Section.

B. Field measure and verify site conditions and work by Others to verify that work and components match shop drawings provided under this Section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Arrange to store components and materials on-site, in locations as determined by the General Contractor/Construction Manager.

B. Handle and store all components with care.

C. Handle and store structural components to comply with manufacturer's instructions and TPI recommendations to avoid damage from bending, overturning, or other cause which component is not designed to resist or endure.

D. Store roofing panels, siding panels and other exterior finish materials to allow water to drain freely.

E. Stack materials on platforms, pallets or other structures covered with tarpaulins or other suitable weather-tight ventilated covering.

F. Do not store materials in contact with other materials that may cause staining or discoloration.

G. Do not store materials in direct contact with ground or in standing water.

1.11 WARRANTY

A. The building manufacturer shall supply a warranty to the Owner meeting the following minimum requirements. The warranty period shall start on the date of Substantial Completion. The warranty shall not be prorated.

1. For a period of fifty (50) years:
   a. Repair or replacement costs, including labor and materials, if any preservative treated wood fails due to decay or insect damage.
   b. Repair or replace the building framework, roofing and siding panels damaged by snow loads.

2. For a period of thirty-five (35) years:
   a. Repainting of prefinished metal roofing or siding panels where, under conditions of normal weathering, paint has separated from panels due to flaking or peeling of painted finish.
   b. Repainting of prefinished metal roofing or siding panels where, under conditions of normal weathering, chalking greater than a rating of 8 (ASTM D4212 Method A) or a color change greater than 5 units (ASDM D2244) has occurred.
   c. Repair or repainting of metal wall panels perforated due to deterioration due to red rust.

3. For a period of ten (10) years:
   a. Repainting of prefinished metal roofing or siding panels where, under conditions of normal weathering, the panels exhibit corrosion resulting from red rust greater than ½" from any sheared edge visible in casual observation.

4. For a period of five (5) years:
   a. Repair, or at its discretion, replace free of charge the building framework, including roofing and/or siding panels, if directly damaged by wind loads, unless damage is caused by flying or falling objects.
   b. Repair any roof leaks due to defects in materials or workmanship.

5. For a period of one (1) year:
   a. Repair other building parts that prove to be defective in materials or workmanship.

PART 2: PRODUCTS

2.01 MANUFACTURER

A. Products by Morton Buildings, Inc are specified; 252 West Adams Street, Morton, Illinois 61550; phone (800) 447-7436.

   1. Local manufacturer's rep: Ben Eyster, 815-761-0142, Ben.eyster@mortonbuildings.com

B. Equivalent products by Lester Building Systems are acceptable; 1111 2nd Avenue South, Lester Prairie, MN 55354; phone (320) 395-2531.

C. Other manufacturers may submit for prior approval as described under Substitutions and Product Options information included elsewhere within the Specifications.

2.02 STRUCTURAL FRAMING

A. Primary Framing:

   1. Columns: Factory fabricated, laminated using ring shank or wire feed nails per manufacturer's engineered nailing pattern.

      a. Lumber: No. 1 or Better SYP. Kiln dried to 19% maximum moisture content.

      b. Configuration:

         1) Sidewall and Endwall Columns: 3 ply or 4 ply combining 2x6, 2x8, or dimension lumber as required by Structural Design requirements and configured to accept interlocking girts and splashplank.

         2) Corner Columns: 2 ply or 3 ply 2x6 or 2x8 dimension lumber as required by Structural Design requirements and configured to accept interlocking girts and splashplank from side and endwall directions.

      c. Column Anchoring: Factory nailed and glued anchor block attached to base of column as required by Structural Design requirements.

   2. Wood Trusses:

      a. Lumber: Top Chord, Bottom Chord and Webs to be SYP of size and grade to meet Structural Design requirements. Constructed of surfaced lumber (S4S) and compliant with SPIB visual and structural grade requirements.

      b. Connector plates shall meet Structural Design requirements and shall be compliant with applicable ICC-ES standards and specifications.

B. Secondary Framing:

1. Purlins and Girts:

a. Lumber: No. 2 or Better SPF dimension lumber kiln dried to 19% maximum moisture content.

b. Configuration: 2x4 or 2x6 as required by Structural Design requirements.

1) Girts: Precision cut to fit.
2) Purlins: Precision cut to fit between trusses flush with top of top chord. Provide 20 gauge galvanized purlin saddle hangers.

c. Spacing: As required by Structural Design requirements. Locate purlins to allow for anchorage of snow guards using mechanical fasteners, or provide additional purlins as required.

2. Baseboard:

a. Lumber: No. 2 or Better SYP, pressure treated with Chromated Copper Arsenate, Type III, to a retention of 0.6 pcf and kiln dried after treating to 19% maximum moisture content.

b. Configuration: 2x8 tongue and groove dimension lumber precision cut to fit between and interlock with columns.

3. Bracing, Wall and Lateral Truss Type:

a. Lumber: No. 2 or Better SPF dimension lumber.

b. Configuration: 2x4 or 2x6 as required by Structural Design requirements.

2.03 PREFINISHED METAL ROOFING AND SIDING PANELS

A. Panel Description: Hi-Rib Panel.

1. Material and Finish

a. Panel substrate shall be 0.019” minimum thickness commercial steel sheet with G90 (zinc) coating per ASTM A653 or AZ55 (aluminum/zinc) coating per ASTM A792.

b. The weather side of the panel shall receive a nominal two-tenths mil polyurethane primer and a nominal eight-tenths mil topcoat of Kynar 500/Hylar 5000 70% polyvinylidene difluoride (PVDF) resin to achieve a total nominal paint film thickness of one mil.

c. The non-weather side paint system shall consist of a two-coat finish with a total nominal thickness of one-half mil.

d. Colors: As selected by Architect from manufacturer’s standard colors

2. Configuration:

a. Roll-formed; 36” coverage width. Provide panels covering up to 38’-9” lengths in single pieces.

b. Corrugations, 7/8” - 1” high, spaced 12 inches on center with 3 low ribs, spaced 3 inches on center between each major corrugation.

c. Form one outboard corrugation as overlapping corrugation.

d. Form opposite outboard corrugation as underneath corrugation with continuous sealant groove.

e. Factory cut to required length.

B. Fasteners: Color coated No. 10 drill screws with ¼” hex head pre-assembled to ½” o.d. dome seal or bond seal galvanized steel and EPDM washers.

C. Accessories:

1. Provide manufacturer’s standard continuous vented roof ridge, eave trims, gable trims, corner trims, and soffit panels and flashings for weather tight construction. Field-fabricate minor flashings as shown on Erection Drawings.

2. Provide manufacturer’s standard gutters and downspouts. Coordinate downspout locations with exterior openings.

3. Closure Strips: Closed cell, 2 pcf density polyethylene foam, premolded to match configuration of panels.

4. Snow Guards: Clear polycarbonate snow guards at spacings as recommended by the manufacturer for the slope and orientation of the roof. Fastened with mechanical fasteners to roof purlins.

5. Eave and rake trim, wall cap, fascia, flashings, etc., shall be provided with a protective coating in accordance with the building manufacturer's standards.

2.04 WEATHER BARRIER, INSULATION AND VAPOR RETARDER

A. Weather barrier as specified in Section 07 65 19.

B. Exterior Wall Insulation: Unfaced fiberglass batt as manufactured by Certain Teed, Johns Manville, and Owens Corning.

1. Thermal resistance: Minimum R-value of 19 per ASTM C518.

2. Conforming to property requirements of ASTM C665, type 1 and ASTM E136.

C. Ceiling Insulation: Formaldehyde-free, blown-in fiberglass as manufactured by Johns Manville and Owens Corning.

1. Thermal resistance: Minimum R-value of 38.

2. Conforming to property requirements of ASTM C764, Type I. ASTM E84.

D. Vapor Retarder: Manufacturers standard, minimum 4 mil polyethelyne sheets.

2.05 INTERIOR PANELS

A. Interior Metal Liner Panels (walls and ceiling):

1. Panel substrate shall be .019” minimum thick commercial steel sheet with a AZ50 (Galvalume) coating ASTM A792.

2. The interior-facing side of the panel shall receive a nominal two tenths mil acrylic primer and a nominal eight tenths mil top coat of white polyester paint to achieve a total nominal paint film thickness of one mil.

3. The hidden (backer) side paint system shall consist of a two coat finish with a total nominal thickness of one half mil.

B. Provide draft stopping as required by Building Code prior to installation of ceiling liner panels.

2.06 DOORS, WINDOWS, OVERHEAD DOORS

A. Hollow Metal Doors and Frames: As specified in Section 08 10 00.

B. Windows: Pella ProLine, Designer Series wood windows are specified. Equivalent products by Marvin Windows are acceptable.

1. Comply with requirements of NWWDA Performance Grade DP15.
2. Sash and Frames: Wood windows with sheet and extruded aluminum cladding and baked-on acrylic coating.
3. Screens: For each operable window provide removeable aluminum-framed screens with aluminum insect screen.
4. Glazing: Manufacturer's standared high performance, low emissivity clear insulated glazing units.
5. Accessories: Provide all necessary fasteners, trim and flashings as required for weatherproof and proper installation
6. Sizes: As indicated on Drawings. Provide custom sizes as required.
7. Color: Architect to select from manufacturers full line of available colors.

C. Overhead Doors: As specified in Section 08 36 00.

D. Accessories: Provide all necessary fasteners, trim, and flashings required for proper installation as recommended by the pre-engineered wood building Manufacturer.

2.07 JOINT SEALANT MATERIALS

A. Sealant: Single Component, Nonsag, Neutral-Curing Silicone joint sealant conforming to ASTM C 920, Type S, Class 100/50, Grade NS.

1. Manufacturers/product:
   a. Dow Corning, 790.
   b. GE/Momentive Performance Materials, SilPruf LM SCS 2700.
   c. Pecora, 890 or 890 FTS
   d. Temco Spectrem 1 or Spectrem 4
2. Colors: As selected by Architect from manufacturers full range of available colors.

PART 3: EXECUTION

3.01 EXAMINATION

A. Coordinate with others for installation of items and anchors to be cast into concrete foundations.

B. Verify that site conditions are acceptable for erection/installation of pre-engineered wood building system.

C. Coordinate with responsible entities to perform corrective work on unsatisfactory conditions.

D. Commencement of work by erector/installer is acceptance of site conditions.

3.02 ERECTION

A. Erect in accordance with manufacturer's instructions and approved shop drawings.

B. Lift and set all materials using methods approved by the manufacturer.

C. Provide temporary erection and wind load bracing to maintain structure plumb and in alignment until installation of permanent bracing and/or roofing and wall coverings are completed.

D. Do not field cut or alter structural members without written approval of Architect, Manufacturer and Professional Structural Engineer responsible for certification of Structural Design.

3.03 INSTALLATION

A. Prefinished Metal Roofing:

1. General: Install in accordance with manufacturer's instructions. Secure to structural framing aligned, level and plumb. Space fasteners as shown on Erection Drawings.

2. Sidelap: Minimum one full corrugation.

3. Endlap: 8 inches for slopes 4:12 to 5:12. Secure together over and to structural members.

4. Accessories: Install as shown on Erection Drawings.

B. Prefinished Metal Siding and Interior Metal Liner Panels:

1. General: Install in accordance with manufacturer's instructions. Secure to structural framing aligned, level and plumb. Space fasteners as shown on Erection Drawings.

2. Sidelap: Minimum one full corrugation.

3. Field cut endwall panels to match roof slope.

4. Accessories: Install as shown on Erection Drawings.

C. Windows:

1. Install materials and systems in accordance with manufacturer's instructions and approved submittal materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

2. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

D. Hollow Metal Doors and Doorframes: As specified in Section 08 10 00.

E. Overhead Doors: As specified in Section 08 36 00.

F. Joint Sealant Materials:

1. Preparation: Clean joints and surfaces to receive sealants of foreign materials.

2. Apply sealant with caulking gun using sufficient pressure to completely fill joints and ensure full contact of sealant to joint sides.

3. Toll surface smooth and uniform, free of ridges, sags and air pockets.

4. Clean sealant from adjacent surfaces.

3.04 CLEANING AND REPAIR

A. Clean surfaces soiled by work as recommended by manufacturer.

B. Touch up repair abrasions and other defects on pre-painted metal panel surfaces with same type of primer and paint as original finish, or replace metal panel. Metal panels that have received repairs/touch-ups which, in the opinion of the Architect, are not aesthetically acceptable are to be replaced by the Contractor at no additional cost.

C. Remove surplus material and debris from site.

END OF SECTION 13 34 21

SECTION 21 05 13

COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2: PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3: EXECUTION (Not Applicable)

END OF SECTION 21 05 13

SECTION 21 05 17
SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2: PRODUCTS

2.01 SLEEVES

A. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

C. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.02 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.
4. Metraflex Company (The).
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Plastic.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.03 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Interior Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 21 05 17

SECTION 21 05 18
ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Escutcheons.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2: PRODUCTS

2.01 ESCUTCHEONS

A. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

C. Split-Plate, Stamped-Steel Type: With chrome-plated finish, exposed-rivet hinge, and spring-clip fasteners.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
e. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.
f. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.

3.02 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 21 05 18

SECTION 21 05 23
GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Two-piece ball valves with indicators.
2. Iron butterfly valves with indicators.
3. Check valves.
4. Iron OS&Y gate valves.
5. Trim and drain valves.

1.03 DEFINITIONS

A. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

B. OS&Y: Outside screw and yoke.

C. SBR: Styrene-butadiene rubber.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Main Level: HAMV - Fire Main Equipment.

a. Level 1: HCBZ - Indicator Posts, Gate Valve.
b. Level 1: HLOT - Valves.

1) Level 3: HLUG - Ball Valves, System Control.
2) Level 3: HLXS - Butterfly Valves.
3) Level 3: HMER - Check Valves.
4) Level 3: HMRZ - Gate Valves.

2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.

a. Level 1: VQGU - Valves, Trim and Drain.

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:

a. Indicator posts.
b. Valves.

1) Gate valves.
2) Check valves.

a) Single check valves.

3) Miscellaneous valves.

C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

D. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
2. ASME B1.20.1 for threads for threaded-end valves.
3. ASME B31.9 for building services piping valves.

E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

F. NFPA Compliance: Comply with NFPA 24 for valves.

G. ure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.

H. Valve Sizes: Same as upstream piping unless otherwise indicated.

I. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.02 TWO-PIECE BALL VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. NIBCO INC.
2. Victaulic Company.

B. Description:

1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
2. Minimum Pressure Rating: 175 psig.

3. Body Design: Two piece.
4. Body Material: Forged brass or bronze.
5. Port Size: Full or standard.
6. Seats: PTFE.
7. Stem: Bronze or stainless steel.
8. Ball: Chrome-plated brass.
9. Actuator: Worm gear or traveling nut.
10. Supervisory Switch: Internal or external.
11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
12. End Connections for Valves NPS 2-1/2: Grooved ends.

2.03 IRON BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anvil International.
2. Globe Fire Sprinkler Corporation.
3. NIBCO INC.
4. Tyco Fire Products LP.
5. Victaulic Company.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Body Design: Lug or wafer.

2.04 CHECK VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anvil International.
2. Globe Fire Sprinkler Corporation.
3. NIBCO INC.
4. Reliable Automatic Sprinkler Co., Inc. (The).
5. Tyco Fire Products LP.
6. Victaulic Company.
7. Viking Corporation.
8. Watts; a Watts Water Technologies company.

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.05 IRON OS&Y GATE VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. NIBCO INC.
2. Victaulic Company.
3. Watts; a Watts Water Technologies company.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged.

2.06 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Potter Roemer LLC.
   e. Tyco Fire Products LP.
   f. Victaulic Company.
   g. Watts; a Watts Water Technologies company.

2. Description:

   a. Pressure Rating: 175 psig.
   b. Body Design: Two piece.
   c. Body Material: Forged brass or bronze.
   d. Port size: Full or standard.
   e. Seats: PTFE.
   f. Stem: Bronze or stainless steel.
   g. Ball: Chrome-plated brass.
   h. Actuator: Handlever.
   i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
   j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. NIBCO INC.
   b. United Brass Works, Inc.

2. Description:

a. Pressure Rating: 175 psig.
b. Body Material: Brass or bronze.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

A. Comply with requirements in the following Sections for specific valve installation requirements and applications:
1. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
2. Section 211316 "Dry-Pipe Sprinkler Systems" for application of valves in dry-pipe, fire-suppression sprinkler systems.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the pipe center.

F. Install valves in position to allow full stem movement.

G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.

I. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION 21 05 23

SECTION 21 05 53

IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

PART 2: PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

E. Pipe-Label Colors:

1. Background Color: Safety Red.
2. Letter Color: White.

2.04 STENCILS

A. Stencils for Piping:

1. Lettering Size: Size letters according to ASME A13.1 for piping.
2. Stencil Material: Fiberboard or metal.
3. Stencil Paint: Safety Red, exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
4. Identification Paint: White, exterior, acrylic enamel. Paint may be in pressurized spray-can form.

2.05 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Fasteners: Brass beaded chain or S-hook.
3. Valve-Tag Color: Safety Red.
4. Letter Color: White.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.06 WARNING TAGS

A. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety Yellow background with black lettering.

PART 3: EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.03 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

A. Piping: Painting of piping is specified in Section 099600 "High-Performance Coatings."

B. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.05 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:
   a. Wet-Pipe Sprinkler System: 1-1/2 inches, round.
   b. Dry-Pipe Sprinkler System: 1-1/2 inches, round.

3.06 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 21 05 53

SECTION 21 11 19
FIRE DEPARTMENT CONNECTIONS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Exposed-type fire-department connections.
2. Flush-type fire-department connections.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection.

PART 2: PRODUCTS

2.01 EXPOSED-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Fire Hose & Cabinet.
2. Elkhart Brass Mfg. Co., Inc.
3. Fire Protection Products, Inc.
4. Fire-End & Croker Corporation.
5. GMR International Equipment Corporation.
6. Guardian Fire Equipment, Inc.

B. Standard: UL 405.

C. Type: Exposed, projecting, for wall mounting.

D. Pressure Rating: 175 psig minimum.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Round, brass, wall type.

I. Outlet: Back, with pipe threads.

J. Number of Inlets: Two.

K. Escutcheon Plate Marking: Similar to "AUTO SPKR."

L. Finish: Polished chrome plated.

M. Outlet Size: NPS 4.

2.02 FLUSH-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Fire Hose & Cabinet.
2. Elkhart Brass Mfg. Co., Inc.
3. GMR International Equipment Corporation.
4. Guardian Fire Equipment, Inc.
5. Potter Roemer LLC.

B. Standard: UL 405.

C. Type: Flush, for wall mounting.

D. Pressure Rating: 175 psig minimum.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Rectangular, brass, wall type.

I. Outlet: With pipe threads.

J. Body Style: Horizontal.

K. Number of Inlets: Two.

L. Outlet Location: Back.

M. Escutcheon Plate Marking: Similar to "AUTO SPKR."

N. Finish: Polished chrome plated.

O. Outlet Size: NPS 4.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire-department connections.

B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install wall-type fire-department connections.

B. Install yard-type fire-department connections in concrete slab support. Comply with requirements for concrete in Section 033000 "Cast-in-Place Concrete."

C. Install two protective pipe bollards on sides of each fire-department connection. Comply with requirements for bollards in Section 055000 "Metal Fabrications."

D. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION 21 11 19

SECTION 21 13 13
WET-PIPE SPRINKLER SYSTEMS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

B. Related Requirements:

1. Section 211119 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.
2. Section 230523 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.03 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig.

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. HVAC hydronic piping.

3. Items penetrating finished ceiling include the following:

   a. Lighting fixtures.
   b. Air outlets and inlets.
   c. Low voltage devices.

4. HVAC ductwork.

B. Qualification Data: For qualified Installer and professional engineer.

C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Fire-hydrant flow test report.

F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

G. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.08 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

   a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.09 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Construction Manager's written permission.

PART 2: PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Sprinkler system design shall be approved by authorities having jurisdiction.

   a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
   b. Sprinkler Occupancy Hazard Classifications:

      1) Automobile Parking Areas: Ordinary Hazard, Group 1.
      2) Building Service Areas: Ordinary Hazard, Group 1.
      3) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
      4) General Storage Areas: Ordinary Hazard, Group 1.
      5) Laundries: Ordinary Hazard, Group 1.
      6) Machine Shops: Ordinary Hazard, Group 2.
      7) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
      8) Office and Public Areas: Light Hazard.
      9) Residential Living Areas: Light Hazard.
      10) Restaurant Service Areas: Ordinary Hazard, Group 1.

2. Minimum Density for Automatic-Sprinkler Piping Design:

   a. Residential (Dwelling) Occupancy: 0.05 gpm over 400-sq. ft. area.
   b. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
   c. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
   d. Ordinary-Hazard, Group 2 Occupancy: [0.20 gpm over 1500-sq. ft.] area.
   e. Special Occupancy Hazard: As determined by authorities having jurisdiction.

3. Maximum Protection Area per Sprinkler: According to UL listing.
4. Maximum Protection Area per Sprinkler:

   a. Residential Areas: 400 sq. ft..
   b. Office Spaces: 225 sq. ft..
   c. Storage Areas: 130 sq. ft..
   d. Mechanical Equipment Rooms: 130 sq. ft..
   e. Electrical Equipment Rooms: 130 sq. ft..
   f. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:

   a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
   b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.

D.

E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.02 STEEL PIPE AND FITTINGS

A. Standard-Weight, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Black-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

D. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

E. Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.

F. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

G. Malleable- or Ductile-Iron Unions: UL 860.

H. Cast-Iron Flanges: ASME 16.1, Class 125.

I. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick.

   a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
   b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.

2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

J. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

K. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International.
   b. Tyco Fire Products LP.
   c. Victaulic Company.

2. Pressure Rating: 175-psig minimum.
3. Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.03 COVER SYSTEM FOR SPRINKLER PIPING

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. DecoShield Systems, Inc.

B. Description: System of support brackets and covers made to protect sprinkler piping.

C. Brackets: Glass-reinforced nylon.

D. Covers: Extruded-PVC sections of length, shape, and size required for size and routing of CPVC piping.

2.04 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Globe Fire Sprinkler Corporation.
   b. Reliable Automatic Sprinkler Co., Inc. (The).
   c. Tyco Fire Products LP.
   d. Victaulic Company.
   e. Viking Corporation.

2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
7. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Reliable Automatic Sprinkler Co., Inc. (The).
   b. Tyco Fire Products LP.

2. Standard: UL 1726.
3. Pressure Rating: 175-psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.05 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International.
   b. Tyco Fire Products LP.
   c. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175-psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.

5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AGF Manufacturing Inc.
   b. Reliable Automatic Sprinkler Co., Inc. (The).
   c. Tyco Fire Products LP.
   d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Elkhart Brass Mfg. Co., Inc.
   b. Fire-End & Croker Corporation.
   c. Potter Roemer LLC.

2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AGF Manufacturing Inc.
   b. Triple R Specialty.
   c. Tyco Fire Products LP.
   d. Victaulic Company.
   e. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aegis Technologies, Inc.
b. CECA, LLC.
c. Corcoran Piping System Co.
d. Merit Manufacturing.

2. Standard: UL 1474.
3. Pressure Rating: 250-psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fivalco Inc.
b. FlexHead Industries, Inc.
c. Gateway Tubing, Inc.
d. Victaulic Company.

2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig minimum.
5. Size: Same as connected piping, for sprinkler.

2.06 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc. (The).
3. Tyco Fire Products LP.
4. Victaulic Company.
5. Viking Corporation.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Residential Applications: UL 1626.
4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

F. Open Sprinklers with Heat-Responsive Element Removed: UL 199.

1. Nominal Orifice: 1/2 inch, with discharge coefficient K.
2. Nominal Orifice: 17/32 inch with discharge coefficient K between 7.4 and 8.2.

G. Sprinkler Finishes: Chrome plated.

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

I. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Reliable Automatic Sprinkler Co., Inc. (The).
   b. Tyco Fire Products LP.
   c. Victaulic Company.
   d. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.07 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fire-Lite Alarms, Inc.; a Honeywell International company.
   b. Notifier.
   c. Potter Electric Signal Company, LLC.

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 6-inch minimum- diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Potter Electric Signal Company, LLC.
   b. System Sensor.
   c. Viking Corporation.
   d. Watts; a Watts Water Technologies company.

2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

D. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Potter Electric Signal Company, LLC.
   b. System Sensor.

c. Tyco Fire Products LP.
d. Viking Corporation.

2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell International company.
b. Kennedy Valve Company; a division of McWane, Inc.
c. Potter Electric Signal Company, LLC.
d. System Sensor.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.08 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AGF Manufacturing Inc.
2. AMETEK, Inc.
3. Ashcroft Inc.
4. Brecco Corporation.
5. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0- to 250-psig minimum.

E. Label: Include "WATER" label on dial face.

PART 3: EXECUTION

3.01 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.02 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Section 221119 "Domestic Water Piping Specialties."

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.03 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

I. Install alarm devices in piping systems.

J. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

K. Install pressure gages on riser or feed main, and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

L. Pressurize and check preaction sprinkler system piping and air compressors.

M. Fill sprinkler system piping with water.

N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.04 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

L. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3.05 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13 or NFPA 13R for supports.

3.06 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.

3.07 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.08 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.09 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.11 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.12 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. CPVC pipe, Schedule 40 CPVC fittings, and solvent-cemented joints may be used for light-hazard and residential occupancies.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
3. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
5. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
6. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

E. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
4. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
5. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

F. Standard-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
4. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
5. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

3.13 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Concealed sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Residential Sprinklers: Dull chrome.
5. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 13

SECTION 21 13 16
DRY-PIPE SPRINKLER SYSTEMS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Specialty valves.
3. Sprinkler specialty pipe fittings.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

B. Related Requirements:

1. Section 211119 "Fire Department Connections" for exposed-, and flush--type fire department connections.
2. Section 210523 "Fire Protection Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.03 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For dry-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For dry-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. HVAC hydronic piping.
3. Items penetrating finished ceiling including the following:

   a. Lighting fixtures.
   b. Air outlets and inlets.

c. Low voltage devices.

4. HVAC ductwork.

B. Qualification Data: For qualified Installer and professional engineer.

C. Field Test Reports and Certificates:

D. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

E. Fire-hydrant flow test report.

F. Field Test Reports:

1. Fire-hydrant flow test report.
2. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

G. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For dry-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.08 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

1.09 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Construction Manager's written permission.

PART 2: PRODUCTS

2.01 SYSTEM DESCRIPTIONS

A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.

2.02 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design dry-pipe sprinkler systems.

D. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:

    a. Automobile Parking Areas: Ordinary Hazard, Group 1.
    b. Building Service Areas: Ordinary Hazard, Group 1.
    c. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
    d. General Storage Areas: Ordinary Hazard, Group 1.
    e. Laundries: Ordinary Hazard, Group 1.
    f. Machine Shops: Ordinary Hazard, Group 2.
    g. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
    h. Office and Public Areas: Light Hazard.
    i. Restaurant Service Areas: Ordinary Hazard, Group 1.

3. Minimum Density for Automatic-Sprinkler Piping Design:

    a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
    b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
    c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
    d. Special Occupancy Hazard: As determined by authorities having jurisdiction.

4. Maximum Protection Area per Sprinkler: According to UL listing.
5. Maximum Protection Area per Sprinkler:

    a. Office Spaces: 225 sq. ft..
    b. Storage Areas: 130 sq. ft..
    c. Mechanical Equipment Rooms: 130 sq. ft..
    d. Electrical Equipment Rooms: 130 sq. ft..
    e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:

    a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
    b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.

2.03 STEEL PIPE AND FITTINGS

A. Standard-Weight, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Galvanized-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

D. Galvanized-Steel Couplings: ASTM A 865/A 865M, threaded.

E. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

F. Malleable- or Ductile-Iron Unions: UL 860.

G. Cast-Iron Flanges: ASME B16.1, Class 125.

H. Plain-End-Pipe Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn or screwed retainer pin to secure pipe in fitting.

I. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International.
   b. Tyco Fire Products LP.
   c. Victaulic Company.

2. Pressure Rating: 175-psig minimum.
3. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.

4. Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
5. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.04 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Dry-Pipe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Tyco Fire Products LP.
   b. Victaulic Company.
   c. Viking Corporation.

2. Standard: UL 260.
3. Design: Differential-pressure type.
4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
5. Air-Pressure Maintenance Device:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Tyco Fire Products LP.
        2) Victaulic Company.
        3) Viking Corporation.

6. Standard: UL 260.
7. Type: Automatic device to maintain minimum air pressure in piping.
8. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig outlet pressure.
9. Air Compressor:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Gast Manufacturing Inc.
        2) General Air Products, Inc.
        3) Viking Corporation.

    b. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
    c. Motor Horsepower: Fractional.
    d. Power: 120-V ac, 60 Hz, single phase.

G. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Reliable Automatic Sprinkler Co., Inc. (The).
    b. Tyco Fire Products LP.

2. Standard: UL 1726.
3. Pressure Rating: 175-psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.05 SPRINKLER PIPING SPECIALTIES

A. General Requirements for Dry-Pipe System Fittings: UL listed for dry-pipe service.

B. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anvil International.
    b. Tyco Fire Products LP.
    c. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175-psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.

5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

C. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AGF Manufacturing Inc.
   b. Reliable Automatic Sprinkler Co., Inc. (The).
   c. Tyco Fire Products LP.
   d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

D. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Elkhart Brass Mfg. Co., Inc.
   b. Fire-End & Croker Corporation.
   c. Potter Roemer LLC.

2. Standard: UL 199.
3. Pressure Rating: 175-psig minimum.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

E. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AGF Manufacturing Inc.
   b. Triple R Specialty.
   c. Tyco Fire Products LP.
   d. Victaulic Company.
   e. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

F. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CECA, LLC.
b. Corcoran Piping System Co.
c. Merit Manufacturing.

2. Standard: UL 1474.
3. Pressure Rating: 250-psig minimum.
4. Body Material: Steel pipe with EPDM O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

G. Flexible Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fivalco Inc.
b. FlexHead Industries, Inc.
c. Gateway Tubing, Inc.
d. Victaulic Company.

2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig minimum.
5. Size: Same as connected piping, for sprinkler.

2.06 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc. (The).
3. Tyco Fire Products LP.
4. Victaulic Company.
5. Viking Corporation.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.
2. Residential Applications: UL 1626.
3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

F. Sprinkler Finishes: Chrome plated.

G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

H. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Reliable Automatic Sprinkler Co., Inc. (The).
b. Tyco Fire Products LP.
c. Victaulic Company.
d. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.07 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell International company.
b. Notifier.
c. Potter Electric Signal Company, LLC.

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 6-inch minimum diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Potter Electric Signal Company, LLC.
b. System Sensor.
c. Tyco Fire Products LP.
d. Viking Corporation.

2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

D. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell International company.
b. Kennedy Valve Company; a division of McWane, Inc.
c. Potter Electric Signal Company, LLC.
d. System Sensor.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

2.08 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AGF Manufacturing Inc.
2. AMETEK, Inc.
3. Ashcroft Inc.
4. Brecco Corporation.
5. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0- to 250-psig minimum.

E. Label: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3: EXECUTION

3.01 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.02 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Connect compressed-air supply to dry-pipe sprinkler piping.

I. Connect air compressor to the following piping and wiring:

1. Pressure gages and controls.
2. Electrical power system.
3. Fire-alarm devices, including low-pressure alarm.

J. Install alarm devices in piping systems.

K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13. Install pressure gages on riser or feed main, and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

L. Drain dry-pipe sprinkler piping.

M. Pressurize and check dry-pipe sprinkler system piping and air compressors.

N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.03 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.04 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install dry-pipe valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

    a. Install air compressor and compressed-air-supply piping.

3.05 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install sprinklers with water supply from heated space. Do not install pendent or sidewall sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.06 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.07 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.08 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.09 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.10 PIPING SCHEDULE

A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

B. Standard-pressure, dry-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3.

C. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3.

D. Standard-pressure, dry-pipe sprinkler system, NPS 5 and NPS 6, shall be one of the following:

1. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3.

3.11 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Dry pendent, recessed, flush, and concealed sprinklers as indicated.
3. Wall Mounting: Dry sidewall sprinklers.
4. Spaces Subject to Freezing: Upright, dry pendent sprinklers; and dry sidewall sprinklers as indicated Insert type.
5. Special Applications: Extended-coverage and quick-response sprinklers where indicated,

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 16

SECTION 22 05 13
COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2: PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3: EXECUTION (Not Applicable)

END OF SECTION 22 05 13

SECTION 22 05 17
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2: PRODUCTS

2.01 SLEEVES

A. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

C. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.02 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.
4. Metraflex Company (The).
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Plastic.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.03 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Interior Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 22 05 17

SECTION 22 05 18
ESCUTCHEONS FOR PLUMBING PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2: PRODUCTS

2.01 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed and exposed-rivet hinge, and spring-clip fasteners.

2.02 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.

g. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.

2. Escutcheons for Existing Piping:

a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with rough-brass finish.
f. Bare Piping in Equipment Rooms: Split-casting brass type with rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.02 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 22 05 18

SECTION 22 05 19
METERS AND GAGES FOR PLUMBING PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.
6. Test plugs.
7. Test-plug kits.
8. Sight flow indicators.

B. Related Requirements:
1. Section 221119 "Domestic Water Piping Specialties" for water meters.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2: PRODUCTS

2.01 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Inc.
2. Miljoco Corporation.
3. Palmer Wahl Instrumentation Group.
4. Trerice, H. O. Co.
5. Watts; a Watts Water Technologies company.
6. Weiss Instruments, Inc.

B. Standard: ASME B40.200.

C. Case: sealed type(s); stainless steel with 3-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass or plastic.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1.5 percent of scale range.

2.02 LIQUID-IN-GLASS THERMOMETERS

A. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Miljoco Corporation.
   b. Palmer Wahl Instrumentation Group.
   c. Watts; a Watts Water Technologies company.
   d. Weiss Instruments, Inc.

2. Standard: ASME B40.200.
3. Case: Plastic; 9-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass or plastic.
8. Stem: Aluminum, brass, or stainless steel and of length to suit installation.

   a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.03 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.04 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ashcroft Inc.
b. Miljoco Corporation.
c. Palmer Wahl Instrumentation Group.
d. Trerice, H. O. Co.
e. Watts; a Watts Water Technologies company.
f. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Stainless steel.
11. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ashcroft Inc.
b. Miljoco Corporation.
c. Palmer Wahl Instrumentation Group.
d. Trerice, H. O. Co.
e. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Sealed type; plastic; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

2.05 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.06 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Miljoco Corporation.
2. Nexus Valve, Inc.
3. Trerice, H. O. Co.
4. Watts; a Watts Water Technologies company.
5. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.07 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Miljoco Corporation.
2. Nexus Valve, Inc.
3. Trerice, H. O. Co.
4. Watts; a Watts Water Technologies company.
5. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

D. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.

E. Carrying Case: Metal or plastic, with formed instrument padding.

2.08 SIGHT FLOW INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ARCHON Industries, Inc.
2. Dwyer Instruments, Inc.
3. Emerson Process Management; Rosemount Division.
4. John C. Ernst Co., Inc.
5. KOBOLD Instruments, Inc. - USA.
6. OPW Engineered Systems; OPW Fluid Transfer Group; a Dover company.
7. Pentair Valves & Controls; Penberthy Brand.

B. Description: Piping inline-installation device for visual verification of flow.

C. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

D. Minimum Pressure Rating: 125 psig.

E. Minimum Temperature Rating: 200 deg F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids.

H. Install test plugs in piping tees.

I. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

J. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.02 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.03 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.04 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Plastic case, industrial-style, liquid-in-glass type.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.05 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.

B. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F.

3.06 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be one of the following:

1. Sealed, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:

1. Sealed, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.

C. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:

1. Sealed, direct-mounted, metal case.
2. Sealed, direct remote-mounted, plastic case.

3.07 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 100 psi.

B. Scale Range for Domestic Water Piping: 0 to 100 psi.

END OF SECTION 22 05 19

SECTION 220523.12
BALL VALVES FOR PLUMBING PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Steel ball valves.

1.03 DEFINITIONS

A. CWP: Cold working pressure.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and soldered ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.5 for flanges on steel valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder-joint connections.
5. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Handlever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.02 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Forged brass.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

2.03 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts; a Watts Water Technologies company.
f. Zurn Industries, LLC.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Bronze or brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

2.04 STEEL BALL VALVES

A. Steel Ball Valves with Full Port, Class 150:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. NIBCO INC.

2. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 285 psig.
c. Body Design: Split body.
d. Body Material: Carbon steel, ASTM A 216, Type WCB.
e. Ends: Flanged or threaded.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.04 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Brass ball valves, two-piece with full port and brass trim.
3. Bronze ball valves, two-piece with full port and bronze or brass trim.

B. Pipe NPS 2-1/2 and Larger:

1. Steel Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Steel ball valves, Class 150 with full port.

END OF SECTION 220523.12

SECTION 220523.14
CHECK VALVES FOR PLUMBING PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Bronze lift check valves.
2. Bronze swing check valves.
3. Iron swing check valves.
4. Iron swing check valves with closure control.
5. Iron, grooved-end swing check valves.

1.03 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.

2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE LIFT CHECK VALVES

A. Bronze Lift Check Valves with Nonmetallic Disc, Class 125, :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Hammond Valve.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 200 psig.
   c. Body Design: Vertical flow.
   d. Body Material: ASTM B 61 or ASTM B 62, bronze.
   e. Ends: Threaded or soldered. See valve schedule articles.
   f. Disc: NBR, PTFE.

2.03 BRONZE SWING CHECK VALVES

A. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. Stockham; Crane Energy Flow Solutions.
   f. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-80, Type 4.
   b. CWP Rating: 200 psig.
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.
   e. Ends: Threaded or soldered. See valve schedule articles.
   f. Disc: PTFE.

B. Bronze Swing Check Valves with Nonmetallic Disc, Class 150:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Hammond Valve.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-80, Type 4.
   b. CWP Rating: 300 psig.
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.
   e. Ends: Threaded or soldered. See valve schedule articles.
   f. Disc: PTFE.

2.04 IRON SWING CHECK VALVES

A. Iron Swing Check Valves with Nonmetallic-to-Metal Seats, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Stockham; Crane Energy Flow Solutions.

2. Description:

   a. Standard: MSS SP-71, Type I.
   b. CWP Rating: 200 psig.
   c. Body Design: Clear or full waterway.
   d. Body Material: ASTM A 126, gray iron with bolted bonnet.
   e. Ends: Flanged or threaded. See valve schedule articles.
   f. Trim: Composition.
   g. Seat Ring: Bronze.
   h. Disc Holder: Bronze.
   i. Disc: PTFE.
   j. Gasket: Asbestos free.

2.05 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Iron Swing Check Valves with Lever- and Spring-Closure Control, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Hammond Valve.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Stockham; Crane Energy Flow Solutions.
   e. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-71, Type I.
   b. CWP Rating: 200 psig.
   c. Body Design: Clear or full waterway.
   d. Body Material: ASTM A 126, gray iron with bolted bonnet.

e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.
h. Closure Control: Factory-installed exterior lever and weight.

2.06 IRON, GROOVED-END SWING CHECK VALVES

A. Iron, Grooved-End Swing Check Valves, 300 CWP:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Victaulic Company.

2. Description:

a. CWP Rating: 300 psig.
b. Body Material: ASTM A 536, ductile iron.
c. Seal: EPDM.
d. Disc: Spring operated, ductile iron or stainless steel.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Lift Check Valves: With stem upright and plumb.

F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.03 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

   a. NPS 2 and Smaller: Bronze swing check valves with nonmetallic disc.
   b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; or iron, center-guided, resilient-seat check valves.
   c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
3. For Copper Tubing, NPS 5 and Larger: Flanged.
4. For Steel Piping, NPS 2 and Smaller: Threaded.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded.
6. For Steel Piping, NPS 5 and Larger: Flanged.
7. For Grooved-End Copper Tubing and Steel Piping: Grooved.

3.05 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze swing check valves with nonmetallic disc, Class 125, with soldered or threaded end connections.

B. Pipe NPS 2-1/2 and Larger:

1. Iron swing check valves with nonmetallic-to-metal seats, Class 125, with threaded or flanged end connections.
2. Iron swing check valves with closure control lever and spring, Class 125, with threaded or flanged end connections.
3. Iron, grooved-end swing check valves, 300 CWP.

END OF SECTION 220523.14

SECTION 220523.15
GATE VALVES FOR PLUMBING PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Bronze gate valves.
2. Iron gate valves.
3. Chainwheels.

1.03 DEFINITIONS

A. CWP: Cold working pressure.

B. NRS: Nonrising stem.

C. OS&Y: Outside screw and yoke.

D. RS: Rising stem.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set gate valves closed to prevent rattling.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.

2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. RS Valves in Insulated Piping: With 2-inch stem extensions.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE GATE VALVES

A. Bronze Gate Valves, NRS, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig.
   c. Body Material: Bronze with integral seat and screw-in bonnet.
   d. Ends: Threaded or solder joint.
   e. Stem: Bronze.
   f. Disc: Solid wedge; bronze.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron, bronze, or aluminum.

2.03 IRON GATE VALVES

A. Iron Gate Valves, NRS, Class 150:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-70, Type I.
   b. CWP Rating: 200 psig.
   c. Body Material: Gray iron with bolted bonnet.
   d. Ends: Flanged.
   e. Trim: Bronze.
   f. Disc: Solid wedge.
   g. Packing and Gasket: Asbestos free.

B. Iron Gate Valves, OS&Y, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
   d. Watts; a Watts Water Technologies company.

2. Description:

   a. Standard: MSS SP-70, Type I.
   b. CWP Rating: 200 psig.
   c. Body Material: Gray iron with bolted bonnet.
   d. Ends: Flanged.
   e. Trim: Bronze.
   f. Disc: Solid wedge.
   g. Packing and Gasket: Asbestos free.

2.04 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries.
3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, chain guides, chain, and attachment brackets for mounting chainwheels directly to hand wheels.

1. Sprocket Rim with Chain Guides: Ductile or cast iron, of type and size required for valve. Include zinc or epoxy coating.
2. Chain: Hot-dip galvanized steel, of size required to fit sprocket rim.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.03 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. Use gate valves for shutoff service only.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.05 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze gate valves, NRS, Class 125 with soldered ends.

B. Pipe NPS 2-1/2 and Larger: Iron gate valves, NRS, Class 125 with flanged ends.

END OF SECTION 220523.15

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.03 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.
4. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.06 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.07 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2: PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.02 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
6. Metallic Coating: Hot-dipped galvanized.

B. Non-MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

6. Coating: Paint.

2.04 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.05 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.06 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.07 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

PART 3: EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099600 "High-Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
5. C-Clamps (MSS Type 23): For structural shapes.
6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
10. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
11. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

a. Light (MSS Type 31): 750 lb.
b. Medium (MSS Type 32): 1500 lb.
c. Heavy (MSS Type 33): 3000 lb.

12. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
14. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2: PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information plus emergency notification instructions.

2.03 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.04 STENCILS

A. Stencils for Piping:

1. Lettering Size: Size letters according to ASME A13.1 for piping.
2. Stencil Material: Fiberboard or metal.
3. Stencil Paint: Exterior, gloss, acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
4. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.05 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.06 WARNING TAGS

A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety yellow background with black lettering.

PART 3: EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.03 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 099600 "High-Performance Coatings."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:

1. Domestic Water Piping

   a. Background: Safety green.
   b. Letter Colors: White.

2. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Safety green.
   b. Letter Color: White.

3.05 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Cold Water: 1-1/2 inches, round.
   b. Hot Water: 1-1/2 inches, round.

2. Valve-Tag Colors:

   a. Cold Water: Natural.
   b. Hot Water: Natural.

3. Letter Colors:

   a. Cold Water: White.
   b. Hot Water: White.

3.06 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Sanitary waste piping exposed to freezing conditions.
5. Storm-water piping exposed to freezing conditions.
6. Roof drains and rainwater leaders.
7. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation."

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Jacket Materials for Pipe: 12 inches long by NPS 2.
3. Sheet Jacket Materials: 12 inches square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.08 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2: PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Block Insulation: ASTM C 552, Type I.
2. Special-Shaped Insulation: ASTM C 552, Type III.
3. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.

4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

H. Mineral-Fiber, Preformed Pipe Insulation:
1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Phenolic:
1. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
2. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
3. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
4. Factory-Applied Jacket: ASJ. Requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1.

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
2. Service Temperature Range: Minus 50 to plus 220 deg F.
3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
4. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.

3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.05 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

2.06 SEALANTS

A. Joint Sealants for Cellular-Glass:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

C. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.07 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.08 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.09 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Adhesive: As recommended by jacket material manufacturer.
   2. Color: White.
   3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

      a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:
   1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

      a. Factory cut and rolled to size.
      b. Finish and thickness are indicated in field-applied jacket schedules.
      c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
      d. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.
      e. Factory-Fabricated Fitting Covers:

         1) Same material, finish, and thickness as jacket.
         2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
         3) Tee covers.
         4) Flange and union covers.
         5) End caps.
         6) Beveled collars.
         7) Valve covers.
         8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

   2. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.

      a. Factory cut and rolled to size.
      b. Material, finish, and thickness are indicated in field-applied jacket schedules.
      c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
      d. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.
      e. Factory-Fabricated Fitting Covers:

         1) Same material, finish, and thickness as jacket.
         2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
         3) Tee covers.
         4) Flange and union covers.
         5) End caps.
         6) Beveled collars.
         7) Valve covers.
         8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Width: 3 inches.
   2. Thickness: 11.5 mils.
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.

6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
   1. Width: 3 inches.
   2. Thickness: 6.5 mils.
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.
   6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. Width: 2 inches.
   2. Thickness: 6 mils.
   3. Adhesion: 64 ounces force/inch in width.
   4. Elongation: 500 percent.
   5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
   1. Width: 2 inches.
   2. Thickness: 3.7 mils.
   3. Adhesion: 100 ounces force/inch in width.
   4. Elongation: 5 percent.
   5. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

A. Bands:
   1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal.
   2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

2.13 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,:
   1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

   1. Verify that systems to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.04 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.05 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.06 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.07 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.08 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.09 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.10 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.11 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.13 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.14 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 3/4 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
d. Phenolic: 1 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
d. Phenolic: thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
d. Phenolic: 1 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1-1/2 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
d. Phenolic: 1 inch thick.

C. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
d. Phenolic: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
d. Phenolic: 1 inch thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1/2 inch thick.

F. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 2 inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

G. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 3/4 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

H. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

I. Hot Service Vents:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

3.15 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

3.16 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:
1. PVC : 20 mils thick.
2. Aluminum, Stucco Embossed: 0.020 inch thick.
3. Painted Aluminum, Stucco Embossed: 0.020 inch thick.
4. Stainless Steel, Type 304 or Type 316, Stucco Embossed: 0.016 inch thick.
5. .

3.17 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 22 07 19

SECTION 22 11 16
DOMESTIC WATER PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Ductile-iron pipe and fittings.
3. Stainless-steel piping
4. PVC pipe and fittings.
5. PP pipe and fittings.
6. Piping joining materials.
7. Encasement for piping.
8. Transition fittings.
9. Dielectric fittings.

1.03 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.04 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.05 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Construction Manager's written permission.

PART 2: PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

C. Comply with NSF Standard 372 for low lead.

2.02 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. NIBCO INC.
   c. Viega LLC.

2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
3. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

H. Appurtenances for Grooved-End Copper Tubing:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International.
   b. Grinnell Mechanical Products.
   c. Shurjoint Piping Products USA Inc.
   d. Victaulic Company.

2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75/B 75M copper tube or ASTM B 584 bronze castings.
3. Mechanical Couplings for Grooved-End Copper Tubing:

   a. Copper-tube dimensions and design similar to AWWA C606.
   b. Ferrous housing sections.
   c. EPDM-rubber gaskets suitable for hot and cold water.
   d. Bolts and nuts.
   e. Minimum Pressure Rating: 300 psig.

2.03 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

E. Appurtenances for Grooved-End, Ductile-Iron Pipe:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Shurjoint Piping Products USA Inc.
   b. Star Pipe Products.
   c. Victaulic Company.

2. Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions that match pipe.
3. Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:

   a. AWWA C606 for ductile-iron-pipe dimensions.
   b. Ferrous housing sections.
   c. EPDM-rubber gaskets suitable for hot and cold water.
   d. Bolts and nuts.

2.04 STAINLESS-STEEL PIPING

A. Potable-water piping and components shall comply with NSF 61 Annex G.

B. Stainless-Steel Pipe: ASTM A 312/A 312M, Schedule 10.

C. Stainless-Steel Pipe Fittings: ASTM A 815/A 815M.

D. Appurtenances for Grooved-End, Stainless-Steel Pipe:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International.
   b. Grinnell Mechanical Products.
   c. Shurjoint Piping Products USA Inc.
   d. Victaulic Company.

2. Fittings for Grooved-End, Stainless-Steel Pipe: Stainless-steel casting with dimensions matching stainless-steel pipe.
3. Mechanical Couplings for Grooved-End, Stainless-Steel Pipe:

   a. AWWA C606 for stainless-steel-pipe dimensions.
   b. Stainless-steel housing sections.
   c. Stainless-steel bolts and nuts.
   d. EPDM-rubber gaskets suitable for hot and cold water.
   e. Minimum Pressure Rating:

      1) NPS 8 and Smaller: 600 psig.

2.05 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 1785, [Schedule 40].

B. PVC Socket Fittings: [ASTM D 2466 for Schedule 40].

C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.

2.06 PP PIPE AND FITTINGS

A. PP Pipe: ASTM F 2389, SDR 11.

B. PVC Socket Fittings: ASTM F 2389.

2.07 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

G. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.08 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105/A21.5.

B. Form: Sheet or tube.

C. Color: Black or natural.

2.09 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

D. Plastic-to-Metal Transition Fittings:
1. Description:

a. PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
b. One end with threaded brass insert and one solvent-cement-socket end.

E. Plastic-to-Metal Transition Unions:
1. Description:

a. PVC four-part union.
b. Brass or stainless-steel threaded end.
c. Solvent-cement-joint plastic end.
d. Rubber O-ring.
e. Union nut.

2.10 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
   1. Standard: ASSE 1079.
   2. Pressure Rating: 125 psig minimum at 180 deg F.
   3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
   1. Standard: ASSE 1079.
   2. Factory-fabricated, bolted, companion-flange assembly.
   3. Pressure Rating: 125 psig minimum at 180 deg F.
   4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:
   1. Nonconducting materials for field assembly of companion flanges.
   2. Pressure Rating: 150 psig.
   3. Gasket: Neoprene or phenolic.
   4. Bolt Sleeves: Phenolic or polyethylene.
   5. Washers: Phenolic with steel backing washers.

PART 3: EXECUTION

3.01 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install domestic water piping level without pitch and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

L. Install piping to permit valve servicing.

M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections.

P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

Q. Install pressure gages on suction and discharge piping for each plumbing pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

R. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

S. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

H. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

I. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Square cut groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

J. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

K. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. PVC Piping: Join according to ASTM D 2855.

L. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.04 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

3.05 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.06 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.

2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

G. Install supports for vertical steel piping every 15 feet.

H. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

I. Install supports for vertical stainless-steel piping every 15 feet.

J. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.07 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.08 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.09 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.

2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be one of the following:

1. Soft copper tube, ASTM B 88, Type L; copper pressure-seal fittings; and pressure-sealed joints.
2. PVC, Schedule 40; socket fittings; and solvent-cemented joints.
3. PP, SDR 11 socket fittings; and fusion-welded joints.

D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:

1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
3. PVC, Schedule 40; socket fittings; and solvent-cemented joints.
4. PP, SDR 11 socket fittings; and fusion-welded joints.

E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:

1. soft copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
2. PVC, Schedule 40; socket fittings; and solvent-cemented joints.
3. PP, SDR 11 socket fittings; and fusion-welded joints.

F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.

H. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6 to NPS 12, shall be one of the following:

1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
2. Stainless-steel Schedule 10 pipe, grooved-joint fittings, and grooved joints.

3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 22 11 16

SECTION 22 11 19
DOMESTIC WATER PIPING SPECIALTIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Wall hydrants.
8. Drain valves.
9. Water-hammer arresters.
10. Air vents.
11. Trap-seal primer valves.
12. Trap-seal primer systems.
13. Flexible connectors.
14. Water meters.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 224300 "Medical Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
4. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
5. Section 224716 "Pressure Water Coolers" for water filters for water coolers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14. Mark "NSF-pw" on plastic piping components.

2.02 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.03 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Fire & Waterworks; A WATTS Brand.
    b. Apollo Valves; Conbraco Industries, Inc.
    c. FEBCO; A WATTS Brand.
    d. WATTS.
    e. Zurn Industries, LLC.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; Conbraco Industries, Inc.
    b. MIFAB, Inc.
    c. WATTS.
    d. Woodford Manufacturing Company.
    e. Zurn Industries, LLC.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Fire & Waterworks; A WATTS Brand.
    b. Apollo Valves; Conbraco Industries, Inc.
    c. FEBCO; A WATTS Brand.
    d. WATTS.
    e. Zurn Industries, LLC.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Accessories:

a. Valves: Ball type, on inlet and outlet.

D. Laboratory-Faucet Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. WATTS.
c. Woodford Manufacturing Company.
d. Zurn Industries, LLC.

2. Standard: ASSE 1035.
3. Size: NPS 1/4 or NPS 3/8 matching faucet size.
4. Body: Bronze.
5. End Connections: Threaded.
6. Finish: Chrome plated.

E. Spill-Resistant Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. WATTS.
c. Zurn Industries, LLC.

2. Standard: ASSE 1056.
3. Operation: Continuous-pressure applications.
4. Accessories:

a. Valves: Ball type, on inlet and outlet.

2.04 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. FEBCO; A WATTS Brand.
c. WATTS.
d. Zurn Industries, LLC.

2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Body: Bronze.
5. End Connections: Union, solder joint.
6. Finish: Chrome plated.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Fire & Waterworks; A WATTS Brand.
b. Apollo Valves; Conbraco Industries, Inc.
c. FEBCO; A WATTS Brand.
d. WATTS.
e. Zurn Industries, LLC.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle third of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Beverage-Dispensing-Equipment Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; Conbraco Industries, Inc.
    b. WATTS.
    c. Zurn Industries, LLC.

2. Standard: ASSE 1022.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

D. Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; Conbraco Industries, Inc.
    b. FEBCO; A WATTS Brand.
    c. WATTS.
    d. Zurn Industries, LLC.

2. Standard: ASSE 1024.
3. Operation: Continuous-pressure applications.
4. Body: Bronze with union inlet.

E. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. WATTS.

2. Standard: ASSE 1032.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

F. Hose-Connection Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; Conbraco Industries, Inc.

b. WATTS.
c. Woodford Manufacturing Company.

2. Standard: ASSE 1052.
3. Operation: Up to 10-foot head of water back pressure.
4. Inlet Size: NPS 1/2 or NPS 3/4.
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least 3-gpm flow.

G. Backflow-Preventer Test Kits:
1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.05 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. WATTS.
c. Zurn Industries, LLC.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. WATTS.
c. Zurn Industries, LLC.

2. Description: Pilot-operated, diaphragm-type, single-seated, main water-control valve.
3. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.06 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.
b. ITT Corporation.
c. NIBCO INC.
d. Schneider Electric USA, Inc.
e. TACO Comfort Solutions, Inc.
f. WATTS.

2. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.

3. Body: Brass or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Armstrong International, Inc.
   b. ITT Corporation.
   c. NIBCO INC.
   d. Schneider Electric USA, Inc.
   e. WATTS.

2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Size: Same as connected piping, but not smaller than NPS 2-1/2.

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

D. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Milwaukee Valve Company.
   c. NIBCO INC.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.07 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Leonard Valve Company.
   c. POWERS; A WATTS Brand.
   d. Symmons Industries, Inc.
   e. TACO Comfort Solutions, Inc.
   f. WATTS.
   g. Zurn Industries, LLC.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Finish: Rough bronze.

B. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; Conbraco Industries, Inc.
   b. Lawler Manufacturing Company, Inc.
   c. Leonard Valve Company.
   d. POWERS; A WATTS Brand.
   e. WATTS.
   f. Zurn Industries, LLC.

2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 110 deg F.

2.08 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

   a. Strainers NPS 2 and Smaller: 0.020 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
   c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.09 OUTLET BOXES

2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg. Co.
   b. MIFAB, Inc.
   c. Woodford Manufacturing Company.
   d. Zurn Industries, LLC.

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.

10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): Two with each wall hydrant.

B. Vacuum Breaker Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg. Co.
   b. WATTS.
   c. Woodford Manufacturing Company.
   d. Zurn Industries, LLC.

2. Standard: ASSE 1019, Type A or Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig.
6. Operation: Loose key.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2 or NPS 3/4.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.11 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.12 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Jay R. Smith Mfg. Co.
   c. MIFAB, Inc.
   d. WATTS.
   e. Zurn Industries, LLC.

2. Standard: ASSE 1010 or PDI-WH 201.

3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.13 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.14 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg. Co.
   b. MIFAB, Inc.
   c. WATTS.
   d. Zurn Industries, LLC.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.15 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Zurn Industries, LLC.

2. Standard: ASSE 1044.
3. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
4. Cabinet: Recessed-mounted steel box with stainless-steel cover.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.

   a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

6. Vacuum Breaker: ASSE 1001.

7. Number Outlets: Coordinatge with floor layout.
8. Size Outlets: NPS 1/2.

2.16 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

C. Install water-control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install Y-pattern strainers for water on supply side of each control valve water pressure-reducing valve solenoid valve and pump.

F. Install water-hammer arresters in water piping according to PDI-WH 201.

G. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

H. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

I. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

J. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.02 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.03 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Carbonated-beverage-machine backflow preventers.
5. Dual-check-valve backflow preventers.
6. Water pressure-reducing valves.
7. Calibrated balancing valves.
8. Supply-type, trap-seal primer valves.
9. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker and reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.05 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 22 11 19

SECTION 22 11 23
DOMESTIC WATER PUMPS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. In-line, sealless centrifugal pumps.

B. Related Sections include the following:

1. Section 221123.13 "Domestic-Water Packaged Booster Pumps" for booster systems.
2. Section 332100 "Water Supply Wells" for well pumps.

1.03 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

1.08 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2: PRODUCTS

2.01 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grundfos Pumps Corp.
2. TACO Comfort Solutions, Inc.

B. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

C. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
2. Casing: Stainbless Steel, with threaded or companion-flange connections.
3. Impeller: Plastic.
4. Motor: Single speed, unless otherwise indicated.

D. Capacities and Characteristics:
1. Minimum Working Pressure: 125 psig.
2. Maximum Continuous Operating Temperature: 220 deg F.
3. Pump Control: Thermostat.
4. Electrical Characteristics:

a. Volts: 120.
b. Phases: Single.
c. Hertz: 60.

2.02 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.03 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 65 to 200 deg F.
3. Enclosure: NEMA 250, Type 4X.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: 120 V, ac.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.02 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install continuous-thread hanger rods and spring hangers with vertical-limit stop of size required to support pump weight.

1. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

D. Install thermostats in hot-water return piping.

3.03 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties."

1. Install pressure gage and snubber at suction of each pump and pressure gage and snubber at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

E. Connect thermostats, to pumps that they control.

3.04 IDENTIFICATION

A. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set thermostats, for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:

   a. Verify bearing lubrication.
   b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
   c. Verify that pump is rotating in the correct direction.

6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.06 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 22 11 23

SECTION 22 12 23
FACILITY INDOOR POTABLE-WATER STORAGE TANKS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Steel, precharged, potable-water storage tanks.

1.03 DEFINITIONS

A. HDPE: High-density polyethylene plastic.

B. LDPE: Low-density polyethylene plastic.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water storage tanks.
   2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.05 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of potable-water storage tank, from manufacturer.

B. Source quality-control reports.

C. Purging and disinfecting reports.

1.06 QUALITY ASSURANCE

A. ASME Compliance for Steel Tanks: Fabricate and label steel, ASME-code, potable-water storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

B. Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," for potable-water storage tanks. Include appropriate NSF marking.

1.07 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2: PRODUCTS

2.01 STEEL, PRECHARGED, POTABLE-WATER STORAGE TANKS

A. Steel, Precharged, Diaphragm, Water Storage Tanks:

   1. Description: Steel, vertical, pressured-rated tank with cylindrical sidewalls and with air-charging valve and air precharge.
   2. Fabricate supports and attachments to tank with reinforcement strong enough to resist tank movement during seismic event when tank supports are anchored to building structure.
   3. Operation: Factory-installed, butyl-rubber diaphragm.

B. Construction: Steel, constructed with nontoxic welded joints, for 150-psig working pressure.

C. Tappings: Factory-fabricated stainless steel, welded to tank before testing and labeling.

1. NPS 2 and Smaller: ASME B1.20.1, with female thread.

D. Exterior Coating: Manufacturer's standard enamel paint.

2.02 SOURCE QUALITY CONTROL

A. Test and inspect potable-water storage tanks according to the following tests and inspections and prepare test reports:
1. Pressure Testing for Non-ASME-Code, Pressure, Potable-Water Storage Tanks: Hydrostatically test to ensure structural integrity and freedom from leaks at pressure of 50 psig above system operating pressure, but not less than 150 psig. Fill tanks with water, vent air, pressurize tanks, disconnect test equipment, hold pressure for two hours with no drop in pressure, and check for leaks.
2. Testing for Nonpressure, Potable-Water Storage Tanks: Fill tanks to water operating level to ensure structural integrity and freedom from leaks. Hold water level for two hours with no drop in water level.

B. Repair or replace tanks that fail test with new tanks, and repeat until test is satisfactory.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install water storage tanks on concrete bases, level and plumb, firmly anchored. Arrange so devices needing servicing are accessible.

B. Anchor tank supports and tanks to substrate.

C. Install tank seismic restraints.

D. Install the following devices on tanks where indicated:
1. Connections to accessories.

E. After installing tanks with factory finish, inspect finishes and repair damages to finishes.

3.02 CONNECTIONS

A. Piping installation requirements are specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to potable-water storage tanks to allow service and maintenance.

C. Connect water piping to water storage tanks with unions or flanges and with shutoff valves. Connect tank drains with shutoff valves and discharge over closest floor drains.

1. General-duty valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

a. Valves NPS 2 and Smaller: Gate or ball.
b. Drain Valves: NPS 3/4 gate or ball valve. Include outlet with, or nipple in outlet with, ASME B1.20.7, 3/4-11.5NH thread for garden-hose service, threaded cap, and chain.

2. Water Piping Connections: Make connections to dissimilar metals with dielectric fittings. Dielectric fittings are specified in Section 221116 "Domestic Water Piping."

3.03 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

A. Perform the following final checks before filling:

1. Verify that air precharge in precharged tanks is correct.
2. Test operation of tank accessories and devices.
3. Verify that pressure relief valves have correct setting.

    a. Manually operate pressure relief valves.
    b. Adjust pressure settings.

B. Filling Procedures: Follow manufacturer's written procedures. Fill tanks with water to operating level.

3.05 CLEANING

A. Clean and disinfect potable-water storage tanks.

B. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, use procedure described in AWWA C652 or as described below:

1. Purge water storage tanks with potable water.
2. Disinfect tanks by one of the following methods:

    a. Fill tanks with water-chlorine solution containing at least 50 ppm of chlorine. Isolate tanks and allow to stand for 24 hours.
    b. Fill tanks with water-chlorine solution containing at least 200 ppm of chlorine. Isolate tanks and allow to stand for three hours.

3. Flush tanks, after required standing time, with clean, potable water until chlorine is not present in water coming from tank.
4. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination made by authorities having jurisdiction shows evidence of contamination.

C. Prepare written reports for purging and disinfecting activities.

END OF SECTION 22 12 23

SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

B. Related Requirements:

1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.
2. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.
3. Section 226600 "Chemical-Waste Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Construction Manager's written permission.

PART 2: PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.02 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.03 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.04 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and CISPI 310.
2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and ASTM C 1540.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.05 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Cast-Iron Drainage Fittings: ASME B16.12, threaded.

B. Steel Pipe Pressure Fittings:

1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. Galvanized-Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

C. Cast-Iron Flanges: ASME B16.1, Class 125.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

2.06 STAINLESS-STEEL PIPE AND FITTINGS

A. Pipe and Fittings: ASME A112.3.1, drainage pattern with socket and spigot ends.

B. Internal Sealing Rings: Elastomeric gaskets shaped to fit socket groove.

2.07 DUCTILE-IRON PIPE AND FITTINGS

A. Ductile-Iron, Mechanical-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Ductile-Iron, Push-on-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot ends unless grooved or flanged ends are indicated.

2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Gaskets: AWWA C111/A21.11, rubber.

2.08 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

E. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.09 ABS PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

C. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

D. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

E. Solvent Cement: ASTM D 2235.

2.10 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

D. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

E. Adhesive Primer: ASTM F 656.

F. Solvent Cement: ASTM D 2564.

2.11 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:

a. Standard: ASTM C 1173.

b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
c. End Connections: Same size as and compatible with pipes to be joined.
d. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:

a. Standard: ASTM C 1460.
b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
c. End Connections: Same size as and compatible with pipes to be joined.

4. Pressure Transition Couplings:

a. Standard: AWWA C219.
b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
c. Center-Sleeve Material: Manufacturer's standard.
d. Gasket Material: Natural or synthetic rubber.
e. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. Dielectric Unions:

a. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig minimum at 180 deg F.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

2. Dielectric Flanges:

a. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 125 psig minimum at 180 deg F.
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

3. Dielectric-Flange Insulating Kits:

a. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig.
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

2.12 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

PART 3: EXECUTION

3.01 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.02 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.

2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Install steel piping according to applicable plumbing code.

O. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.

P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

Q. Install aboveground ABS piping according to ASTM D 2661.

R. Install aboveground PVC piping according to ASTM D 2665.

S. Install underground ABS and PVC piping according to ASTM D 2321.

T. Install engineered soil and waste and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

U. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

   a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

   a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
   b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

3. Install drains in sanitary waste gravity-flow piping.

   a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

V. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

W. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    c. Do not use pipe sections that have cracked or open welds.

E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

F. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

G. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

H. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.04 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:

    a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
    b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.05 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Install backwater valves in accessible locations.
3. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.06 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.

I. Install supports for vertical steel piping every 15 feet.

J. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2: 84 inches with 3/8-inch rod.

2. NPS 3: 96 inches with 1/2-inch rod.
3. NPS 4: 108 inches with 1/2-inch rod.
4. NPS 6: 10 feet with 5/8-inch rod.

K. Install supports for vertical stainless-steel piping every 10 feet.

L. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

M. Install supports for vertical copper tubing every 10 feet.

N. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

O. Install supports for vertical ABS and PVC piping every 48 inches.

P. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.07 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Comply with requirements for backwater valves cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
7. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.08 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.09 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.
5. Copper Type DWV tube, copper drainage fittings, and soldered joints.
6. Cellular-core ABS pipe, ABS socket fittings, and solvent-cemented joints.
7. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
8. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.
5. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings gaskets, and gasketed joints.
5. Copper Type DWV tube, copper drainage fittings, and soldered joints.

    a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.

6. Cellular-core ABS pipe, ABS socket fittings, and solvent-cemented joints.
7. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
8. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

E. Aboveground, vent piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Extra Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
4. Solid wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Extra Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; coupled joints.
3. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.

END OF SECTION 22 13 16

SECTION 22 13 19
SANITARY WASTE PIPING SPECIALTIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Cleanouts.
   2. Roof flashing assemblies.
   3. Through-penetration firestop assemblies.
   4. Miscellaneous sanitary drainage piping specialties.

1.03 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene.

B. FOG: Fats, oils, and greases.

C. PVC: Polyvinyl chloride.

1.04 ACTION SUBMITTALS

A. Shop Drawings:

   1. Show fabrication and installation details for frost-resistant vent terminals.
   2. Wiring Diagrams: Power, signal, and control wiring.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

PART 2: PRODUCTS

2.01 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing, and marked for intended location and application.

2.02 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Jay R. Smith Mfg. Co.
      b. MIFAB, Inc.
      c. Watts; a Watts Water Technologies company.

d. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg. Co.
b. Watts; a Watts Water Technologies company.
c. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Inside calk.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Light Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg. Co.
b. MIFAB, Inc.
c. Watts; a Watts Water Technologies company.
d. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:

a. Brass.
b. Countersunk head.
c. Drilled and threaded for cover attachment screw.
d. Size: Same as or not more than one size smaller than cleanout size.

6. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.

2.03 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Company.

b. Thaler Metal Industries Ltd.
c. Zurn Industries, LLC.

2. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

a. Open-Top Vent Cap: Without cap.

2.04 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve-and-stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

2.05 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564 rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

a. NPS 2: 4-inch- minimum water seal.
b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install backwater valves in building drain piping.

1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

F. Assemble open drain fittings and install with top of hub 2 inches above floor.

G. Install deep-seal traps on floor drains and other waste outlets, if indicated.

H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

J. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

K. Install wood-blocking reinforcement for wall-mounting-type specialties.

L. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.03 FLASHING INSTALLATION

A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.

C. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

D. Set flashing on floors and roofs in solid coating of bituminous cement.

E. Secure flashing into sleeve and specialty clamping ring or device.

F. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."

G. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.04 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.05 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.06 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 221319.13
SANITARY DRAINS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Floor drains.
2. Channel drainage systems.

1.03 DEFINITIONS

A. ABS: Acrylonitrile-butadiene styrene.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene.

D. PE: Polyethylene.

E. PP: Polypropylene.

F. PVC: Polyvinyl chloride.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2: PRODUCTS

2.01 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.02 FLOOR DRAINS

A. Cast-Iron Floor Drains FD-1, SD-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Zurn.
   b. J. R. Smith
   c. Mifab.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.

11. Sediment Bucket: Not required.
12. Top or Strainer Material: Nickel bronze.
13. Top of Body and Strainer Finish: Polished bronze.
14. Top Shape: Square.
15. Dimensions of Top or Strainer: 6 inch by 6 inch.
16. Top Loading Classification: Light Duty.
17. Funnel: Not required.
18. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
19. Trap Material: Not required.
20. Trap Pattern: Not required.
21. Trap Features: Not required.

B. Cast-Iron Floor Drains FD-2:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Zurn.
   b. J. R. Smith
   c. Mifab.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
11. Sediment Bucket: Polypropylene.
12. Top or Strainer Material: Gray iron.
13. Top of Body and Strainer Finish: Gray Iron.
14. Top Shape: Round.
15. Dimensions of Top or Strainer: 12 inch diameter.
16. Top Loading Classification: Heavy Duty.
17. Funnel: Not required.
18. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
19. Trap Material: Not required.
20. Trap Pattern: Not required.
21. Trap Features: Not required

2.03 CHANNEL DRAINAGE SYSTEMS

A. HDPE or PE Channel Drainage Systems TD-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Zurn.
   b. J. R. Smith
   c. Mifab.
2. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
3. Channel Sections: Interlocking-joint, HDPE or PE modular units, with end caps. Include flat, rounded, or inclined bottom, with level invert and with outlets in number, sizes, and locations indicated.

   a. Dimensions: 4 incheswide. Include number of units required to form total lengths indicated.

4. Grates: With slots or perforations and widths and thickness that fit recesses in channel sections.

    a. Material: Gray iron.

5. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
6. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inchesor Less: Equivalent to 1 percent slope, but not less than 1/4-inchtotal depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inchesor Larger: Equivalent to 1 percent slope, but not greater than 1-inchtotal depression.

4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.

    a. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

B. Install trench drains at low points of surface areas to be drained.

1. Set grates of drains flush with finished surface, unless otherwise indicated.

C. Install FRP channel drainage system components on support devices, so that top will be flush with adjacent surface.

D. Install plastic channel drainage system components on support devices, so that top will be flush with adjacent surface.

E. Install open drain fittings with top of hub 2 inches above floor.

3.02 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.

C. Comply with requirements in Section 221323 "Sanitary Waste Interceptors" for grease interceptors, grease-removal devices, oil interceptors, sand interceptors, and solid interceptors.

D. Install piping adjacent to equipment to allow service and maintenance.

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.03 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319.13

SECTION 22 13 23
SANITARY WASTE INTERCEPTORS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Oil interceptors.

1.03 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. PP: Polypropylene plastic.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of metal and plastic interceptor. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   1. Piping connections. Include size, location, and elevation of each.
   2. Interface with underground structures and utility services.

PART 2: PRODUCTS

2.01 OIL INTERCEPTORS

A. Cast-Iron or Steel Oil Interceptors: Factory-fabricated; with removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Jay R. Smith Mfg. Co.
      b. MIFAB, Inc.
      c. Rockford Sanitary Systems, Inc.
      d. Zurn Industries, LLC.

   2. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
   3. Extension: Cast-iron or steel shroud, full size of interceptor, extending from top of interceptor to grade.
   4. Cover: Cast iron or steel, with steel reinforcement to provide ASTM C 890, A-03, walkway load.
   5. Comply with requirements in Section 231113 "Facility Fuel-Oil Piping" for waste-oil storage tank and piping.

B. Plastic Oil Interceptors: Removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Schier Products Company.
b. Zurn Industries, LLC.

2. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
3. Extension: Plastic shroud, full size of interceptor, extending from top of interceptor to grade.
4. Cover: 1/4" Diamond plate steel.

C. Capacities and Characteristics:
1. Cleanout: Integral or field installed on outlet.
2. Vent Pipe Size: 2 NPS.
3. Mounting: Recessed, flush with floor.
4. Flow-Control Fitting: Not required.

PART 3: EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.02 INSTALLATION

A. Equipment Mounting:
1. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

B. Install precast concrete interceptors according to ASTM C 891.

C. Set interceptors level and plumb.

D. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

E. Set tops of grating frames and grates flush with finished surface.

F. Set metal and plastic interceptors level and plumb.

G. Set tops of metal interceptor covers flush with finished surface in pavements.

H. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

3.03 CONNECTIONS

A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.04 IDENTIFICATION

A. Identification materials and installation are specified in Section 312000 "Earth Moving."

1. Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
2. Use warning tapes or detectable warning tape over ferrous piping.
3. Use detectable warning tape over nonferrous piping and over edges of underground structures.

B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1. Oil interceptors.

3.05 PROTECTION

A. Protect sanitary waste interceptors from damage during construction period.

B. Repair damage to adjacent materials caused by sanitary waste interceptor installation.

END OF SECTION 22 13 23

SECTION 22 34 00
FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.

1.03 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

   1. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of commercial, gas-fired, domestic-water heater, from manufacturer.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.07 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

   1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: Three years.
2) Controls and Other Components: One year(s).

PART 2: PRODUCTS

2.01 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Heat Transfer Products, Inc.
b. Lochinvar, LLC.
c. PVI; A WATTS Brand.
d. Smith, A. O. Corporation.
e. State Industries.

2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Description: Manufacturer's proprietary design to provide at least 90 percent combustion efficiency at optimum operating conditions.
4. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

5. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
e. Jacket: Steel with enameled finish.
f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
g. Temperature Control: Adjustable thermostat.
h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

2.02 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Smith, A. O. Corporation.
   c. State Industries.

2. d. TACO Comfort Solutions, Inc.Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
   b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

   a. Working-Pressure Rating: 150 psig.
   b. Capacity Acceptable: 4 gal. minimum.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

D. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

   1. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."

E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.

G. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

   1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

2.03 SOURCE QUALITY CONTROL

A. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

PART 3: EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

C. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping."

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

F. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

G. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

H. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

I. Fill domestic-water heaters with water.

J. Charge domestic-water compression tanks with air.

3.02 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Section 231123 "Facility Natural-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.05 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION 22 34 00

SECTION 22 41 00
RESIDENTIAL PLUMBING FIXTURES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Faucets.
2. Kitchen sinks.
3. Supply fittings.
4. Waste fittings.

B. Related Requirements:

1. Section 224213.13 "Commercial Water Closets."
2. Section 224216.13 "Commercial Lavatories."
3. Section 224216.16 "Commercial Sinks."
4. Section 224223 "Commercial Showers."

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.

B. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For plumbing fixtures and faucets to include in emergency, operation, and operation and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2: PRODUCTS

2.01 KITCHEN SINKS

A. Kitchen Sinks SK-1: Two bowl, counter mounted, stainless steel.

1. Stainless-Steel Kitchen Sinks:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Elkay Manufacturing Co.
        2) Just Manufacturing.
        3) Advance Tabco

2. Fixture:
    a. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel kitchen sinks.
    b. Metal Thickness: 18 guage.

    c. Left Bowl:

        1) Drain: 3-1/2-inchgrid.

            a) Location: Near back of bowl.

    d. Right Bowl:

        1) Drain: 3-1/2-inchgrid.

            a) Location: Near back of bowl.

3. Faucet: SF-1.
4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
5. Waste Fittings: Comply with requirements in "Waste Fittings" Article, except include continuous waste for multibowl sinks.

    a. Disposer: Not required.
    b. Dishwasher Air-Gap Fitting: Not required.
    c. Hot-Water Dispenser: Not required.

2.02 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Sink Faucets SF-1: Solid brass, kitchen sink.

1. General-Duty, Solid-Brass Faucets:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Chicago Faucet.
        2) Delta Faucet Company.
        3) Moen Incorporated.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

4. Kitchen Sink Option: Separate hand spray complying with ASSE 1025.
5. Finish: Polished chrome plate.
6. Maximum Flow Rate: 1.5 gpmunless otherwise indicated.
7. Mixing Valve: Two-lever handle.
8. Backflow-Prevention Device for Hand Spray: Not required.
9. Centers: 8 inches.
10. Mounting: Deck, concealed.
11. Handle(s): Wrist blade, 4 inches.
12. Spout Type: Swivel gooseneck.
13. Spout Outlet: Aerator.
14. Drain: Grid.

2.03 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Kitchen Sink Supply Fittings:

1. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.
2. Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.

   a. Operation: Loose key.

3. Risers:

   a. Size: NPS 1/2 for kitchen sinks.
   b. Material: Chrome-plated, soft-copper flexible tube riser.

2.04 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2straight tailpiece for standard kitchen sinks Trap:

1. Size: NPS 1-1/2for kitchen sinks.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated-brass or -steel wall flange.

2.05 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing-fixture installation.

B. Examine walls, floors, cabinets, and counters for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install plumbing fixtures level and plumb according to roughing-in drawings.

B. Install counter-mounting fixtures in and attached to casework.

C. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball or gate valves if supply stops are not specified with fixture. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

D. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

E. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes unless otherwise indicated.

F. Install hot-water dispensers in back top surface of sink or in countertop with spout over sink.

G. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

H. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

I. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.04 ADJUSTING

A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.

B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed plumbing fixtures and fittings.

D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 41 00

SECTION 224213.13
COMMERCIAL WATER CLOSETS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.
4. Supports.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for residential water closets.

1.03 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

B. Remote Water Closet: Located more than 30 feetfrom other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2: PRODUCTS

2.01 WALL-MOUNTED WATER CLOSETS

A. Water Closets WC-1: Wall mounted, top spud, accessible.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Standard America.
    b. Crane Plumbing, L.L.C.
    c. Gerber Plumbing Fixtures LLC.
    d. Kohler Co.

2. Bowl:

    a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
    b. Material: Vitreous china.
    c. Type: Siphon jet.
    d. Style: Flushometer valve.
    e. Height: Standard.
    f. Rim Contour: Elongated.
    g. Water Consumption: 1.28 gal. per flush.
    h. Spud Size and Location: NPS 1-1/2; top.

3. Flushometer Valve: FV-1.
4. Toilet Seat: TS-1.
5. Support: Water closet carrier.
6. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.

2.02 FLUSHOMETER VALVES

A. Hard-Wired, Solenoid-Actuator, Piston Flushometer Valves FV-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Zurn Industries.
    b. Sloan Valve Company.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig).
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: **Exposed**.
9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
10. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Consumption: 1.28 gal per flush.
12. Minimum Inlet: NPS 1.
13. Minimum Outlet: NPS 1-1/4.

2.03 TOILET SEATS

A. Toilet Seats TS-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Bemis Manufacturing Company.
    b. Church Seats; Bemis Manufacturing Company.
    c. Olsonite Seat Co.

2. Standard: IAPMO/ANSI Z124.5.

3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

2.04 SUPPORTS

A. Water Closet Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Zurn Industries.
   b. J. R. Smith
   c. Mifab

2. Standard: ASME A112.6.1M.
3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install actuators in locations that are easy for people with disabilities to reach.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.04 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.05 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 224216.13
COMMERCIAL LAVATORIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.
3. Supports.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for residential lavatories.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

PART 2: PRODUCTS

2.01 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory L-1: Vitreous china, wall mounted, with back.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard.
b. Kohler.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For wall hanging.
c. Nominal Size: Oval, 19 by 16 inches.
d. Faucet-Hole Punching: One hole.
e. Faucet-Hole Location: Top.
f. Color: White.
g. Mounting Material: Chair carrier.

3. Faucet: LF-1.
4. Support: Type II, concealed-arm lavatory carrier. Include rectangular, steel uprights.
5. Lavatory Mounting Height: Handicapped/elderly according to ICC A117.1.

2.02 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets LF-1: Automatic-type, hard-wired, electronic-sensor-operated, mixing, solid-brass valve.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Sloan
b. Chicago Faucet

2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: Single hole.
6. Body Material: Commercial, solid brass.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 0.5 gpm.
9. Mounting Type: Deck, concealed.
10. Spout: Rigid type.
11. Spout Outlet: Aerator.
12. Drain: Not part of faucet.

2.03 SUPPORTS

A. Type II Lavatory Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Zurn Industries
b. J. R. Smith
c. Mifab

2. Standard: ASME A112.6.1M.

2.04 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2.
2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

2.05 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.

2.06 SUPPORTS

A. Type II Lavatory Carrier:

1. Standard: ASME A112.6.1M.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.03 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.05 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

SECTION 224216.16
COMMERCIAL SINKS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Service basins.
2. Sink faucets.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for residential sinks.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
2. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2: PRODUCTS

2.01 SERVICE BASINS

A. Service Basins MB-1: Terrazzo, floor mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fiat Products.
   b. Florestone Products Co., Inc.
   c. Stern-Williams Co., Inc.

2.

3. Fixture:

    a. Standard: IAPMO PS 99.
    b. Shape: Square.
    c. Nominal Size: 24 by 24 inches.
    d. Height: 12 inches.
    e. Tiling Flange: Not required.
    f. Rim Guard: On all top surfaces.
    g. Color: Not applicable.
    h. Drain: Grid with NPS 3outlet.

4. Mounting: On floor and flush to wall.
5. Faucet: MBF-1.

2.02 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets MBF-1: Manual type, two-lever-handle mixing valve.

1. Commercial, Solid-Brass Faucets.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Chicago Faucets; Geberit Company.
        2) Delta Faucet Company.
        3) Moen Incorporated.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. Body Type: Centerset.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 2.2 gpm.
8. Handle(s): Wrist blade, 4 inches.
9. Mounting Type: Back/wall, exposed.
10. Spout Type: Rigid, solid brass with wall brace.
11. Vacuum Breaker: Required for hose outlet.
12. Spout Outlet: Hose thread according to ASME B1.20.7.

2.03 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.03 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

SECTION 22 42 23
COMMERCIAL SHOWERS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Individual shower receptors.
2. Shower faucets.
3. Grout.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for residential showers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for showers.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For shower faucets to include in maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2: PRODUCTS

2.01 SHOWER FAUCETS

A. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.

B. Shower Faucets SV-1:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Chicago Faucet.
2) Delta Faucet Company.
3) Moen Incorporated.

2. Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and shower head.
3. Faucet:

    a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
    b. Body Material: Solid brass.
    c. Finish: Polished chrome plate.
    d. Shower-Arm, Flow-Control Fitting: 1.5 gpm.
    e. EPA WaterSense: Required.
    f. Mounting: Concealed.
    g. Operation: Single-handle, twist or rotate control.
    h. Antiscald Device: Integral with mixing valve.
    i. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

4. Supply Connections: NPS 1/2.
5. Shower Head:

    a. Standard: ASME A112.18.1/CSA B125.1.
    b. Type: Hamdshower with standard 24” stainless steel slide bar.
    c. Shower Head Material: Metallic with chrome-plated finish.
    d. Spray Pattern: Adjustable.
    e. Integral Volume Control: Required.
    f. Shower-Arm, Flow-Control Fitting: 1.5 gpm.
    g. Temperature Indicator: Integral with faucet.

2.02 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before shower installation.

B. Examine walls and floors for suitable conditions where showers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Assemble shower components according to manufacturers' written instructions.

B. Install showers level and plumb according to roughing-in drawings.

C. Install water-supply piping with stop on each supply to each shower faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with shower. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

D. Install shower flow-control fittings with specified maximum flow rates in shower arms.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheons requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

3.04 ADJUSTING

A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

A. After completing installation of showers, inspect and repair damaged finishes.

B. Clean showers, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of showers and basins for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 23

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2: PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.05 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3: EXECUTION (Not Applicable)

END OF SECTION 23 05 13

SECTION 23 05 17
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Sleeves.
2. Grout.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2: PRODUCTS

2.01 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.02 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3: EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.02 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than NPS 6: Sleeve-seal fittings.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

   b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.

4. Interior Partitions:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
   b. Piping NPS 6> and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 23 05 17

SECTION 23 05 18
ESCUTCHEONS FOR HVAC PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Escutcheons.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2: PRODUCTS

2.01 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with rough-brass finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with rough-brass finish.

2. Escutcheons for Existing Piping:

   a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
   e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with rough-brass finish.
   f. Bare Piping in Equipment Rooms: Split-casting brass type with rough-brass finish.

3.02 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 23 05 18

SECTION 230523.12
BALL VALVES FOR HVAC PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Steel ball valves.
4. Iron ball valves.

1.03 DEFINITIONS

A. CWP: Cold working pressure.

B. SWP: Steam working pressure.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for solder-joint connections.

6. ASME B31.1 for power piping valves.
7. ASME B31.9 for building services piping valves.

C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valve Actuator Types:
1. Handlever: For quarter-turn valves smaller than NPS 4.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

B. Brass Ball Valves, Three-Piece with Full Port and Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Three piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.03 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.

h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

B. Bronze Ball Valves, Three-Piece with Full Port Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Three piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.04 STEEL BALL VALVES

A. Steel Ball Valves with Full Port and Stainless-Steel Trim, Class 150:

1. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 285 psig.
c. Body Design: Split body.
d. Body Material: Carbon steel, ASTM A 216, Type WCB.
e. Ends: Flanged.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

2.05 IRON BALL VALVES

A. Iron Ball Valves, Class 125:

1. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 200 psig.
c. Body Design: Split body.
d. Body Material: ASTM A 126, gray iron.
e. Ends: Flanged.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5and Larger: Flanged ends.
4. For Steel Piping, NPS 2and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

END OF SECTION 230523.12

SECTION 230523.16
PLUG VALVES FOR HVAC PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Lubricated plug valves.
2. Eccentric plug valves.

1.03 DEFINITIONS

A. CWP: Cold working pressure.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set plug valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B31.1 for power piping valves.
5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valve Actuator Types: Wrench. Furnish Owner with one wrench for every five plug valves, for each size square plug-valve head.

2.02 LUBRICATED PLUG VALVES

A. Class 125, Lubricated Plug Valves with Threaded Ends:

1. Description:

a. Standard: MSS SP-78, Type I single gland.
b. NPS 2-1/2 to NPS 4, CWP Rating: 200 psig.
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short venturi.
e. Plug: Cast iron or bronze with sealant groove.

B. Class 125, Lubricated Plug Valves with Flanged Ends:

1. Description:

a. Standard: MSS SP-78, Type I single gland or Type II regular gland.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
e. Pattern: Regular or short venturi.
f. Plug: Cast iron or bronze with sealant groove.

C. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:

1. Description:

a. Standard: MSS SP-78, Type IV.
b. NPS 2-1/2 to NPS 4, CWP Rating: 200 psig.
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short venturi.
e. Plug: Cast iron or bronze with sealant groove.

D. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:

1. Description:

a. Standard: MSS SP-78, Type IV.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short venturi.
e. Plug: Cast iron or bronze with sealant groove.

2.03 ECCENTRIC PLUG VALVES

A. 175 CWP, Eccentric Plug Valves with Resilient Seating.
1. Description:

a. Standard: MSS SP-108.
b. CWP Rating: 175 psigminimum.
c. Body and Plug: ASTM A 48/A 48M, gray iron; ASTM A 126, gray iron; or ASTM A 536, ductile iron.
d. Bearings: Oil-impregnated bronze or stainless steel.
e. Ends: Flanged.
f. Stem-Seal Packing: Asbestos free.

g. Plug, Resilient-Seating Material: Suitable for potable-water service unless otherwise indicated.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements for valve tags and schedules in Section 230553 "Identification for HVAC Piping and Equipment."

3.03 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Plug valves.

B. If valves with CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. Select valves with the following end connections:

1. For Copper Tubing, NPS 2and Smaller: Threaded ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For Grooved-End Copper Tubing and Steel Piping except Steam and Steam Condensate Piping: Valve ends may be grooved.

END OF SECTION 230523.16

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Fastener systems.
3. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-protection piping.
3. Division 23 Section " Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
4. Division 23 Section " Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
5. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.03 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.04 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.05 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

B. Welding certificates.

1.06 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Globe Pipe Hanger Products, Inc.
3. Grinnell Corp.
4. Approved equal.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.03 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.
f. Approved equal.

B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.
g. Approved equal.

2.04 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.05 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3: EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

L. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.02 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

D. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

E. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

F. Install lateral bracing with pipe hangers and supports to prevent swaying.

G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

H. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

J. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.

7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.06 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 05 29

SECTION 230548.13
VIBRATION CONTROLS FOR HVAC

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Elastomeric hangers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
   2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.

B. Shop Drawings:

   1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
   2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For each vibration isolation device.

   1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For testing agency.

C. Welding certificates.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2: PRODUCTS

2.01 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

   1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.

2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 VIBRATION CONTROL DEVICE INSTALLATION

A. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

END OF SECTION 230548.13

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Duct labels.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

1.04 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2: PRODUCTS

2.01 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick for labels up to 20 sq. in. or 8 inches in length, and 1/8 inch thick for larger labels, and having predrilled holes for attachment hardware.
2. Letter Color: White, unless otherwise noted.
3. Background Color: Black, unless otherwise noted.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 3/8 inch.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, owner assigned maintenance number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.03 DUCT LABELS

A. Material and Thickness: Self-Adhesive flexible vinyl labels, permanent-adhesive backing.

B. Letter Color: Black**,** unless otherwise noted.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 3/8 inch.

G. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

PART 3: EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

C. Identify rooftop unit, condensing unit, exhaust fans, unit heaters, smoke dampers, and heat transfer equipment with stick-on, laminated plastic nameplates. Install nameplate on the equipment and on the equipment starter. Identify the name of the equipment as listed on the drawing and coordinate with the owner for additional requirement.

D. Equipment manuals: Furnish three sets of manuals in bound form containing all submittal data, parts lists, installation instructions, maintenance and operation instructions, and lubrication instructions for each piece of equipment and all apparatus

3.03 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Refrigerant Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

2. Natural Gas:

   a. Background Color: Yellow.
   b. Letter Color: Black.

3.04 DUCT LABEL INSTALLATION

A. Install plastic-laminated self-adhesive duct labels with permanent adhesive on air ducts

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.05 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.03 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.04 SUBMITTALS

A. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 15 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.05 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by NEBB and TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by NEBB or TABB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.06 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.07 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2: PRODUCTS (Not Applicable)

PART 3: EXECUTION

3.01 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following:

1. Approved by Engineer

3.02 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.03 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.04 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP)] units.

3.05 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.06 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

   a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

   a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
   b. Measure static pressure directly at the fan outlet or through the flexible connection.
   c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
   d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

   a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.07 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.08 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Air pressure drop.

4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.09 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.10 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.11 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.

10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.

f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

G. Gas-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.12 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Verify that balancing devices are marked with final balance position.
e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.13 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 07 13
DUCT INSULATION

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply air.
2. Indoor, concealed supply, return, and exhaust air duct located in unconditioned space.
3. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
4. Outdoor, exposed supply and return.

B. Related Sections:

1. Division 23 Section "Metal Ducts" for duct liners.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

C. Qualification Data: For qualified Installer.

D. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.07 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2: PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

   a. CertainTeed Corp.; SoftTouch Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Friendly Feel Duct Wrap.
   d. Manson Insulation Inc.; Alley Wrap.
   e. Owens Corning; SOFTR All-Service Duct Wrap.
   f. No Substitutions.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

   a. CertainTeed Corp.; Commercial Board.
   b. Johns Manville; 800 Series Spin-Glas.
   c. Knauf Insulation; Insulation Board.
   d. Manson Insulation Inc.; AK Board.
   e. Owens Corning; Fiberglas 700 Series.
   f. No Substitutions.

2.02 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. Tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide the following:

    a. Johns Manville; Super Firetemp M.
    b. No Substitutions.

B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide the following:

    a. CertainTeed Corp.; FlameChek.
    b. Johns Manville; Firetemp Wrap.
    c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
    d. Thermal Ceramics; FireMaster Duct Wrap.
    e. 3M; Fire Barrier Wrap Products.
    f. Unifrax Corporation; FyreWrap.
    g. No Substitutions.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    d. Mon-Eco Industries, Inc.; 22-25.
    e. No Substitutions.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    d. Mon-Eco Industries, Inc.; 22-25.
    e. No Substitutions.

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide the following:

    a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.

b. Vimasco Corporation; 749.
c. No Substitutions.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
b. Eagle Bridges - Marathon Industries; 501.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
d. Mon-Eco Industries, Inc.; 55-10.
e. No Substitutions.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
b. Eagle Bridges - Marathon Industries; 570.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
d. No Substitutions.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.
f. No Substitutions.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.05 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements, provide the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
    b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    c. Vimasco Corporation; 713 and 714.
    d. No Substitutions.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.06 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    b. Eagle Bridges - Marathon Industries; 405.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
    d. Mon-Eco Industries, Inc.; 44-05.
    e. No Substitutions.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

2.07 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.08 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Metal Jacket:
1. Products: Subject to compliance with requirements, provide the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
    b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.

c. RPR Products, Inc.; Insul-Mate.
d. No Substitutions.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.

2.09 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide the following:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
e. No Substitutions.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.
e. No Substitutions.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
c. No Substitutions.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal.

3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

   a. Products: Subject to compliance with requirements, provide the following:

      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; CD.
      3) Midwest Fasteners, Inc.; CD.
      4) Nelson Stud Welding; TPA, TPC, and TPS.
      5) No Substitutions.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

   a. Products: Subject to compliance with requirements, provide the following:

      1) AGM Industries, Inc.; CHP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.
      5) No Substitutions.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products: Subject to compliance with requirements, provide the following:

      1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
      2) GEMCO; Perforated Base.
      3) Midwest Fasteners, Inc.; Spindle.
      4) No Substitutions.

   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products: Subject to compliance with requirements, provide the following:

      1) GEMCO; Nylon Hangers.
      2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
      3) Approved Equal.

   b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.

c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide the following:

1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
2) GEMCO; Peel & Press.
3) Midwest Fasteners, Inc.; Self Stick.
4) No Substitutions.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements**,** provide the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.
5) No Substitutions.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Manufacturers: Subject to compliance with requirements, provide the following:

1) GEMCO.
2) Midwest Fasteners, Inc.
3) Approved Equal.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide the following:

a. C & F Wire.
b. Approved Equal.

2.11 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping"firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.05 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for minimum 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for minimum 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.

e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.06 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.07 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.08 FINISHES

A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

   a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum jackets.

3.09 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective work if sample inspection reveals noncompliance with requirements.

3.10 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply air.
2. Indoor, concealed supply, return, and exhaust located in unconditioned space, such as ductwork located in the attic above the building insulation.
3. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
4. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
5. Indoor, concealed oven and warewash exhaust.
6. Indoor, exposed oven and warewash exhaust.
7. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
8. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.0-lb/cu. ft nominal density.

B. Concealed, rectangular, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.0-lb/cu. ft. nominal density.

3.12 DUCT LOCATED IN ATTIC, DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Concealed, round and flat-oval, supply, return, and exhaust-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 2 inches and 1.0-lb/cu. ft. nominal density.

C. Concealed, rectangular, supply, return, and exhaust-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 2 inches and 1.0-lb/cu. ft. nominal density.

3.13 OUTDOOR, ABOVE GROUND, DUCT AND PLENUM INSULATION SCHEDULE

A. Mineral-Fiber Blanket: 2 inches and 1.0-lb/cu. ft. nominal density with aluminum jacket.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None.

D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION 23 07 13

SECTION 230923.16
GAS INSTRUMENTS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes the Following Gas Instruments:

1. Single-point oxygen monitoring system.

1.03 DEFINITIONS

A. NDIR: Nondispersive infrared.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
2. Installation instructions, including factor affecting performance.
3. Product description with complete technical data, performance curves, product specification sheets.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include diagrams for power, signal, and control wiring.
3. Number-coded identification system for unique identification of wiring, cable, and tubing ends.

C. Samples: For each exposed product installed in finished space.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plan drawings and corresponding product installation details, drawn to scale, on which wall-mounted instruments located in finished space are shown and coordinated with each other, showing relationship to light switches, fire alarm devices, and other installed devices using input from installers of the items involved.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas instruments to include in operation and maintenance manuals.

PART 2: PRODUCTS

2.01 MULTIPOINT CARBON-MONOXIDE MONITORING SYSTEM

A. Description:

1. Each sampling point shall monitor any variation in the carbon-monoxide concentration level.
2. Each sampling point shall be individually piped to the monitoring system.

3. Provide sampling point with a 0.3-micron filter.
4. Each sampling point shall be an alarm point.
5. A dual-head diaphragm pump shall draw an air sample through piping system and through a microprocessor-controlled sequencer feeding an analyzer with a new sample every 15 seconds.
6. Sample time shall be adjustable in 1 second increments from zero to 60 minutes.
7. Span and zero calibration gas shall be automatically initiated by the microprocessor. System shall also provide manual initiation of span and zero calibration gas.
8. Analyzer output shall be corrected by the microprocessor.
9. Monitoring system shall have 8 sample points.
10. System shall operate on 120-V ac, single-phase, 60-Hz power.
11. Final adjustment; calibration, testing, and startup of the system shall be performed by a trained representative of manufacturer.

B. Analyzer:

1. Analyzer shall operate using principle of nondispersive infrared absorption.
2. Sampling response time shall be within 10 seconds.
3. Zero drift and span drift shall be less than 1 percent of full scale within a 24-hour period.
4. Repeatability shall be within 1 percent of full scale.
5. Accuracy shall be within 1 percent of full scale.
6. Calibration range shall be zero to 500 ppm.
7. Digital display on analyzer face with scale shall be in ppm.
8. Temperature shall be compensated from 30 to 120 deg Fambient temperature.

C. Control and Display:

1. Each sample shall send a 4-20 mA output signal proportional to the highest concentration.
2. Alphanumeric visual display of current analyzer concentration reading shall be in ppm or another industry-accepted measurement.
3. Visual indication for sample analyzing, sample high-concentration alarm, analyzer malfunction, and calibration.
4. Any number and configuration of sample points shall be capable of being bypassed.
5. Each sample point shall be capable of being manually sampled through an override feature.
6. System parameters shall be stored in nonvolatile memory.
7. Provide at least an eight-hour battery backup of current alarm status. Battery shall be rechargeable.

D. Enclosure:

1. NEMA 250, Type 1.
2. Hinged and locking door, full size of face.
3. House all system components. Multiple adjoining enclosures are acceptable if joined to a common support structure.

E. Calibration Equipment:

1. Provide equipment necessary to automatically and manually calibrate the system, including, but not be limited to, the following:

    a. Regular assembly.
    b. Zero cap.
    c. Calibration cap.
    d. Two cylinders filled with calibration gas.
    e. Instruction book.
    f. Carrying case.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.

C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Furnish and install products required to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Properly support instruments, tubing, piping, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to seismic loads.

D. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by using excessive force or oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

E. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.03 ELECTRICAL POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."

C. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

3.04 INSTRUMENTS, GENERAL INSTALLATION REQUIREMENTS

A. Mounting Location:

1. .Install gas switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
2. Mount switches and transmitters not required to be mounted within system control panels on walls, floor-supported freestanding pipe stands, or floor-supported structural support frames. Use manufacturer's mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.

B. Mounting Height:

1. Mount instruments in user-occupied space to match mounting height of light switches unless otherwise indicated on Drawings. Mounting height shall comply with codes and accessibility requirements.
2. Mount switches and transmitters located in mechanical equipment rooms and other similar space not subject to code, state, and federal accessibility requirements within a range of 42 to 72 inchesabove the adjacent floor, grade, or service catwalk or platform.

    a. Make every effort to mount at 60 inches.

C. Seal penetrations to ductwork, plenums, and air-moving equipment to comply with duct static-pressure class and leakage and seal classes indicated, using neoprene gaskets or grommets.

3.05 CARBON-MONOXIDE MONITORING SYSTEM

A. Install sample points in monitored area to provide accurate measurement of gas concentration.

B. Install exposed sampling points with a finished appearance consistent with other materials in space. Submit proposed products to be installed for review and approval.

C. Individually install each sample point to the carbon-monoxide monitoring system.

D. Install tubing in a minimum size of NPS 3/8.

E. Use compression fittings at connections to equipment.

F. If not indicated on Drawings, locate carbon-monoxide monitoring system in a secured and serviceable location accessible to authorized personnel.

G. Support carbon-monoxide monitoring system from floor or wall. Support floor-mounted systems using a structural channel frame. Provide mounting brackets.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install engraved phenolic nameplate with instrument identification on face.

3.07 CHECKOUT PROCEDURES

A. Check out installed products before continuity tests, leak tests, and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that impact performance.

D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.

3.08 ADJUSTMENT, CALIBRATION, AND TESTING

A. Description:

1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
2. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.
3. For each analog instrument, perform a three-point calibration test for both linearity and accuracy.
4. Equipment and procedures used for calibration shall comply with instrument manufacturer's written recommendations.
5. Provide diagnostic and test equipment for calibration and adjustment.
6. Field instruments and equipment used to test and calibrate installed instruments shall have an accuracy of at least twice the instrument accuracy being calibrated. For example, an installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
7. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.

8. If, after calibration, indicated performance cannot be achieved, replace out-of-tolerance instruments.
9. Comply with field-testing requirements and procedures in ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.

B. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.

C. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact.

D. Meters: Check sensors at zero, 50, and 100 percent of Project design values.

E. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

F. Switches: Calibrate switches to make or break contact at set points indicated.

G. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistance source.

3.09 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include semiannual preventive maintenance, repair or replacement of worn or defective components, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain instrumentation and control devices.

B. Coordinate gas instrument demonstration video with operation and maintenance manuals and classroom instruction for use by Owner in operating, maintaining, and troubleshooting.

C. Record videos on DVD disks.

D. Owner shall have right to make additional copies of video for internal use without paying royalties.

END OF SECTION 230923.16

SECTION 230923.19
MOISTURE INSTRUMENTS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes moisture switches, sensors, and transmitters.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
2. Product description with complete technical data, performance curves, and product specification sheets.

B. Shop Drawings:

1. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.
3. Include number-coded identification system for unique identification of wiring, cable, and tubing ends.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: To include in operation and maintenance manuals.

PART 2: PRODUCTS

2.01 MOISTURE SWITCHES

A. Humidistat for Duct Applications:

1. Description:

   a. Two-position control.
   b. Field-adjustable set point.
   c. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Performance:

   a. Relative Humidity Range: 15 to 95 percent.
   b. Relative Humidity Differential: 5 percent.
   c. Ambient Temperature: 40 to 135 deg F.
   d. Voltage: 120-V ac.
   e. Current: 7.2 FLA.
   f. Switch Type: SPDT snap switch.

3. Construction:

a. Enclosure: Metal, NEMA 250, Type 1.
b. Electrical Connections: Screw terminals.

B. Humidistat for Space Applications:

1. Description:

a. Two-position control.
b. Field-adjustable set point.
c. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Performance:

a. Relative Humidity Range: 10 to 90 percent.
b. Relative Humidity Differential: 5 percent.
c. Ambient Temperature: 40 to 135 deg F
d. Voltage: 24-V ac.
e. Pilot Duty: 60 VA.
f. Switch Type: SPDT snap switch.

3. Construction:

a. Enclosure: Plastic, NEMA 250, Type 1.
b. Electrical Connections: Cable, 6 inches long.

2.02 MOISTURE SENSORS AND TRANSMITTERS

A. Sensors and Transmitters with Digital Display:

1. Performance:

a. Accuracy including non-linearity, hysteresis, and repeatability: Within 2 percent from zero to 90 percent relative humidity and within 2.5 percent from 90 to 100 percent relative humidity when operating between 60 to 77 deg F.
b. Relative Humidity Range: Zero to 100 percent.
c. Factory calibrated and NIST traceable with certificate included.

2. Construction:

a. Provide housing with integral sensor for room applications.
b. Provide housing with remote sensor probe for ducted applications.

1) Duct Sensor Body: 300 series stainless steel or chrome-plated aluminum, at least 2 inches long for duct-mounted applications.
2) Provide sensor with cable for field installation in conduit.
3) For duct-mounted applications, thread the sensor assembly for connection to a threaded mounting flange.

c. Provide general-purpose humidity sensor unless application requires special requirements. Provide sensor with sintered stainless-steel filter for duct applications.
d. Housing shall be ABS/PC plastic or powder-coated aluminum.
e. Housing Classification: NEMA 250, Type 4 or 4X.
f. Provide housing with wall-mounting plate.

3. Output Signal: 2-wire, 4- to 20-mA output signal with a drive capacity of at least 500 ohms at 24-V dc.
4. Provide unit with a digital display of relative humidity in percent.

B. Sensor and Transmitter without Display:

1. Performance:

a. Accuracy including non-linearity, hysteresis, and repeatability: Within 2 percent from zero to 90 percent relative humidity and within 3 percent from 90 to 95 percent relative humidity when operating at 68 deg F.
b. Relative Humidity Range:

1) Duct: Zero to 100 percent.
2) Space: Zero to 95 percent relative.

c. Factory calibrated and NIST traceable with certificate included.

2. Construction for Space Applications:

a. Housing with integral sensor.
b. Housing shall be ABS plastic or powder-coated aluminum.
c. Enclosure: NEMA 250, Type 4.
d. Provide housing with a wall-mounting plate.

3. Construction for Duct and Equipment Applications:

a. Housing with integral sensor.
b. Duct Sensor Body: 300 series stainless steel.
c. Provide sensor with sintered stainless-steel filter for duct applications.
d. Housing shall be cast aluminum.
e. Enclosure: NEMA 250, Type 4.

4. Output Signal: Two-wire, 4- to 20-mA output signal with drive capacity of at least 500 ohms at 24-V dc.

C. Sensor and Transmitter without Display:

1. Performance:

a. Relative Humidity Range: Zero to 100 percent.
b. Accuracy: Within 2 or 3 percent.
c. Operating Temperatures: Minus 30 to 130 deg F.
d. Hysteresis: Within 1 percent.

2. Construction:

a. Duct-type sensor for duct-mounted applications. Integral-type sensor for room or space applications.
b. Sensor Body: 300 series stainless steel, 6 inches long for duct-mounted applications.
c. For outdoor and duct applications, install circuitry in a NEMA 250, Type 4 or 4X enclosure.

3. Output Signal:

a. Two-wire, 4- to 20-mA output signal with a drive capacity of at least 600 ohms at 24-V dc.
b. Non-interacting zero and span adjustments.

D. Combination Humidity and Temperature Sensor and Transmitter with Display:

1. Description:

a. Factory package consisting of humidity and temperature sensor, digital display, keypad user interface, installation hardware, interconnecting sensor cabling, installation instructions, and operating manual.
b. Each transmitter shall be individually calibrated and provided with NIST traceable calibration certifications.
c. Provide a service cable for connecting to a notebook computer and Microsoft Windows compatible software.

2. Display:

a. Alphanumeric display of the following on the face of the enclosure:

1) Percent relative humidity.
2) Absolute humidity.
3) Mixing ratio.
4) Dry-bulb temperature.
5) Wet-bulb temperature.
6) Dew point temperature.
7) Enthalpy.

b. Visual display of measurement trends, and minimum and maximum values over a one-year period.

3. Electronics Enclosure:

a. Integral to sensors for wall- (room-)mounted applications and remote from temperature and humidity sensors for duct and equipment applications.
b. NEMA 250, Type 4 or 4X.
c. Labeled terminal strip for field wiring connections.

4. Programming:

a. Transmitter parameters shall be field programmable through keypad on the face of the enclosure.
b. Programmed parameters shall be stored in nonvolatile EEPROM.

5. Output Signals:

a. Three Analog Outputs: 4 to 20 mA or zero to 10-V dc for each output. Option to use a serial communication interface.

6. Temperature Sensor:

a. Temperature range matched to application, but not less than minus 40 to 140 deg F.
b. Within 0.5 deg F accuracy over the temperature range of 50 to 100 deg F and within 1 deg F over the remainder of the range.
c. Provide duct installation kit for duct applications.

7. Humidity Sensor:

a. Relative Humidity Measurement Range: Zero to 100 percent.
b. Response time in still air within 40 seconds.
c. Accuracy including non-linearity, hysteresis, and repeatability:

1) For Temperature Between 59 and 77 Deg F and Relative Humidity between Zero and 90 Percent: Within 1 percent.
2) For Temperature between 59 and 77 Deg F and Relative Humidity between 90 and 100 Percent: Within 1.7 percent.

3) For Temperature between Minus 4 and 104 Deg F: Within 1 percent plus 0.008 times relative humidity reading.
4) For Temperature between Minus 40 and 356 Deg F: Within 1.5 percent plus 0.015 times the relative humidity reading.

d. Sintered, stainless-steel filter, protecting sensor.
e. Provide duct installation kit for duct applications.

8. Power Supply:

a. Field Power: 120-V ac, 60 Hz unless otherwise required by the application.
b. Internal Power: As required by transmitter.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Install products level, plumb, parallel, and perpendicular with building construction.

B. Properly support instruments, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to a 50 lb force.

C. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

D. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.03 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."

C. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

3.04 MOISTURE INSTRUMENTS INSTALLATION

A. Mounting Location: Rough-in instrument-mounting locations before setting instruments and routing, cable, wiring, tubing, and conduit to final location.

B. Mounting Height:

1. Mount instruments in user-occupied space to match mounting height of light switches unless otherwise indicated on Drawings. Mounting height shall comply with codes and accessibility requirements.
2. Mount switches and transmitters located in mechanical equipment rooms and other similar space not subject to code, state, and Federal accessibility requirements within a range of 42 to 72 inches above the adjacent floor, grade, or service catwalk or platform.

    a. Make every effort to mount at 60 inches.

3.05 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install engraved phenolic nameplate with instrument identification on face of ceiling directly below instruments concealed above ceilings.

3.06 CHECKOUT PROCEDURES

A. Check installed products before continuity tests and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that impact performance.

3.07 ADJUSTMENT, CALIBRATION, AND TESTING

A. Description:

1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
2. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.
3. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.
4. Equipment and procedures used for calibration shall meet instrument manufacturer's written instructions.
5. Provide diagnostic and test equipment for calibration and adjustment.
6. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. For example, an installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
7. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.
8. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.
9. Comply with field-testing requirements and procedures indicated by ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.

B. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistance source.

C. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact.

D. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

E. Switches: Calibrate switches to make or break contact at set points indicated.

F. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistance source.

3.08 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include semiannual preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.09 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain instrumentation and control devices.

B. Coordinate video with operation and maintenance manuals and classroom instruction for use by Owner in operating, maintaining, and troubleshooting.

C. Record videos on DVD disks.

D. Owner shall have right to make additional copies of video for internal use without paying royalties.

END OF SECTION 230923.19

SECTION 230923.27
TEMPERATURE INSTRUMENTS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Air temperature sensors.

1.03 DEFINITIONS

A. HART (Highway Addressable Remote Transducer) Protocol: The global standard for sending and receiving digital information across analog wires between smart devices and control or monitoring systems through bidirectional communication that provides data access between intelligent field instruments and host systems. A host can be any software application from a technician's hand-held device or laptop to a plant's process control, asset management, safety, or other system using any control platform.

B. RTD: Resistance temperature detector.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
3. Product description with complete technical data, performance curves, and product specification sheets.
4. Installation operation and maintenance instructions, including factors affecting performance.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Include number-coded identification system for unique identification of wiring, cable, and tubing ends.

C. Samples: For each exposed product installed in finished space.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plan drawings and corresponding product installation details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Product installation location shown in relationship to room, duct, pipe, and equipment.
2. Wall-mounted instruments located in finished space showing relationship to light switches, fire-alarm devices, and other installed devices.
3. Sizes and locations of wall access panels for instruments installed behind walls.
4. Sizes and locations of ceiling access panels for instruments installed in inaccessible ceilings.

B. Product Certificates: For each product requiring a certificate.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

D. Field quality-control reports.

PART 2: PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Environmental Conditions:

1. Instruments shall operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.

    a. If instrument alone cannot meet requirement, install instrument in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, filtered, and ventilated as required by instrument and application.

2. Instruments and accessories shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Instruments not available with integral enclosures complying with requirements indicated shall be housed in protective secondary enclosures. Instrument's installed location shall dictate following NEMA 250 enclosure requirements:

    a. Outdoors, Protected: Type 3.
    b. Outdoors, Unprotected: Type 4.
    c. Indoors, Heated with Filtered Ventilation: Type 1.
    d. Indoors, Heated with Non-Filtered Ventilation: Type 2.

    e. Indoors, Heated and Air Conditioned: Type 1.

    f. Mechanical Equipment Rooms: Type 1.

    g. Localized Areas Exposed to Washdown: Type 4.
    h. Within Duct Systems and Air-Moving Equipment Not Exposed to Possible Condensation: Type 2.
    i. Within Duct Systems and Air-Moving Equipment Exposed to Possible Condensation: Type 4.
    j. Hazardous Locations: Explosion-proof rating for condition.

2.02 AIR TEMPERATURE SENSORS

A. Platinum RTDs: Common Requirements:

1. 100 or 1000 ohms at zero deg C and a temperature coefficient of 0.00385 ohm/ohm/deg C.
2. Two-wire, PTFE-insulated, 22-gage stranded copper leads.
3. Performance Characteristics:

    a. Range: Minus 50 to 275 deg F.
    b. Interchangeable Accuracy: At 32 deg Fwithin 0.5 deg F.
    c. Repeatability: Within 0.5 deg F.
    d. Self-Heating: Negligible.

4. Transmitter Requirements:

    a. Transmitter required for each 100-ohm RTD.
    b. Transmitter optional for 1000-ohm RTD, contingent on compliance with end-to-end control accuracy.

B. Platinum RTD, Single-Point Air Temperature Duct Sensors:

1. 100 or 1000 ohms.
2. Temperature Range: Minus 50 to 275 deg F
3. Probe: Single-point sensor with a stainless-steel sheath.
4. Length: As required by application to achieve tip at midpoint of air tunnel, up to 18 inches.
5. Enclosure: Junction box with removable cover; NEMA 250, Type 1 for indoor applications and Type 4 for outdoor applications.
6. Gasket for attachment to duct or equipment to seal penetration airtight.
7. Conduit Connection: 1/2-inch.

C. Platinum RTD, Air Temperature Averaging Sensors:

1. 100 or 1000 ohms.
2. Temperature Range: Minus 50 to 275 deg F
3. Multiple sensors to provide average temperature across entire length of sensor.
4. Rigid probe of aluminum, brass, copper, or stainless-steel sheath.
5. Flexible probe of aluminum, brass, copper, or stainless-steel sheath and formable to a 4-inch radius.
6. Length: As required by application to cover entire cross section of air tunnel.
7. Enclosure: Junction box with removable cover; NEMA 250, Type 1 for indoor applications and Type 4 for outdoor applications.
8. Gasket for attachment to duct or equipment to seal penetration airtight.
9. Conduit Connection: 1/2-inch.

D. Platinum RTD Outdoor Air Temperature Sensors:

1. 100 or 1000 ohms.
2. Temperature Range: Minus 50 to 275 deg F
3. Probe: Single-point sensor with a stainless-steel sheath.
4. Solar Shield: Stainless steel.
5. Enclosure: NEMA 250, Type 4 or 4X junction box or combination conduit and outlet box with removable cover and gasket.
6. Conduit Connection: 1/2-inchtrade size.

E. Platinum RTD Space Air Temperature Sensors:

1. 100 or 1000 ohms.
2. Temperature Range: Minus 50 to 212 deg F
3. Sensor assembly shall include a temperature sensing element mounted under a flush, brushed-aluminum cover.
4. Provide a mounting plate that is compatible with the surface shape that it is mounted to and electrical box used.
5. Concealed wiring connection.

F. Thermal Resistors (Thermistors): Common Requirements:

1. 10,000 ohms at 25 deg C and a temperature coefficient of 23.5 ohms/ohm/deg C.
2. Two-wire, PTFE-insulated, 22-gage stranded copper leads.
3. Performance Characteristics:

    a. Range: Minus 50 to 275 deg F.
    b. Interchangeable Accuracy: At 77 deg Fwithin 0.5 deg F.
    c. Repeatability: Within 0.5 deg F.
    d. Drift: Within 0.5 deg F over 10 years.
    e. Self-Heating: Negligible.

4. Transmitter optional, contingent on compliance with end-to-end control accuracy.

G. Thermistor, Single-Point Duct Air Temperature Sensors:

1. Temperature Range: Minus 50 to 275 deg F
2. Probe: Single-point sensor with a stainless-steel sheath.

3. Length: As required by application to achieve tip at midpoint of air tunnel, up to 18 inches.
4. Enclosure: Junction box with removable cover; NEMA 250, Type 1 for indoor applications and Type 4 for outdoor applications.
5. Gasket for attachment to duct or equipment to seal penetration airtight.
6. Conduit Connection: 1/2- inch trade size

H. Thermistor Averaging Air Temperature Sensors:

1. Temperature Range: Minus 50 to 275 deg F
2. Multiple sensors to provide average temperature across entire length of sensor.
3. Rigid probe of aluminum, brass, copper, or stainless-steel sheath.
4. Flexible probe of aluminum, brass, copper, or stainless-steel sheath and formable to a 4-inchradius.
5. Length: As required by application to cover entire cross section of air tunnel.
6. Enclosure: Junction box with removable cover; NEMA 250, Type 1 for indoor applications and Type 4 for outdoor applications.
7. Gasket for attachment to duct or equipment to seal penetration airtight.
8. Conduit Connection: 1/2-inch trade size.

I. Thermistor Outdoor Air Temperature Sensors:

1. Temperature Range: Minus 50 to 275 deg F
2. Probe: Single-point sensor with a stainless-steel sheath.
3. Solar Shield: Stainless steel.
4. Enclosure: NEMA 250, Type 4 or 4X junction box or combination conduit and outlet box with removable cover and gasket.
5. Conduit Connection: 1/2-inch trade size.

J. Thermistor Space Air Temperature Sensors:

1. Temperature Range: Minus 50 to 212 deg F
2. Sensor assembly shall include a temperature sensing element mounted under a flush, brushed-aluminum cover.
3. Provide a mounting plate that is compatible with the surface shape that it is mounted to and electrical box used.
4. Concealed wiring connection.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.

C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPERATURE INSTRUMENT APPLICATIONS

A. Air Temperature Sensors:

1. Duct: Thermistor.
2. Outdoor: Thermistor.
3. Space: Thermistor.

3.03 INSTALLATION, GENERAL

A. Install products level, plumb, parallel, and perpendicular with building construction.

B. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

C. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.04 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."

C. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

3.05 TEMPERATURE INSTRUMENT INSTALLATIONS

A. Mounting Location:

1. Roughing In:

a. Outline instrument mounting locations before setting instruments and routing cable, wiring, tubing, and conduit to final location.
b. Provide independent inspection to confirm that proposed mounting locations comply with requirements indicated and approved submittals.

1) Indicate dimensioned locations with mounting height for all surface-mounted products on Shop Drawings.
2) Do not begin installation without submittal approval of mounting location.

c. Complete installation rough-in only after confirmation by independent inspection is complete and approval of location is documented for review by Owner and Architect on request.

B. Special Mounting Requirements:

1. Protect products installed outdoors from solar radiation, building and wind effect with stand-offs and shields constructed of Type 316 stainless.
2. Temperature instruments having performance impacted by temperature of mounting substrate shall be isolated with an insulating barrier located between instrument and substrate to eliminate effect. Where instruments requiring insulation are located in finished space, conceal insulating barrier in a cover matching the instrument cover.

C. Mounting Height:

1. Mount temperature instruments in user-occupied space to match mounting height of light switches unless otherwise indicated on Drawings. Mounting height shall comply with codes and accessibility requirements.

2. Mount switches and transmitters located in mechanical equipment rooms and other similar space not subject to code or state and Federal accessibility requirements within a range of 42 to 72 inches above the adjacent floor, grade, or service catwalk or platform.

    a. Make every effort to mount at 60 inches.

D. Seal penetrations to ductwork, plenums, and air-moving equipment to comply with duct static-pressure class and leakage and seal classes indicated using neoprene gaskets or grommets.

E. Space Temperature Sensor Installation:

1. Conceal assembly in an electrical box of sufficient size to house sensor and transmitter, if provided.
2. Install electrical box with a faceplate to match sensor cover if sensor cover does not completely cover electrical box.
3. In finished areas, recess electrical box within wall.
4. In unfinished areas, electrical box may be surface mounted if electrical light switches are surface mounted. Use a cast-aluminum electric box for surface-mounted installations.
5. Align electrical box with other electrical devices such as visual alarms and light switches located in the vicinity to provide a neat and well-thought-out arrangement. Where possible, align in both horizontal and vertical axis.

F. Outdoor Air Temperature Sensor Installation:

1. Mount sensor in a discrete location facing north.
2. Protect installed sensor from solar radiation and other influences that could impact performance.
3. If required to have a transmitter, mount transmitter remote from sensor in an accessible and serviceable location indoors.

G. Single-Point Duct Temperature Sensor Installation:

1. Install single-point-type, duct-mounted, supply- and return-air temperature sensors. Install sensors in ducts with sensitive portion of the element installed in center of duct cross section and located to sense near average temperature. Do not exceed 24 inchesin sensor length.
2. Install return-air sensor in location that senses return-air temperature without influence from outdoor or mixed air.
3. Rigidly support sensor to duct and seal penetration airtight.
4. If required to have transmitter, mount transmitter remote from sensor at accessible and serviceable location.

H. Averaging Duct Temperature Sensor Installation:

1. Install averaging-type air temperature sensor for temperature sensors located within air-handling units, similar equipment, and large ducts with air tunnel cross-sectional area of 20 sq. ft. and larger.
2. Install sensor length to maintain coverage over entire cross-sectional area. Install multiple sensors where required to maintain the minimum coverage.
3. Fasten and support sensor with manufacturer-furnished clips to keep sensor taut throughout entire length.
4. If required to have transmitter, mount transmitter in an accessible and serviceable location.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install engraved phenolic nameplate with instrument identification.

3.07 CLEANING

A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.

B. Wash and shine glazing.

C. Polish glossy surfaces to a clean shine.

3.08 CHECK-OUT PROCEDURES

A. Check installed products before continuity tests, leak tests, and calibration.

B. Check temperature instruments for proper location and accessibility.

C. Verify sensing element type and proper material.

D. Verify location and length.

E. Verify that wiring is correct and secure.

3.09 ADJUSTMENT, CALIBRATION, AND TESTING

A. Description:

1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
2. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.
3. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.
4. Equipment and procedures used for calibration shall meet instrument manufacturer's written instructions.
5. Provide diagnostic and test equipment for calibration and adjustment.
6. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. For example, an installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
7. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.
8. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.
9. Comply with field-testing requirements and procedures indicated by ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements and to supplement requirements indicated.

B. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistance source.

C. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact.

D. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

E. Switches: Calibrate switches to make or break contact at set points indicated.

F. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistance source.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections.

B. Prepare test and inspection reports.

3.11 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.12 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include semiannual preventive maintenance, repair or replacement of worn or defective components, cleaning and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain temperature instruments.

B. Provide a complete set of instructional videos covering each product specified and installed and showing the following:

1. Operation and maintenance requirements and procedures.
2. Troubleshooting procedures.

C. Coordinate video with operation and maintenance manuals and classroom instruction for use by Owner in operating, maintaining, and troubleshooting.

D. Record videos on DVD disks.

E. Owner shall have right to make additional copies of video for internal use without paying royalties.

END OF SECTION 230923.27

SECTION 230923.43
WEATHER STATIONS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes weather stations connected to direct-digital controls for HVAC.

1.03 DEFINITIONS

A. I/O: Input/output.

B. RS-232: A TIA standard for asynchronous serial data communications between terminal devices.

C. RS-485: A TIA standard for multipoint communications using two twisted pairs.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating control signal over range, electrical power requirements, and limitations of ambient operating environment including temperature and humidity.
3. Product description with complete technical data, performance curves, and product specification sheets.
4. Installation operation and maintenance instructions including factors affecting performance.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Include number-coded identification system for unique identification of wiring, cable, and tubing ends.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For weather stations to include in operation and maintenance manuals.

PART 2: PRODUCTS

2.01 WEATHER STATION

2.02 Description:

1. Weather station shall measure and record wind speed and direction, air temperature and relative humidity, barometric pressure, solar radiation, and rain.
2. Design weather station for applications with minimal visual impact, high reliability, and a long interval between routine servicing.

3. Weather station shall use solid-state sensors with no moving parts.
4. Weather station shall not be impaired by heavy snowfall or freezing conditions that produce rime ice. Provide a thermostatically controlled heater element in the sensor head that keeps the wind sensor elements and the precipitation sensor surface free of snow and ice to minus 62 deg F
5. Weather station shall directly connect to host device, or wirelessly connect to a host device through a fully integrated, industrial-grade, 916-MHz spread spectrum radio-frequency communications technology. Where required by application, replace 916-MHz radio-frequency components with 922-MHz and 2.4-GHz radio-frequency components to comply with local, regional, and national radio-frequency licensing requirements.
6. RS-232 serial data I/O shall be located on the bottom of the weather station and used as a second serial communications port, for programming and testing the system, or for direct data downloads using a personal computer or personal digital assistant.
7. Weather station shall be provided with a mounting system supplied by weather station manufacturer that is suitable for the installation.

B. Sensor Technology:

1. Wind speed and direction shall use acoustic techniques. Sensor shall consist of three equally spaced ultrasonic transducers in a horizontal plane. Values of any two array paths shall enable computation of both wind speed and direction, and a signal processing technique shall enable the measurement to be calculated using the two array paths of the best quality.
2. Rain shall be measured using a stainless-steel piezometric impact surface that counts the raindrops and measures their acoustic signature, integrating that information to provide a near-real-time value for rainfall amount and rate.
3. Air-temperature and relative-humidity sensors shall be combined in an integrated, user-replaceable unit that requires no calibration.

    a. Relative humidity sensor shall be a thin-polymer, capacitive sensor.
    b. Air-temperature sensor shall be a capacitive ceramic sensor.

C. Performance:

1. Air Temperature:

    a. Range: Minus 60 to 140 deg F.
    b. Accuracy: Within 0.9 deg F.
    c. Resolution: 0.1 deg F.

2. Relative Humidity:

    a. Range: Zero to 100 percent.
    b. Accuracy: Within 3 percent over the range of zero to 90 percent and within 5 percent between 90 to 100 percent.
    c. Resolution: 0.1 percent.

3. Data Storage: 60 days of hourly data.

D. Output Signals:

1. RS-232 or RS-485 serial interface directly from weather station to host.
2. In applications that cannot accept a serial signal, provide a serial-to-analog converter.
3. Serial-to-Analog Converter:

    a. Serial converter designed to add analog outputs for measuring instruments that have only serial output.
    b. Configure to give analog outputs from all measuring sensors and calculated parameters.
    c. Each converter shall have four analog outputs with a 4- to 20-mA signal.
    d. Provide multiple converters for applications requiring more points.
    e. Converter requires a 24-V dc power supply.

E. Communication Interface:

1. Weatherproof serial cables shall be used to connect the RS-232 I/O on the weather station. Cables shall use nickel-plated brass DB-9 connectors for corrosion resistance and include a Sanoprene jacket suitable for both high-ultraviolet and direct-burial environments.
2. An RF4xx spread spectrum radio-frequency transceiver shall be provided with every wireless weather station.

F. Unit shall be provided with a 120-V ac, 60-Hz power supply, a serial cable, and an antenna.

G. Software:

1. Data Transfer Protocols, Software, and Data Interface Hardware: Weather stations that communicate using a proprietary protocol shall be provided with a software development kit to enable a qualified software developer in development of software drivers for third-party devices or software.
2. Manufacturer shall submit description and pricing information of software application offerings for weather station management, data acquisition and logging, report generation, and data display for review and consideration.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install products level, plumb, parallel, and perpendicular with building construction.

B. Properly support weather station, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to forces that are consistent with building code structural design requirements.

C. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

3.03 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."

C. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install engraved phenolic nameplate with instrument identification.

3.05 ADJUSTMENT, CALIBRATION, AND TESTING

A. Description:

1. Calibrate each weather station installed that is not factory calibrated and provided with calibration documentation.
2. Provide a written description of proposed field procedures and equipment used for calibrating. Submit procedures before calibration and adjustment.
3. For each analog signal, make a three-point test of calibration for both linearity and accuracy.
4. Equipment and procedures used for calibration shall comply with instrument manufacturer's written instructions.
5. Provide diagnostic and test equipment for calibration and adjustment.
6. Field instruments and equipment used to test and calibrate installed weather stations shall have accuracy at least twice the instrument accuracy being calibrated. For example, an installed weather station with a signal accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
7. Calibrate each weather station according to instrument instruction manual supplied by manufacturer.
8. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.
9. Comply with field-testing requirements and procedures indicated by ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements and to supplement requirements indicated.

B. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistance source.

C. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Prepare test and inspection reports.

3.07 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

3.08 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include semiannual preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.09 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain weather stations.

B. Provide a complete set of instructional videos covering each product specified and installed and showing the following:

1. Software programming.
2. Calibration and test procedures.
3. Operation and maintenance requirements and procedures.
4. Troubleshooting procedures.

C. Coordinate video with operation and maintenance manuals and classroom instruction for use by Owner in operating, maintaining, and troubleshooting.

D. Record videos on DVD disks.

E. Owner shall have right to make additional copies of video for internal use without paying royalties.

END OF SECTION 230923.43

SECTION 23 11 23
FACILITY NATURAL-GAS PIPING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.04 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Dielectric fittings.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot.
2. Detail mounting, supports, and valve arrangements for pressure regulator assembly.

1.06 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

C. Qualification Data: For qualified professional engineer.

D. Welding certificates.

E. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.08 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.10 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

1.11 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 083113 "Access Doors and Frames."

PART 2: PRODUCTS

2.01 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

1. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. OmegaFlex, Inc.
    b. Parker Hannifin Corporation; Parflex Division.
    c. Titeflex.
    d. Tru-Flex Metal Hose Corp.

2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
3. Coating: PE with flame retardant.

    a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

        1) Flame-Spread Index: 25 or less.
        2) Smoke-Developed Index: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
5. Striker Plates: Steel, designed to protect tubing from penetrations.
6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
7. Operating-Pressure Rating: 5 psig.

2.02 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.03 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.04 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. BrassCraft Manufacturing Company; a Masco company.
   b. Conbraco Industries, Inc.; Apollo Div.
   c. Lyall, R. W. & Company, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. BrassCraft Manufacturing Company; a Masco company.
   b. Conbraco Industries, Inc.; Apollo Div.
   c. Lyall, R. W. & Company, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Lee Brass Company.
   b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Flowserve.
   b. Homestead Valve; a division of Olson Technologies, Inc.
   c. McDonald, A. Y. Mfg. Co.
   d. Milliken Valve Company.

e. Mueller Co.; Gas Products Div.
f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.05 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Canadian Meter Company Inc.
b. Eaton Corporation; Controls Div.
c. Harper Wyman Co.
d. Maxitrol Company.
e. SCP, Inc.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 2 psig.

2.06 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Hart Industries International, Inc.

d. Jomar International Ltd.
e. Matco-Norca, Inc.
f. McDonald, A. Y. Mfg. Co.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
h. Wilkins; a Zurn company.

2. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Matco-Norca, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Wilkins; a Zurn company.

2. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 125 psig minimum at 180 deg F.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

2.07 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.03 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

    a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

    a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage ports upstream and downstream from each line regulator.

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.04 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.05 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

3.06 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.07 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.08 LABELING AND IDENTIFYING

A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.09 PAINTING

A. Comply with requirements in Section 099113 "Exterior Painting" for painting exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

   a. Prime Coat: Alkyd anticorrosive metal primer.
   b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
   c. Topcoat: Exterior alkyd enamel.
   d. Color: Gray.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

D. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be the following:

1. Steel pipe with steel welding fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.

D. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

B. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, lubricated plug valve.

C. Valves in branch piping for single appliance shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.

2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

END OF SECTION 23 11 23

SECTION 23 31 13
METAL DUCTS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.03 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.04 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

D. Welding certificates.

E. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2: PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. Spiral Manufacturing Co., Inc.
f. No Substitutions.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.04 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation; Insulation Group.
b. Johns Manville.
c. Knauf Insulation.
d. Owens Corning.
e. No Substitutions.

2. Maximum Thermal Conductivity:

a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

a. Fan discharges.
b. Intervals of lined duct preceding unlined duct.

8. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.05 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.06 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3: EXECUTION

3.01 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling

equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire and / or smoke-rated interior partitions and exterior walls, install fire and / or dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.04 DUCT SEALING

A. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.05 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.06 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.07 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.08 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.09 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Dishwasher Exhaust Ducts: Stainless Steel.
2. Dryer Exhaust Ducts: Aluminum.
3. Kitchen Grease Exhaust Ducts: Carbon-Steel Sheets.

B. Supply Ducts:

1. Ducts Connected to Constant-Volume Air-Handling Units:

   a. Pressure Class: Positive 3-inch wg.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 6.
   d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Equipment Not Listed Above:

   a. Pressure Class: Positive 2-inch wg.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 6.
   d. SMACNA Leakage Class for Round and Flat Oval: 6.

C. Return Ducts:

1. Ducts Connected to Air-Handling Units:

   a. Pressure Class: Positive or negative 2-inch wg.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 6.
   d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Equipment Not Listed Above:

   a. Pressure Class: Positive or negative 2-inch wg.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 6.

d. SMACNA Leakage Class for Round and Flat Oval: 6.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Commercial Kitchen Hoods:

a. 16 gauge, Carbon-Steel Sheets.
b. Pressure Class: Positive or negative 3-inch wg.
c. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
d. Leakage Class: Liquid tight with light test.

3. Ducts Connected to Dishwasher Hoods:

a. Type 304, stainless-steel sheet.
b. Exposed to View: No. 4 finish.
c. Concealed: No. 2D finish.
d. Welded seams and flanged joints with watertight EPDM gaskets.
e. Pressure Class: Positive or negative 2-inch wg.
f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
g. SMACNA Leakage Class: 3.

4. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

2. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Galvanized.

3. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

F. Liner (Acoustical):

1. Return Air Ducts: Fibrous glass, Type I, 1 inch thick.
2. Exhaust Air Ducts: Fibrous glass, Type I, 1 inch thick.
3. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 1 inch thick.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

   a. Velocity 1000 fpm or Lower: 90-degree tap.
   b. Velocity 1000 to 1500 fpm: Conical tap.
   c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Control dampers.
3. Flange connectors.
4. Turning vanes.
5. Remote damper operators.
6. Duct-mounted access doors.

B. Related Requirements:

1. Section 233346 "Flexible Ducts" for insulated and non-insulated flexible ducts.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2: PRODUCTS

2.01 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and paint grip finish for exposed ducts.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inchminimum diameter for lengths 36 inches or less; 3/8-inchminimum diameter for lengths longer than 36 inches.

2.03 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Standard leakage rating, with linkage outside airstream.
2. Suitable for horizontal or vertical applications.
3. Frames:

    a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized-steel, 0.064 inchthick.

5. Blade Axles: Stainless steel.
6. Bearings:

    a. Oil-impregnated stainless-steel sleeve.
    b. Dampers in ducts with pressure classes of 3-inch wgor less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

1. Standard leakage rating, with linkage outside airstream.
2. Suitable for horizontal or vertical applications.
3. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:

   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.

5. Blade Axles: Stainless steel.
6. Bearings:

   a. Stainless-steel sleeve.
   b. Dampers in ducts with pressure classes of 3-inch wgor less shall have axles full length of damper blades and bearings at both ends of operating shaft.

2.04 CONTROL DAMPERS

A. Low-leakage rating**,** with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

B. Frames:

1. Hat shaped.
2. 0.125 inch extruded aluminum.
3. Mitered and welded corners.

C. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. Opposed-blade design.
3. Aluminum.
4. 0.0747-inch-thick dual skin.
5. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch-diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F

E. Bearings:

1. Molded synthetic.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.05 FLANGE CONNECTORS

A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

2.06 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Single wall.

E. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.07 REMOTE DAMPER OPERATORS

A. Description: Cable system designed for remote manual damper adjustment.

B. Cable: Stainless steel.

C. Wall-Box Mounting: Recessed.

D. Wall-Box Cover-Plate Material Stainless steel or PVC.

2.08 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
   d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.09 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

F. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Compliance with ASHRAE/IESNA 90.1-2004 includes Section 6.4.3.3.3 - "Shutoff Damper Controls," restricts the use of backdraft dampers, and requires control dampers for certain applications. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install duct security bars. Construct duct security bars from 0.164-inch steel sleeve, continuously welded at all joints and 1/2-inch-diameter steel bars, 6 inches o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch steel angle to 4 sides and both ends of sleeve. Connect duct

security bars to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. At drain pans and seals.
3. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
4. At each change in direction and at maximum 50-foot spacing.
5. Upstream from turning vanes.
6. Control devices requiring inspection.
7. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

O. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

P. Install duct test holes where required for testing and balancing purposes.

Q. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Inspect turning vanes for proper and secure installation.
4. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 33 46
FLEXIBLE DUCTS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Non-insulated flexible ducts.
2. Insulated flexible ducts.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For flexible ducts.

1. Include plans showing locations and mounting and attachment details.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from installers of the items involved.

PART 2: PRODUCTS

2.01 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."

D. Comply with ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

2.02 NON-INSULATED FLEXIBLE DUCTS

A. Non-Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wgnegative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.

2.03 INSULATED FLEXIBLE DUCTS

A. Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.

2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-Value: Comply with ASHRAE/IES 90.1 .

2.04 FLEXIBLE DUCT CONNECTORS

A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

B. Non-Clamp Connectors: Adhesive plus sheet metal screws.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.

C. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inchlengths of flexible duct clamped or strapped in place.

D. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

E. Install duct test holes where required for testing and balancing purposes.

F. Installation:

1. Install ducts fully extended.
2. Do not bend ducts across sharp corners.
3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
5. Install flexible ducts in a direct line, without sags, twists, or turns.

G. Supporting Flexible Ducts:

1. Suspend flexible ducts with bands 1-1/2 incheswide or wider and spaced a maximum of 48 inchesapart. Maximum centerline sag between supports shall not exceed 1/2 inchper 12 inches.
2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 incheso.c.

END OF SECTION 23 33 46

SECTION 23 34 13
AXIAL HVAC FANS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Tubeaxial fans.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, furnished specialties, and accessories for each fan.
2. Certified fan performance curves with system operating conditions indicated.
3. Certified fan sound-power ratings.
4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
5. Material thickness and finishes, including color charts.
6. Dampers, including housings, linkages, and operators.
7. Fan speed controllers.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

B. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For axial fans to include in emergency, operation, and maintenance manuals.

PART 2: PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. AMCA Compliance:

1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.

2. Operating Limits: Classify according to AMCA 99.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 TUBEAXIAL FANS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Twin City Fan

   b. Greenheck
   c. Loren cook.

B. Description: Fan wheel and housing, factory-mounted motor with direct drive, an inlet cone section, and accessories.

C. Housings: Steel with flanged inlet and outlet connections.

D. Wheel Assemblies: Cast aluminum, machined and fitted to shaft.

E. Accessories:
1. Swingout Construction: Assembly allowing entire fan section to swing out from duct for cleaning and servicing, of same material as housing.
2. Horizontal Support: Pair of supports bolted to fan housing, of same material as housing.
3. Vertical Support: Short duct section with welded brackets bolted to fan housing, of same material as housing.
4. Inlet Screen: Wire-mesh screen on fans not connected to ductwork, of same material as housing.
5. Shaft Seal: Elastomeric seal and Teflon wear plate, suitable for up to 300 deg F.

F. Factory Finishes:

1. Sheet Metal Parts: Prime coat before final assembly.
2. Exterior Surfaces: Baked-enamel finish coat after assembly.

2.03 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."

PART 3: EXECUTION

3.01 INSTALLATION

A. Install axial fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting:
1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

E. Install units with clearances for service and maintenance.

F. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.02 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.04 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

END OF SECTION 23 34 13

SECTION 23 34 16
CENTRIFUGAL HVAC FANS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes: For each product.

1. Airfoil centrifugal fans.
2. Backward-inclined centrifugal fans.
3. Forward-curved centrifugal fans.
4. Plenum fans.
5. Plug fans.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Include rated capacities, furnished specialties, and accessories for each fan.
2. Certified fan performance curves with system operating conditions indicated.
3. Certified fan sound-power ratings.
4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
5. Material thickness and finishes, including color charts.
6. Dampers, including housings, linkages, and operators.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

B. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

PART 2: PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. AMCA Compliance:

1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
2. Operating Limits: Classify according to AMCA 99.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 BACKWARD-INCLINED CENTRIFUGAL FANS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Twin City Fan.
   b. Greenheck
   c. Loren Cook.

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
3. Factory-installed and -wired disconnect switch.

C. Housings:

1. Formed panels to make curved-scroll housings with shaped cutoff.
2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
3. Horizontally split, bolted-flange housing.
4. Spun inlet cone with flange.
5. Outlet flange.

D. Backward-Inclined Wheels:

1. Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades, and fastened to shaft with set screws.
2. Welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate.

E. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Prelubricated and Sealed Shaft Bearings:

1. Self-aligning, pillow-block-type ball bearings.

G. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Companion Flanges: Rolled flanges for duct connections of same material as housing.
3. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
4. Spark-Resistant Construction: AMCA 99.

5. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.

2.03 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.04 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."

PART 3: EXECUTION

3.01 INSTALLATION

A. Install centrifugal fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting:
   1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

E. Install units with clearances for service and maintenance.

F. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.02 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   3. Verify that cleaning and adjusting are complete.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
   5. Adjust belt tension.

6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. See Section 230593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
10. Remove and replace malfunctioning units and retest as specified above.

D. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 23 34 16

SECTION 233713.13
AIR DIFFUSERS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Rectangular and square ceiling diffusers.
   2. Louver face diffusers.
   3. Linear slot diffusers.

B. Related Requirements:

   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
   2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   1. Ceiling suspension assembly members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   5. Duct access panels.

B. Source quality-control reports.

PART 2: PRODUCTS

2.01 RECTANGULAR AND SQUARE CEILING DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Titus.
   2. Metal aire
   3. Nailor
   4. Price.

B.

C. Devices shall be specifically designed for variable-air-volume flows.

D. Material: Steel.

E. Finish: Baked enamel, white.

F. Face Size: 24 by 24.

G. Face Style: Plaque.

H. Mounting: T-bar.

I. Pattern: Adjustable.

J. Accessories:
   1. Sectorizing baffles.

2.02 LOUVER FACE DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Titus.
   2. Metal aire
   3. Nailor
   4. Price.

B.

C. Devices shall be specifically designed for variable-air-volume flows.

D. Material: Steel.

E. Finish: Baked enamel, white.

F. Mounting: Surface.

G. Pattern: Adjustable core style.

H. Accessories:

   1. Square to round neck adaptor.
   2. Adjustable pattern vanes.
   3. Throw reducing vanes.
   4. Equalizing grid.

2.03 LINEAR SLOT DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Titus.
   2. Metal aire
   3. Nailor
   4. Price.

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material - Shell: Steel, insulated.

D. Material - Pattern Controller and Tees: Aluminum.

E. Finish - Face and Shell: Baked enamel, black.

F. Finish - Pattern Controller: Baked enamel, black.

G. Finish - Tees: Baked enamel, white.

H. Slot Width: 3/4 inch.

I. Number of Slots: Two.

J. Length: 48 inches.

K. Accessories: T-bar on both sides.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install diffusers level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

SECTION 233713.23
REGISTERS AND GRILLES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Fixed face registers and grilles.

B. Related Requirements:

   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
   2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified. Smallest size register and grille indicated.

C. Samples for Initial Selection: For registers and grilles with factory-applied color finishes. Smallest size register and grille indicated.

D. Samples for Verification: For registers and grilles, in manufacturer's standard sizes to verify color selected. Smallest size register and grille indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   1. Ceiling suspension assembly members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   5. Duct access panels.

B. Source quality-control reports.

PART 2: PRODUCTS

2.01 REGISTERS

A. Adjustable Blade Face Register :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Titus.

b. Metal aire
c. Nailor
d. Price.

2. Material: Steel, Aluminum, or Stainless steel.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
5. Core Construction: Integral.
6. Rear-Blade Arrangement: Vertical spaced 1/2 inchapart.
7. Frame: 1 inch wide.
8. Mounting: Countersunk screw.
9. Accessories:

a. Rear-blade gang operator.

B. Fixed Face Register:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Titus.
   b. Metal aire
   c. Nailor
   d. Price.
2. Material: Steel or Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
5. Face Arrangement: Perforated core.
6. Core Construction: Integral.
7. Frame: 1 inch wide.
8. Mounting: Countersunk screw.

2.02 GRILLES

A. Fixed Face Grille :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Titus.
   b. Metal aire
   c. Nailoi
   d. Price.
2. Material: Steel or Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal; spaced 1/2 inch apart.
5. Face Arrangement: Perforated core.
6. Core Construction: Integral.
7. Frame: 1 inchide.
8. Mounting: Countersunk screw or Lay in.

2.03 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 23 41 00
PARTICULATE AIR FILTRATION

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Pleated panel filters.
   2. Filter gages.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Provide one complete set(s) of filters for each filter bank. If system includes prefilters, provide only prefilters.
   2. Provide one container(s) of red oil for inclined manometer filter gage.

PART 2: PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance:

   1. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."
   2. Comply with ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.

B. Comply with NFPA 90A and NFPA 90B.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 PLEATED PANEL FILTERS

A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.

B. Filter Unit Class: UL 900, Class 1.

C. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.

1. Media shall be coated with an antimicrobial agent.
2. Separators shall be bonded to the media to maintain pleat configuration.
3. Welded-wire grid shall be on downstream side to maintain pleat.
4. Media shall be bonded to frame to prevent air bypass.
5. Support members on upstream and downstream sides to maintain pleat spacing.

D. Filter-Media Frame: Cardboard frame with perforated metal retainer sealed or bonded to the media.

E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
1. MERV Rating: 8 when tested according to ASHRAE 52.2.

2.03 FILTER GAGES

A. Diaphragm-type gage with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.

1. Diameter: 4-1/2 inches.
2. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1.0-Inch wg or Less: 0- to 1.0-inch wg.
3.

B. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

PART 3: EXECUTION

3.01 INSTALLATION

A. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

B. Install filters in position to prevent passage of unfiltered air.

C. Install filter gage for each filter bank.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

E. Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.

F. Coordinate filter installations with duct and air-handling-unit installations.

3.02 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Air filter will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.03 CLEANING

A. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 23 41 00

SECTION 23 51 23
GAS VENTS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Listed double-wall vents.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for product.

B. Shop Drawings: For vents.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of hangers and seismic restraints.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Sample Warranty: For special warranty.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents.

B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

PART 2: PRODUCTS

2.01 LISTED TYPE B AND BW VENTS

A. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B or 550 deg Fcontinuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.

B. Construction: Inner shell and outer jacket separated by at least a 1/4-inchairspace.

C. Inner Shell: ASTM A 666, Type 430 stainless steel.

D. Outer Jacket: Aluminized steel.

E. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.

2.02 LISTED TYPE L VENTS

A. Description: Double-wall metal vents tested according to UL 641 and rated for 570 deg F continuously or 1700 deg Ffor 10 minutes; with neutral or negative flue pressure complying with NFPA 211.

B. Construction: Inner shell and outer jacket separated by at least a 1-inchairspace filled with high-temperature, mineral-wool insulation.

C. Inner Shell: ASTM A 666, Type 304 stainless steel.

D. Outer Jacket: Aluminized steel.

E. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Round chimney top designed to exclude 98 percent of rainfall.

2.03 LISTED SPECIAL GAS VENTS

A. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg Fcontinuously, with positive or negative flue pressure complying with NFPA 211.

B. Construction: Inner shell and outer jacket separated by at least a 1/2-inchairspace.

C. Inner Shell: ASTM A 959, Type 29-4C stainless steel.

D. Outer Jacket: Aluminized steel.

E. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATION

A. Listed Type B and BW Vents: Vents for certified gas appliances.

B. Listed Type L Vent: Vents for low-heat appliances.

C. Listed Special Gas Vent: Condensing gas appliances.

3.03 INSTALLATION OF LISTED VENTS

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

B. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

C. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

D. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

E. Lap joints in direction of flow.

3.04 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

END OF SECTION 23 51 23

SECTION 235533.16
GAS-FIRED UNIT HEATERS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes gas-fired unit heaters.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of gas-fired unit heater.

1. Include rated capacities, operating characteristics, and accessories.

B. Shop Drawings: For gas-fired unit heaters. Include plans, elevations, sections, and attachment details.

1. Prepare by or under the supervision of a qualified professional engineer detailing fabrication and assembly of gas-fired unit heaters, as well as procedures and diagrams.
2. Design Calculations: Calculate requirements for selecting vibration isolatorsand for designing vibration isolation bases.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
4. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which equipment will be attached.
2. Items penetrating roof and the following:

   a. Vent and gas piping rough-ins and connections.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas-fired unit heaters to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.07 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace heat exchanger of gas-fired unit heater that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 MANUFACTURERS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Modine.
    b. Sterling
    c. Reznor

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 MANUFACTURED UNITS

A. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.

B. Gas Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

C. Type of Venting: Indoor, separated combustion, power vented.

D. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.

1. External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.
2. Discharge Louvers: Independently adjustable, horizontal blades.
3. Discharge Nozzle: Discharge at 25 to 65 degreesfrom horizontal.

E. Accessories:

1. Four-point suspension kit.
2. Power Venter: Centrifugal aluminized-steel fan, with stainless-steel shaft; 120-V ac motor.
3. Concentric, Terminal Vent Assembly: Combined combustion-air inlet and power-vent outlet with wall or roof caps. Include adapter assembly for connection to inlet and outlet pipes, and flashing for wall or roof penetration.

F. Heat Exchanger: Aluminized steel.

G. Burner Material: Aluminized steel with stainless-steel inserts.

H. Propeller Unit Fan:

1. Formed-steel propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.
2. Fan-Blade Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.

I. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Enclosure Materials: Rolled steel.

J. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

1. Gas Control Valve: Two stage.
2. Ignition: Electronically controlled electric spark with flame sensor.
3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
4. Vent Flow Verification: Flame rollout switch.
5. Control transformer.
6. High Limit: Thermal switch or fuse to stop burner.
7. Thermostat: Devices and wiring are specified in Section 230923.27 "Temperature Instruments."

8. Wall-Mounted Thermostat:

    a. Two stage.
    b. Fan on-off-automatic switch.
    c. 24-V ac.
    d. 50 to 90 deg F operating range.

K. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install and connect gas-fired unit heaters and associated gas and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written instructions.

3.02 EQUIPMENT MOUNTING

A. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to gas-fired unit heater, allow space for service and maintenance.

C. Gas Piping: Comply with Section 231123 "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.

D. Vent Connections: Comply with Section 235123 "Gas Vents."

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

    1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    2. Verify bearing lubrication.
    3. Verify proper motor rotation.
    4. Test Reports: Prepare a written report to record the following:

        a. Test procedures used.
        b. Test results that comply with requirements.
        c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Gas-fired unit heater will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.05 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gas-fired unit heaters.

END OF SECTION 235533.16

SECTION 237416.13
PACKAGED, LARGE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes packaged, large-capacity, rooftop air conditioning units (RTUs) with the following components and accessories:

1. Casings.
2. Fans.
3. Motors.
4. Coils.
5. Refrigerant circuit components.
6. Air filtration.
7. Gas furnaces.
8. Dampers.
9. Electrical power connections.
10. Controls.
11. Accessories
12. Roof curbs.

1.03 DEFINITIONS

A. DDC: Direct-digital controls.

B. ECM: Electronically commutated motor.

C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

D. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, large-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

E. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

F. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.04 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

1. Factory selection calculations for each antimicrobial ultraviolet lamp installation.

B. Shop Drawings:

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Include diagrams for power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which RTUs will be attached.
2. Wall openings.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) of filters for each unit.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 SYSTEM DESCRIPTION

A. AHRI Compliance:

1. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with AHRI 270 for testing and rating sound performance for RTUs.
3. Comply with AHRI 1060 for testing and rating performance for air-to-air exchanger.

B. AMCA Compliance:

1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
2. Damper leakage tested in accordance with AMCA 500-D.
3. Operating Limits: Classify according to AMCA 99.

C. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.

2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

E. NFPA Compliance: Comply with NFPA 90A or NFPA 90B.

F.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Daikin Applied
2. AAON
3. Trane
4. Carrier.
5.

2.03 CASINGS

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Double-Wall Construction: Fill space between walls with 1 inchfoam insulation and seal moisture tight for R-7 performance.

C. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.

D. Inner Casing Fabrication Requirements:

1. Inside Casing: G-90-coated galvanized steel, 0.034 inchthick.

E. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071, Type I.
2. Thickness: 1 inch.
3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

F. Condensate Drain Pans: Fabricated using stainless 0.025 inch thick steel sheet, a minimum of 2 inches deep, and complying with ASHRAE 62.1 for design and construction of drain pans.

1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
2. Drain Connections: Threaded nipple.

G. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.04 FANS

A. Supply-Air Fans: Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

1. Direct-Driven Supply-Air Fans: Motor shall be resiliently mounted in the fan inlet.

B. Condenser-Coil Fan: Variable-speed propeller, mounted on shaft of permanently lubricated ECM motors.

2.05 MOTORS

A. Comply with Section 230513 "Common Motor Requirements for HVAC Equipment" and the requirements of this Article.

B. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

C. Service Factor: 1.15.

D. Efficiency: Premium efficient.

2.06 COILS

A. Supply-Air Refrigerant Coil:

1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
2. Coil Split: Interlaced.
3. Condensate Drain Pan: Stainless steel formed with pitch and drain connections complying with ASHRAE 62.1.

B. Outdoor-Air Refrigerant Coil:

1. Aluminum plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.

C. Hot-Gas Reheat Refrigerant Coil:

1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
2. Suction-discharge bypass valve.

2.07 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: Two.

B. Compressor: Hermetic, variable speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief.

C. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.
10. Hot-gas reheat solenoid valve modulating with a replaceable magnetic coil.
11. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.08 AIR FILTRATION

A. Minimum arrestance and a minimum efficiency reporting value according to ASHRAE 52.2.

B. Pleated Panel Filters:

1. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.
2. Filter Unit Class: UL 900, Class 1.
3. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.
   a. Media shall be coated with an antimicrobial agent.
   b. Separators shall be bonded to the media to maintain pleat configuration.
   c. Welded-wire grid shall be on downstream side to maintain pleat.
   d. Media shall be bonded to frame to prevent air bypass.
   e. Support members on upstream and downstream sides to maintain pleat spacing.

2.09 GAS FURNACES

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.

1. CSA Approval: Designed and certified by and bearing label of CSA.

B. Burners: Stainless steel.

1. Fuel: Natural gas.
2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.

C. Heat-Exchanger and Drain Pan: Stainless steel.

D. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve.

E. Safety Controls:

1. Gas Control Valve: Modulating.
2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.10 DAMPERS

A. Outdoor- and Return-Air Mixing Dampers: Opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage or gears and interconnect so dampers operate simultaneously.

1. Leakage Rate: As required by ASHRAE/IES 90.1.
2. Damper Motor: Modulating with adjustable minimum position.
3. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IES 90.1, with bird screen and hood.

B. Barometric relief dampers.

2.11 ELECTRICAL POWER CONNECTIONS

A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.12 CONTROLS

A. Electronic Controller:

1. Controller shall have volatile-memory backup.
2. Safety Control Operation:

   a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
   b. Firestats: Stop fan and close outdoor-air damper if air greater than 130 deg Fenters unit. Provide additional contacts for alarm interface to fire alarm control panel.

c. Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Section 284621.11 "Addressable Fire-Alarm Systems."
d. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 deg F.

3. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
4. Unoccupied Period:

a. Heating Setback: Plus 10 deg F.
b. Cooling Setback: System off.
c. Override Operation: Two hours.

5. Supply Fan Operation:

a. Occupied Periods: Run fan continuously.
b. Unoccupied Periods: Cycle fan to maintain setback temperature.

6. Refrigerant Circuit Operation:

a. Occupied Periods: Cycle or stage compressors to match compressor output to cooling load to maintain discharge temperature and humidity. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
b. Unoccupied Periods: Cycle compressors and condenser fans for heating to maintain setback temperature.
c. Switch reversing valve for heating or cooling mode on air-to-air heat pump.

7. Hot-Gas Reheat-Coil Operation:

a. Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles compressor.
b. Unoccupied Periods: Reheat not required.

8. Gas Furnace Operation:

a. Occupied Periods: Modulate burner to maintain room temperature.
b. Unoccupied Periods: Cycle burner to maintain setback temperature.

9. Economizer Outdoor-Air Damper Operation:

a. Morning warm up, cool down, and building outdoor air flush cycles.
b. Occupied Periods: Open to 33 percent fixed minimum intake, and maximum 100 percent of the fan capacity. Controller shall permit air-side economizer operation when outdoor air is less than 60 deg F. Use mixed-air temperature and select between outdoor-air and return-air enthalpy to adjust mixing dampers. During economizer cycle operation, lock out cooling.
c. Unoccupied Periods: Close outdoor-air damper and open return-air damper.

10. Terminal-Unit Relays:

a. Provide heating- and cooling-mode changeover relays compatible with terminal control system required in Section 233600 "Air Terminal Units" and Section 230923 "Direct Digital Control (DDC) System for HVAC."

2.13 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

C. Remote potentiometer to adjust minimum economizer damper position.

D. Factory- or field-installed demand-controlled ventilation.

E. Safeties:

1. Smoke detector.
2. Condensate overflow switch.
3. Phase-loss protection.
4. High and low pressure control.
5. Gas furnace airflow-proving switch.

F. Hail guards of galvanized steel, painted to match casing.

G. Door switches to disable heating or reset set point when open.

H. Outdoor air intake weather hood with moisture eliminator.

2.14 ROOF CURBS

A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

a. Materials: ASTM C 1071, Type I or II.
b. Thickness: 2 inches.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

a. Liner Adhesive: Comply with ASTM C 916, Type I.
b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
d. Liner Adhesive: Comply with ASTM C 916, Type I.

B. Curb Dimensions: Height of 24 inches.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Roof Curb: Install on roof structure or concrete base, level and secure, according to AHRI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof

Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

B. Equipment Mounting:

1. Install RTUs on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete.
2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

3.03 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap and indirect connection to grade.

B. Install piping adjacent to RTUs to allow service and maintenance.

1. Gas Piping: Comply with applicable requirements in Section 231123 "Facility Natural-Gas Piping"Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

C. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
3. Install return-air duct continuously through roof structure.

D. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inchhigh.
3. Locate nameplate where easily visible.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. RTU will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

3.06 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 237416.13

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

PART 2: PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Alpha Wire.
2. Belden Inc.
3. Encore Wire Corporation.
4. General Cable Technologies Corporation.
5. Southwire Incorporated.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

2.02 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Gardner Bender.
3. Hubbell Power Systems, Inc.
4. Ideal Industries, Inc.
5. Ilsco; a branch of Bardes Corporation.
6. NSi Industries LLC.
7. O-Z/Gedney; a brand of the EGS Electrical Group.
8. 3M; Electrical Markets Division.
9. Tyco Electronics.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.03 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3: EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper.

B. Branch Circuits: Copper.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Feeders: Type THHN-2, THWN-2 copper, single conductors in raceway.

B. All branch circuits and control wiring: Type THHN-2, THWN-2, copper, single conductors in raceway.

C. Ground Wires: Copper only

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material .

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.05 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.08 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 05 19

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes: Grounding systems and equipment.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2: PRODUCTS

2.01 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding; if wood, use pressure-treated fir, cypress, or cedar.

D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.02 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.03 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet in diameter.

PART 3: EXECUTION

3.01 APPLICATIONS

A. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.02 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.03 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 12 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

3.04 LABELING

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.05 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.05 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.06 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2: PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3: EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" and Section 099600 "High Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.

1.03 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.04 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2: PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney; a brand of EGS Electrical Group.
6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company; a division of John Maneely Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. FMC: Comply with UL 1; zinc-coated steel or aluminum.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

   a. Material: Steel.
   b. Type: compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

I. Joint Compound for IMC, GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.
6. Condux International, Inc.
7. Electri-Flex Company.
8. Kraloy.
9. Lamson & Sessions; Carlon Electrical Products.
10. Niedax-Kleinhuis USA, Inc.
11. RACO; a Hubbell company.
12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company.
3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.04 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Mono-Systems, Inc.
   b. Panduit Corp.
   c. Wiremold / Legrand.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Hubbell Incorporated; Wiring Device-Kellems Division.
   b. Mono-Systems, Inc.
   c. Panduit Corp.
   d. Wiremold / Legrand.

2.05 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Adalet.
2. Cooper Technologies Company; Cooper Crouse-Hinds.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman; a Pentair company.
7. Hubbell Incorporated; Killark Division.
8. Kraloy.
9. Milbank Manufacturing Co.
10. Mono-Systems, Inc.
11. O-Z/Gedney; a brand of EGS Electrical Group.
12. RACO; a Hubbell Company.
13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.
15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
16. Thomas & Betts Corporation.
17. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

J. Gangable boxes are prohibited.

PART 3: EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: IMC.
3. Underground Conduit: RNC, Type EPC-80-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Unfinished area, Not Subject to Physical Damage: EMT.
2. Exposed, Finished area: Surface raceway.
3. Exposed and Subject to Severe Physical Damage: IMC.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 1/2-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install surface raceways only where indicated on Drawings.

3.02 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inchesof enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-footintervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from RNC to GRC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Surface Raceways:

1. Install surface raceway with a minimum 2-inchradius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations.

W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Z. Locate boxes so that cover or plate will not span different building finishes.

AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

CC. Set metal floor boxes level and flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.04 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.05 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.06 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 44
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

PART 2: PRODUCTS

2.01 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

   a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
   b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Advance Products & Systems, Inc.
   b. CALPICO, Inc.
   c. Metraflex Company (The).
   d. Pipeline Seal and Insulator, Inc.
   e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.03 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Presealed Systems.

2.04 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.05 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3: EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

    a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
    b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 05 44

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Identification of power and control cables.
2. Identification for conductors.
3. Underground-line warning tape.
4. Equipment identification labels.
5. Miscellaneous identification products.

1.03 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.04 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2: PRODUCTS

2.01 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.

2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE.

2.02 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.03 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.04 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3: EXECUTION

3.01 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Identify all junction boxes with panel name and circuits present in the box.

C. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

D. Apply identification devices to surfaces that require finish after completing finish work.

E. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

J. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded conductors.

a. Color shall be factory applied.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

C. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

D. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Install underground-line warning tape for cables in raceway.

E. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
e. Label all starters, equipment, RTU's, Chillers, etc with the panel name and circuits serving them.

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchboards.
e. Emergency system boxes and enclosures.
f. Enclosed switches.
g. Enclosed circuit breakers.
h. Enclosed controllers.
i. Variable-speed controllers.
j. Push-button stations.
k. Power transfer equipment.
l. Contactors.
m. Remote-controlled switches, dimmer modules, and control devices.
n. Battery-inverter units.
o. Power-generating units.
p. Monitoring and control equipment.

END OF SECTION 26 05 53

SECTION 260573.13
SHORT-CIRCUIT STUDIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.03 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.04 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Short-circuit study input data, including completed computer program input data sheets.
2. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.
    b. Revised single-line diagram, reflecting field investigation results and results of short-circuit study.

1.05 INFORMATIONAL SUBMITTALS

A. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.06 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Short-Circuit Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Short-Circuit Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2: PRODUCTS

2.01 COMPUTER SOFTWARE

A. Comply with IEEE 399 and IEEE 551.

B. Analytical features of fault-current-study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.02 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Comments and recommendations for system improvements, where needed.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data: As described in "Power System Data" Article in the Evaluations.

G. Short-Circuit Study Output:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. Calculated asymmetrical fault currents:

1) Based on fault-point X/R ratio.
2) Based on calculated symmetrical value multiplied by 1.6.
3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3: EXECUTION

3.01 EXAMINATION

A. Obtain all data necessary for the conduct of the study.

1. Verify completeness of data supplied on the one-line diagram. Call any discrepancies to the attention of Architect.
2. For equipment provided that is Work of this Project, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For relocated equipment and that which is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support the short-circuit study. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.

6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.02 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin short-circuit current analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To system low-voltage load buses where fault current is 10 kA or less.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:

1. Electric utility's supply termination point.
2. Incoming switchgear.
3. Unit substation primary and secondary terminals.
4. Low-voltage switchgear.
5. Motor-control centers.
6. Control panels.
7. Standby generators and automatic transfer switches.
8. Branch circuit panelboards.
9. Disconnect switches.

3.03 ADJUSTING

A. Make minor modifications to equipment as required to accomplish compliance with short-circuit study.

3.04 DEMONSTRATION

A. Train Owner's operating and maintenance personnel in the use of study results.

END OF SECTION 260573.13

SECTION 26 24 16
PANELBOARDS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.04 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

B. Infrared Scan results.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

1.07 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.08 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.09 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Finishes:

   a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   b. Back Boxes: Galvanized steel.

4. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.

2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.02 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents. Breakers shall be selected, as required to provide a complete selectively coordinated system, at no additional cost to the project.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
    e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
    f. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

B. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

B. Mount top of trim 90 inches above finished floor unless otherwise indicated.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install overcurrent protective devices and controllers not already factory installed.

    1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

H. Comply with NECA 1.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Perform the following infrared scan tests and inspections and prepare reports:
   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each Panelboard. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
   c. Instruments and Equipment:
      1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action. Include colored pictures of all devices scanned.

3.05 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated by the results of the coordination study.

END OF SECTION 26 24 16

SECTION 26 27 13
ELECTRICITY METERING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes equipment for electricity metering by utility company.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For electricity-metering equipment.

1. Dimensioned plans and sections or elevation layouts.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.05 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electrical service.

1.06 COORDINATION

A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:

1. Comply with requirements of utilities providing electrical power services.
2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2: PRODUCTS

2.01 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Meters will be furnished by utility company.

B. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.

C. Meter Sockets: Comply with requirements of electrical-power utility company.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

END OF SECTION 26 27 13

SECTION 26 27 26
WIRING DEVICES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Snap switches.

1.03 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

B. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.03 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide the following:

   a. Cooper; 5351 (single), CR5362 (duplex).
   b. Hubbell; HBL5351 (single), HBL5352 (duplex).
   c. Leviton; 5891 (single), 5352 (duplex).
   d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.04 GFCI RECEPTACLES

A. General Description:

1. Straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements**,** provide the following:

   a. Cooper; VGF20.
   b. Hubbell; GFR5352L.
   c. Pass & Seymour; 2095.
   d. Leviton; 7590.

2.05 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide the following:
   a. Single Pole:

      1) Cooper; AH1221.
      2) Hubbell; HBL1221.
      3) Leviton; 1221-2.
      4) Pass & Seymour; CSB20AC1.
   b. Two Pole:

      1) Cooper; AH1222.
      2) Hubbell; HBL1222.
      3) Leviton; 1222-2.
      4) Pass & Seymour; CSB20AC2.
   c. Three Way:

      1) Cooper; AH1223.
      2) Hubbell; HBL1223.
      3) Leviton; 1223-2.
      4) Pass & Seymour; CSB20AC3.
   d. Four Way:

1) Cooper; AH1224.
2) Hubbell; HBL1224.
3) Leviton; 1224-2.
4) Pass & Seymour; CSB20AC4.

2.06 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.07 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3: EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles.

3.03 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 26 27 26

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.03 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

B. Infrared Scan results.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.08 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2: PRODUCTS

2.01 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary contacts – for tie into elevator controller for interlock.

2.02 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

2.03 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.03 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
   c. Instruments and Equipment:
      1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies Enclosed Switches and circuit breakers included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action. Include colored pictures of all devices scanned.

END OF SECTION 26 28 16

SECTION 26 43 13
SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.03 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.02 SERVICE ENTRANCE SUPPRESSOR

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. SPDs: Comply with UL 1449, Type 2.

1. SPDs with the following features and accessories:
   a. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
   b. Indicator light display for protection status.
   c. Surge counter.

C. Comply with UL 1283.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 208Y/120 V.
3. Line to Line: 1000 V for 208Y/120 V.

F. SCCR: Equal or exceed 100 kA.

G. Inominal Rating: 20 kA.

2.03 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

2.04 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3: EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.02 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.03 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 26 43 13

SECTION 26 51 00
INTERIOR LIGHTING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Exit signs.
3. Lighting fixture supports.

1.03 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
4. Energy-efficiency data.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
4. Ceiling-mounted projectors.
5. Structural members to which suspension systems for lighting fixtures will be attached.
6. Other items in finished ceiling including the following:

    a. Air outlets and inlets.
    b. Speakers.
    c. Sprinklers.

d. Smoke and fire detectors.
e. Occupancy sensors.
f. Access panels.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.07 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

1.08 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.02 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

F. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.

d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
f. CCT and CRI for all luminaires.

2.03 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

2.04 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3: EXECUTION

3.01 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires**,** independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least twp independent support rods or wires from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.02 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

END OF SECTION 26 51 00

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Poles and accessories.

B. Related Sections:

1. Section 265100 "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.03 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. LER: Luminaire efficacy rating.

D. Luminaire: Complete lighting fixture, including ballast housing if provided.

E. Pole: Luminaire support structure, including tower used for large area illumination.

F. Standard: Same definition as "Pole" above.

1.04 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf, distributed as stated in AASHTO LTS-4-M.

C. Ice Load: Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4-M Ice Load Map.

D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles 50 feet high or less is 100 mph.

   a. Wind Importance Factor: 1.0.
   b. Minimum Design Life: 25 years.
   c. Velocity Conversion Factors: 1.0.

1.05 ACTION SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.

4. Luminaire materials.
5. Materials, dimensions, and finishes of poles.
6. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
7. Anchor bolts for poles.

1.06 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.08 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with IEEE C2, "National Electrical Safety Code."

D. Comply with NFPA 70 and all local ordinances.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

B. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.02 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

a. Color: As selected from manufacturer's standard catalog of colors.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

a. Color: Dark bronze.

2.03 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

2.04 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; one-piece construction up to 40 feet in height with access handhole in pole wall.

1. Shape: Round, tapered or Square, straight.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
3. Match pole material and finish.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

E. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

a. Color: As indicated by manufacturer's designations.

PART 3: EXECUTION

3.01 LUMINAIRE INSTALLATION

A. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

B. Adjust luminaires that require field adjustment or aiming

3.02 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches.
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
3. Trees: 15 feet from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

D. Raise and set poles using web fabric slings (not chain or cable).

3.03 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.04 GROUNDING

A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.05 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

END OF SECTION 26 56 00

SECTION 27 11 00
COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Telecommunications equipment racks and cabinets.
3. Grounding.

B. Related Requirements:

1. Section 271500 "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

1.03 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. LAN: Local area network.

C. RCDD: Registered Communications Distribution Designer.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

PART 2: PRODUCTS

2.01 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Hubbell Premise Wiring.

B. Wall-Mounted Racks: Modular-type, steel construction.
1. Provide wall mounted rack for patch panels

2.02 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with J-STD-607-A.

2.03 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3: EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

D. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.02 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-B, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.03 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.04 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.

D. Labels shall be preprinted or computer-printed type.

END OF SECTION 27 11 00

SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. UTP cabling.
2. Coaxial cable.
3. Multiuser telecommunications outlet assemblies.
4. Cable connecting hardware, patch panels, and cross-connects.
5. Telecommunications outlet/connectors.
6. Cabling system identification products.
7. Cable management system.

1.03 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

D. EMI: Electromagnetic interference.

E. IDC: Insulation displacement connector.

F. LAN: Local area network.

G. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.

H. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

I. RCDD: Registered Communications Distribution Designer.

J. UTP: Unshielded twisted pair.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For coaxial cable, include the following installation data for each type used:

   a. Nominal OD.
   b. Minimum bending radius.
   c. Maximum pulling tension.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. Cabling administration drawings and printouts.
3. Wiring diagrams to show typical wiring schematics, including the following:

    a. Cross-connects.
    b. Patch panels.
    c. Patch cords.

4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

1.06 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

B. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
    1. Test each pair of UTP cable for open and short circuits.

1.10 WARRANTY

A. Hubbell Certified installer to provide mission critical 25 year system warranty. Must provide test results using a level 3 tester, as built drawings

PART 2: PRODUCTS

2.01 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.
4. Splitters shall not be installed as part of the optical fiber cabling.

B. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

2.02 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Grounding: Comply with J-STD-607-A.

2.03 UTP CABLE

A. Basis of Design Manufacturer: Hubbell Premise Wiring

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following
1. Berk-Tek; a Nexans company.
2. CommScope, Inc.
3. Superior Essex Inc.

C. Description: 100-ohm, 4-pair UTP 6,
1. Hubbell #C6RPB for blue.
2. Comply with ICEA S-90-661 for mechanical properties.
3. Comply with TIA/EIA-568-B.1 for performance specifications.
4. Comply with TIA/EIA-568-B.2, Category 6e.
5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
   a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.

2.04 UTP CABLE HARDWARE

A. Basis of Design Manufacturer: Hubbell Premise Wiring

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Systemax.
2. Panduit Corp.

C. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
1. Number of Jacks per Field: One for each four-pair UTP cable indicated.
2. Hubbell #UDX48E

E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals. Hubbell #HXJ6B for blue, Hubbell #HXJ6Y for yellow, Hubbell #HXJ6GN for green, Hubbell #HXJ6OR for orange.

F. Patch Cords: Factory-made, 4-pair cables in 6 foot (provide 2/3 total quantity required) and 8 foot (provide 1/3 total quantity required) lengths; terminated with 8-position modular plug at each end. Provide a patch cord for each 4 pair cable termination.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.
3. Six Foot: Hubbell #HC606B for blue
4. Eight Foot: Hubbell #HC608B for blue

2.05 COAXIAL CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Alpha Wire Company.
2. Belden Inc.
3. Coleman Cable, Inc.
4. CommScope, Inc.
5. Draka Cableteq USA.

B. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

C. RG-6/U (plenum rated): NFPA 70, Type CATVP

1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
3. Jacketed with black PVC or PE.
4. Suitable for indoor installations.
5. Plenum Ceiling Rated

D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
1. Number of Jacks per Field: One for each Coaxial cable indicated.
2. Hubbell #UDX48E

E. Jacks and Jack Assemblies: Modular, F connector. Hubbell #SFFX.

F. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Plenum Rated: Type CATVP, complying with NFPA 262.

2.06 COAXIAL CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Emerson Network Power Connectivity Solutions.
2. Leviton Commercial Networks Division.
3. Siemon Co. (The).

B. Coaxial-Cable Connectors: Type F, 75 ohms.

C. Terminate cables in Mechanical room at splitter/amplifier

2.07 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.

B. Workstation Outlets: Four-port-connector assemblies mounted in single faceplate.

1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
2. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.
3. Legend: Machine printed, in the field, using adhesive-tape label.

2.08 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with J-STD-607-A.

2.09 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.10 SOURCE QUALITY CONTROL

A. Factory test UTP cables according to TIA/EIA-568-B.2.

B. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3: EXECUTION

3.01 WIRING METHODS

A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal pathways and cables except in unfinished spaces.

1. Install plenum cable in all areas.

B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
2. Install lacing bars and distribution spools.
3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.02 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.03 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-B, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.04 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.05 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Administration Class: 1.
2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.

C. Cable and Jack Colors shall be as follows:
1. Data = Blue

D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

F. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.06 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

4. UTP Performance Tests:

a. Test for each outlet. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:

1) Wire map.
2) Length (physical vs. electrical, and length requirements).
3) Insertion loss.
4) Near-end crosstalk (NEXT) loss.
5) Power sum near-end crosstalk (PSNEXT) loss.
6) Equal-level far-end crosstalk (ELFEXT).
7) Power sum equal-level far-end crosstalk (PSELFEXT).
8) Return loss.
9) Propagation delay.
10) Delay skew.

5. Coaxial Cable Tests: Conduct tests according to Section 274133 "Master Antenna Television System."
6. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.

a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 27 15 00

SECTION 28 31 11
DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Remote annunciator.
7. Addressable interface device.
8. Digital alarm communicator transmitter.
9. Radio alarm transmitter.

1.03 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.04 SYSTEM DESCRIPTION

A. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire-alarm system design.

1.06 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

   a. Frequency of testing of installed components.
   b. Frequency of inspection of installed components.
   c. Requirements and recommendations related to results of maintenance.
   d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.09 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. GAMEWELL; a Honeywell company.
2. NOTIFIER; a Honeywell company.
3. Silent Knight; a Honeywell company.
4. Firelite
5. Simplex

2.02 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.
6. Heat detectors in elevator shaft and pit.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Recall elevators to primary or alternate recall floors.
6. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Elevator shunt-trip supervision.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.03 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
b. Include a real-time clock for time annotation of events on the event recorder and printer.

2. Addressable initiation devices that communicate device identity and status.

a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.

2. Serial Interfaces: Two RS-232 ports for printers.

D. Notification Appliance Circuit: Operation shall sound in a temporal pattern.

E. Elevator Recall:

1. Smoke detectors at the following locations shall initiate automatic elevator recall.

a. Elevator lobby detectors except the lobby detector on the designated floor.
b. Smoke detector in elevator machine room.
c. Smoke detectors in elevator hoistway.

2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

F. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

G. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station. Verify if phone connection or radio connection is required by the AHJ.

I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

J. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

K. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.04 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.

2.05 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated **and power-on status**.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

   a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
   b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
   c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.

e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

3. Each sensor shall have multiple levels of detection sensitivity.
4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
5. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.06 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.07 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output:
   a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

2.08 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.09 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall to circuit-breaker shunt trip for power shutdown.

2.10 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.11 RADIO ALARM TRANSMITTER

A. Transmitter shall comply with NFPA 1221 and shall be listed and labeled by an NRTL.

B. Comply with 47 CFR 90.

C. Description: Manufacturer's standard commercial product; factory assembled, wired, tested, and ready for installation and operation.

1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
3. Normal Power Input: 120-V ac.
4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
5. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.

D. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:

1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
6. Local Fire-Alarm-System Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

PART 3: EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

C. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.

3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix Ain NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

F. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

G. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

3.02 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated air-conditioning duct systems.
4. Alarm-initiating connection to elevator recall system and components.
5. Alarm-initiating connection to activate emergency lighting control.
6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
9. Supervisory connections at elevator shunt trip breaker.
10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
11. Supervisory connections at fire-pump engine control panel.

3.03 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.04 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.05 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

   a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
   b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 28 31 11

SECTION 31 10 00 - SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removing surface debris.
   2. Excavating topsoil.

B. Related Sections:
   1. Section 02 41 16 - Structure Demolition: Removing underground storage tanks and designated utilities.
   2. Section 31 22 13 - Rough Grading.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Areas for temporary construction and field offices

1.3 REFERENCES

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

1.4 QUALITY ASSURANCE

A. Conform to applicable code for environmental requirements, disposal of debris, burning debris on site, and use of herbicides.

B. Perform Work in accordance with IEPA, NPDES and Municipalities.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify existing plant life designated to remain is tagged or identified.

3.2 PREPARATION

A. Call Municipality and J.U.L.I.E. for Utility Line Information service not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.
   2. Contact Private Utility Locator for location of Private utilities not Located by Municipality or J.U.L.I.E.

3.3 PROTECTION

A. Protect utilities indicated to remain, from damage.

B. Protect trees, plant growth, and features designated to remain, as final landscaping per plans.

C. Protect bench marks, survey control points, and existing structures from damage or displacement.

3.4 CLEARING

A. Per SSRB Section 201

3.5 REMOVAL

A. Per SSRB Section 201

B. Do Not Disrupt Public Utilities without permit from agency having jurisdiction.

C. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

D. Do not burn or bury materials on site. Leave site in clean condition.

3.6 TOPSOIL EXCAVATION

A. Excavate topsoil from project area without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site.

D. Remove excess topsoil not intended for reuse, from site.

END OF SECTION

SECTION 312213 - ROUGH GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cutting, grading, filling, rough contouring, compacting, site for building pads.

B. Related Sections:
   1. Section 311000 - Site Clearing: Excavating topsoil.
   2. Section 312317 - Trenching: Trenching and backfilling for utilities.
   3. Section 329119 - Landscape Grading: Finish grading with topsoil to contours.

1.2 REFERENCES

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

   1. Sections 205 Embankment and Section 204 Borrow and Furnished Excavation

1.3 QUALITY ASSURANCE

B. Perform Work in accordance with Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB) Sections 204 and 205

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials per Section 205 SSRB

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

A. Call J.U.L.I.E. Line Information service at 1-800-892-0123 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Protect utilities indicated to remain from damage.

D. Protect plant life, lawns, and other features remaining as portion of final landscaping.

E. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 EXCAVATION

A. Excavate material per Section 204 SSRB

3.4 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Place fill material in conformance with Section 205 SSRB

C. Repair or replace items indicated to remain damaged by excavation or filling.

3.5 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

3.6 FIELD QUALITY CONTROL

A. Compact Material as specified in Section 205.06 SSRB

B. Structural Fill: In Conformance with Section 205 SSRB

END OF SECTION 312213

SECTION 312316 - EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavating for paving, roads, and parking areas.
   2. Excavating for slabs-on-grade.
   3. Excavating for landscaping.

B. Related Sections:
   1. Section 312213 - Rough Grading: Topsoil and subsoil removal from site surface.
   2. Section 312317 - Trenching: Excavating for utility trenches.
   3. Section 312323 - Fill.

1.2 REFERENCES

A. IEPA and Municipal Standards for Soil Erosion and Sediment Control.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with State and Municipal Department of Public Work's standard.

PART 2 - PRODUCTS

2.1 Not Used.

PART 3 - EXECUTION

3.1 PREPARATION

A. Call J.U.L.I.E. Utility Line Information service at 811 not less than three working days before performing Work.

B. Identify required lines, levels, contours, and datum locations.

C. Unclassified Excavation
   1. All suitable material removed in the excavation shall be used as far as practicable in the formation of embankments, subgrades, and shoulders and at such other places as may be indicated on the drawings or as directed by the Engineer.
   2. The Engineer will designate materials that are unsuitable.

3. The Contractor shall furnish disposal areas for the unsuitable and/or excess material excess material except where the Engineer permits the use of such material in the widening or flattening of fill slopes.

D. Undercut Excavation

1. When the Engineer determines that the native soil materials in areas where fills are to be placed are undesirable in their location or condition, the Engineer may require the Contractor to remove the undesirable material and backfill with approved material properly compacted.
2. When the Engineer determines that the finished graded cross-section contains materials which are undesirable in their location or condition, the Engineer may require the Contractor to remove the undesirable material and backfill with approved material properly compacted to the finished graded section.
3. Contractor shall conduct undercut operations such that excavation and hauling operations cause the lease disturbance and destruction to the unstable and surrounding subgrade materials.
4. Cost for undercuts shall include sawcut and removal of pavement (if any), removal of unsuitable material to the satisfaction of Engineer and placement of backfill materials including stone or other suitable fill material as determined by Engineer. Contractor shall remove all unsuitable material from site.

3.2 EXCAVATION

A. Excavate to accommodate paving and construction operations.

B. Slope banks with machine to angle of repose or less until shored.

C. Grade top perimeter of excavation to prevent surface water from draining into excavation.

D. Trim excavation. Remove loose matter.

E. Notify Architect/Engineer of unexpected subsurface conditions.

F. Correct areas over excavated as specified in Section 312323.

G. Remove unsuitable material from site.

H. Remove excavated material from site.

I. Stockpile excavated material to be re-used in area designated on site in accordance with Section 312200.

3.3 FIELD QUALITY CONTROL

A. Request visual inspection of bearing surfaces by Geotechnical Engineer or inspection agency before installing subsequent work.

3.4 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION 312316

SECTION 312316.13 - TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating trenches for utilities from 5 feet outside building to utility service.
2. Compacted fill from top of utility bedding to subgrade elevations.
3. Backfilling and compaction.

B. Related Sections:
1. Section 312213 - Rough Grading: Topsoil and subsoil removal from site surface.
2. Section 312323 - Fill: General backfilling.
3. Section 329119 - Landscape Grading: Filling of topsoil over backfilled trenches to finish grade elevation.
4. Section 334100 - Storm Utility Drainage Piping: Storm sewer piping and bedding from building to utility service.

1.2 REFERENCES

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

B. Municipal Subdivision and Development Control Regulations.

1.3 SUBMITTALS

A. Section 013000 – Administrative Requirements for Submittals.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Municipality

B. Perform work in conformance with Section 542.04 SSRB

1.5 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Per Section 312323 Fill and Per Section 542.04 SSRB

B. Granular Fill: Per Sections 1003.04 SSRB and 542.04 SSRB

PART 3 - EXECUTION

3.1 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION

A. Call J.U.L.I.E. Line Information service at 1-800-892-0123 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 TRENCHING

A. Trenching as Specified in Section 542.04 a & b, SSRB

3.4 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. Backfill trenches per Section 542.04 of SSRB

3.5 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

C. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.6 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

3.7 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION 312316.13

SECTION 312323 - FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Section 312213 - Rough Grading: Site filling.
   2. Section 312316 - Excavation.
   3. Section 312317 - Trenching: Backfilling of utility trenches.
   4. Section 329119 - Landscape Grading: Filling of topsoil and to finish grade elevation.

1.2 REFERENCES

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

1.3 QUALITY ASSURANCE

B. Perform Work in accordance with Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Fill Materials: Per Section 205 SSRB

2.2 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

2.3 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Preparation of existing ground surface per Section 205.03 SSRB

D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

2.4 BACKFILLING

A. Backfill areas to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Place fill material in conformance with Section 205.04 SSRB

D. Employ placement method that does not disturb or damage other work.

E. Maintain optimum moisture content of backfill materials to attain required compaction density.

F. Make gradual grade changes. Blend slope into level areas.

G. Remove surplus backfill materials from site.

H. Leave fill material stockpile areas free of excess fill materials.

2.5 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling: Plus or minus 1 inch from required elevations.

C. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

D. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

2.6 FIELD QUALITY CONTROL

A. Compact material as specified in Section 205.06 SSRB.

B. Proof roll compacted fill surfaces under paving.

2.7 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic.

2.8 SCHEDULE

A. Fill in conformance with Section 205 SSRB.

END OF SECTION 312323

SECTION 32 11 23 - AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Aggregate base course.
2. Paving aggregates.

B. Related Sections:
1. Section 31 22 00 - Grading: Preparation of site for base course.
2. Section 31 23 16.13 - Trenching: Compacted fill over utility trenches under base course.
3. Section 31 23 23 - Fill: Topsoil fill at areas adjacent to aggregate base course.
4. Section 31 23 23 - Fill: Compacted fill under base course.
5. Section 32 12 16 - Asphalt Paving: Binder and finish asphalt courses.
6. Section 32 13 13 - Concrete Work: Finish concrete surface course.
7. Section 33 05 13 - Manholes and Structures: Manholes including frames.
8. Section 31 22 13 - Rough Grading: Preparation of site for base course.

1.2 REFERENCES

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Compaction Density Test Reports

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

PART 2 PRODUCTS

2.1 AGGREGATE MATERIALS

A. Subbase Granular Material: CA6 SSRBC Section 311.

B. Base Aggregate: CA6 SSRBC Section 351, Type B

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting. SSRBC Section 301.

B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.3 DELIVERY STORAGE AND HANDLING

A. When necessary, store materials onsite in advance of need.

B. When aggregate materials need to be stored on site, locate stockpiles in a location away from vehicle and pedestrian traffic and to minimize disturbance.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

3.4 SEQUENCING AND SCHEDULING

A. Schedule, sequence and coordinate the work of this section, and prior and subsequent portions of the work, in accordance with the requirements of Section 01 32 00 – Construction Scheduling.

3.5 INSTALLATION SSRBC 351

A. Under Bituminous Concrete Paving

B. Under Portland Cement Concrete Paving

C. Place aggregate in maximum 4 inch layers and roller compact to specified density.

D. Level and contour surfaces to elevations and gradients indicated.

E. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

F. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

G. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.6 TOLERANCES

A. Flatness: Maximum variation of ¼ inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 90% as specified on plans.

C. Variation From Design Elevation: Within ½ inch.

3.7 FIELD QUALITY CONTROL

A. See Section 01 40 00- Quality Control.

B. Compaction density testing will be performed on compacted aggregate base course in accordance with SSRBC Section 351.

C. If test indicate work does not meet specified requirements, remove work, replace and retest.

D. Proof roll compacted aggregate at all surfaces.

3.8 CLEANING

A. Remove unused stockpiled materials; leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Asphalt materials.
2. Aggregate materials.
3. Aggregate subbase.
4. Asphalt paving base course, binder course, and wearing course.
5. Asphalt paving overlay for existing paving.

B. Related Requirement:
1. Section 312213 - Rough Grading: Preparation of site for paving and base.
2. Section 312323 - Fill: Compacted subbase for paving.
3. Section 321123 - Aggregate Base Courses: Compacted subbase for paving.
4. Section 321713 - Parking Bumpers: Concrete bumpers.
5. Section 321723 - Pavement Markings: Painted pavement markings, lines, and legends.

1.2 REFERENCE STANDARDS

A. Illinois Department of Transportation: Standard Specifications for Road and Bridge Construction (SSRB).

B. Municipal Subdivision and Development Control Regulations.

1.3 SUBMITTALS

A. Product Data:

1. Submit product information for asphalt and aggregate materials.
2. Submit mix design with laboratory test results supporting design.

1.4 QUALITY ASSURANCE

A. Mixing Plant: Certified by State.

B. Obtain materials from same source throughout.

C. Perform Work in accordance with State SSRB and Municipality.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 3 years' experience.

1.6 AMBIENT CONDITIONS

A. As specified in Section 406.06B SSRB.

PART 2 - PRODUCTS

2.1 ASPHALT PAVING

A. Performance / Design Criteria:

1. Paving: Design as specified on plans.

B. Asphalt Materials:

1. HMA: As specified in Section 1030 SSRB.
2. Primer: Per Section 406.02 SSRB.
3. Tack Coat: Per Section 406.02 SSRB.

C. Aggregate Materials:

1. Coarse Aggregate: Per Section 1004.03 SSRB.
2. Fine Aggregate: Per Section 1003.03 SRRB.

D. Aggregate Subbase: As specified in Geotechnical Report.

2.2 MIXES

A. Per Section 1030 SSRB.

2.3 ACCESSORIES

2.4 SOURCE QUALITY CONTROL

A. Submit proposed mix design for review prior to beginning of Work.

B. Test samples in accordance with independent testing and inspection professional services firm to be engaged by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.

B. Verify compacted subbase is dry and ready to support paving and imposed loads.

1. Proof roll subbase in conformance with recommendations from Geotechnical Engineer
2. Remove soft subbase and replace with compacted fill as specified in Section 312323.

C. Verify gradients and elevations of base are correct.

D. Verify manhole frames and lids are installed in correct position and elevation.

3.2 PREPARATION

A. Section 358 of SSRB.

3.3 DEMOLITION

A. As specified in Section 406.05 SSRB.

3.4 INSTALLATION

A. Subbase:

1. Aggregate Subbase: Install as specified in Section 358.04 SSRB.

B. Primer:

1. Apply primer in accordance with Section 406.05 SSRB.

C. Double Course Asphalt Paving: as specified in Section 406.05 SSRB.

3.5 TOLERANCES

A. Variation from Indicated Elevation: Within 1inch.

3.6 FIELD QUALITY CONTROL

A. Take samples and perform tests in conformance with recommendations from independent testing and inspection professional services firm.

3.7 PROTECTION

A. Immediately after placement, protect paving from mechanical injury until they have hardened to the satisfaction of independent testing and inspection professional services firm.

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete paving for:
      a. Concrete sidewalks.
      b. Concrete curbs and gutters.
      c. Concrete parking areas and roads.

B. Related Requirements:
   1. Section 312213 - Rough Grading: Preparation of site for paving.
   2. Section 312323 - Fill: Compacted sub-base for paving.
   3. Section 329119 - Landscape Grading: Preparation of subsoil at pavement perimeter.

1.2 REFERENCE STANDARDS

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

1.3 SUBMITTALS

A. Section 013000 – Administrative Requirements.

1.4 QUALITY ASSURANCE

A. Obtain cementitious materials from same source throughout.

B. Perform Work according to Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB) Sections 420, 421, 423, 424.

PART 2 - PRODUCTS

2.1 AGGREGATE SUBGRADE

A. As Specified on Plans.

2.2 CONCRETE PAVING

A. Form Materials:

1. Form Materials: as Specified in Sections 420.06 and 423.05 SSRB

B. Reinforcement:

1. Reinforcing Steel and Wire Fabric: as Specified on Plans.

C. Concrete Materials:

1. Concrete Materials: as Specified in Sections 420.02 and 424.02 SSRB

2.3 MIXES

A. Concrete Mix: As Specified in Section 1020 SSRB

1. Mix and deliver concrete according to Sections 420.02 and 424.02 SSRB

2.4 FINISHES

A. Finishes: As Specified in Section 420.09 and 424.06 SSRB

PART 3 - EXECUTION

3.1 PREPARATION

A. Preparation: As Specified in Sections 420.04 and 424.06 SSRB

3.2 INSTALLATION

A. Installation: As Specified in Sections 420.07 and 424.06 SSRB

B. Forms: As Specified in Sections 420.06 and 424.05 SSRB

C. Reinforcement: As Specified on Plans.

D. Placing Concrete: As Specified in Sections 420.07 and 424.06 SSRB

E. Joints: As Specified in Sections 420.05 and 424.07 SSRB

F. Finishing: As Specified in Sections 420.09 and 424.06 SSRB

G. Curing and Protection

1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
3. Cure concrete surfaces as specified in Section 1020.13 SSRB.

H. Backfilling for Sidewalks: As Specified in Section 424.10 SSRB

3.3 FIELD QUALITY CONTROL

A. Perform field testing as Specified in Section 1020.09 SSRB.

3.4 PROTECTION

A. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Curing as Specified in Section 1020.13 SSRB

END OF SECTION 321313

SECTION 321623 - SIDEWALKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete paving for sidewalks.

B. Related Requirements:
   1. Section 099000 - Painting and Coating: Pavement markings.
   2. Section 312213 – Rough Grading: Preparation of Site for paving and base subgrade.
   3. Section 312323 - Fill: Compacted subgrade for paving.

1.2 REFERENCE STANDARDS

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction. (SSRB)

1.3 SUBMITTALS

A. Section 013000 – Administrative Requirements for submittals.

1.4 QUALITY ASSURANCE

A. Obtain cementitious materials from same source throughout.

B. Perform Work according to Illinois Department of Transportation Standard Specifications for Road and Bridge Construction Section 424 (SSRB)

PART 2 - PRODUCTS

2.1 SUBGRADE

A. As specified on plans.

2.2 MATERIALS

A. Forms:

   1. Description: As specified in Section 423.05 SSRB
   2. Height: Equal to full depth of finished sidewalk.

B. Concrete:

1. Concrete Materials:

a. As specified in Section 424.02 SSRB

2.3 MIXES

A. Concrete: As specified in Section 1020 SSRB

B. Concrete Mix:

1. Mix and deliver concrete according to Section 424.02 and 1020 SSRB

2.4 FINISHES

A. Finishes as specified in Section 424.06 SSRB

PART 3 - EXECUTION

3.1 PREPARATION

A. Preparation as specified in Section 424.06 SSRB

3.2 INSTALLATION

A. Installation as Specified in Section 424.06 SSRB

B. Forms: As Specified ins Section 424.05 SSRB

C. Placing Concrete: As Specified in Section 424.06 SSRB

D. Joints: As Specified in Section 424.07 SSRB

E. Finishing: As Specified in Section 424.06 SSRB

F. Curing: As Specified in Section 1020.13 SSRB

G. Backfilling: As Specified in Section 424.10 SSRB

3.3 FIELD QUALITY CONTROL

A. Inspection and Testing: as Specified in Section 1020.09 SSRB

3.4 PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, rain and flowing water, and mechanical injury.

B. Curing: As Specified in Section 1020.13 SSRB

C. Damaged Concrete:

1. Remove and reconstruct concrete that has been damaged for entire length between scheduled joints.
2. Refinishing damaged portion is not acceptable.
3. Dispose of damaged portions.

END OF SECTION

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Traffic lines and markings.
2. Paint.

B. Related Requirements:

1. Section 321216 - Asphalt Paving: Asphalt paving for roads, parking areas, and sidewalks.
2. Section 321313 - Concrete Paving: Concrete paving for roads, parking areas, and sidewalks.

1.2 REFERENCE STANDARDS

A. MUTCD – Manual on Uniform Traffic Control Devices

B. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

1.3 QUALIFICATIONS

A. Applicator: Company specializing in performing Work of this Section with minimum three years' experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Storage:

1. According to manufacturer instructions.
2. Paint:

a. Invert containers several days prior to use if paint has been stored more than two months.
b. Minimize exposure to air when transferring paint.
c. Seal drums and tanks when not in use.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.5 AMBIENT CONDITIONS

A. Ambient Conditions as Specified in Section 780 SSRB.

PART 2 - PRODUCTS

2.1 PAINTED PAVEMENT MARKINGS

A. Paint: As Specified in Section 780.06 SSRB

B. Thermoplastic Compound: As Specified in Section 780.05 SSRB

C. Preformed Plastic and Thermoplastic: As Specified in Section 780.07 and 780.08 SSRB

2.2 APPLICATION EQUIPMENT

A. Equipment As Specified in Section 780.03, 1105.01 (a), 1105.01 (b)

PART 3 - EXECUTION

3.1 PREPARATION

A. Preparation as Specified in Section 780.04 SSRB

3.2 DEMOLITION

A. Demolition as Specified in Section 783 SSRB

B. Do not remove existing pavement markings by painting over with blank paint.

3.3 APPLICATION

A. Application Rate: As Specified in Section 780 SSRB, 780.05, 780.06, 780.07, 780.08

3.4 FIELD QUALITY CONTROL

A. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.

B. Acceptance:

1. Repair lines and markings which after application and curing do not meet following criteria:

a. Incorrect location.
b. Insufficient thickness, width, coverage, or retention.
c. Uncured or discolored material.
d. Insufficient bonding.

3.5 CLEANING

A. Collect and legally dispose of residues from painting operations.

3.6 PROTECTION

A. Protect painted pavement markings from vehicular and pedestrian traffic until paint is dry and track free.

B. If vehicle crosses a marking and tracks it, or if splattering or overspray occurs, eradicate affected marking and resultant tracking and apply new markings.

C. Barrier cones are satisfactory protection for materials being dried.

3.7 ATTACHMENTS

A. Pavement Markings: As Specified on Plans

END OF SECTION 321723

SECTION 32 31 13 - CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Concrete foundation for posts and center drop for gates.
4. Manual gates and related hardware.
5. Privacy slats.

B. Related Sections:
1. Section 03 30 00 Cast in place concrete.

1.2 REFERENCES

A. ASTM International:
1. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
4. ASTM F552 - Standard Terminology relating to Chain Link Fencing.
5. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
6. ASTM F626 - Standard Specification for Fence Fittings.
7. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
8. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
9. ASTM F1184 - Standard Specification for Industrial and Commercial Horizontal Slide Gates.

B. Chain Link Fence Manufacturers Institute:
1. CLFMI - Product Manual.

1.3 SYSTEM DESCRIPTION

A. Fence Height: 6 feet as indicated on Drawings.

B. Line Post Spacing: At intervals not exceeding 10 feet.

C. Fence Post and Rail Strength: Conform to ASTM F1043 Light Industrial Fence quality.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

C. Product Data: Submit data on fabric, posts, accessories, fittings and hardware.

D. Manufacturer's Installation Instructions: Submit installation requirements, post foundation anchor bolt templates.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines.

C. Operation and Maintenance Data: Procedures for submittals.

1.6 QUALITY ASSURANCE

A. Supply material in accordance with CLFMI - Product Manual.

B. Perform installation in accordance with ASTM F567.

C. Perform Work in accordance with Village of Oswego and CLFMI Standards.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 3 years documented experience approved by manufacturer.

1.8 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

C. Identify each package with manufacturer’s name.

D. Store fence fabric and accessories in secure and dry place.

PART 2 PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Materials and Components: Conform to CLFMI Product Manual.

B. Fabric Size: CLFMI Light Industrial service.

C. Intermediate Posts: Type I round.

D. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round.

E. Concrete: Type specified in Section 03 30 00.

2.2 COMPONENTS

A. Line Posts: 2.38 inch diameter.

B. Corner and Terminal Posts: 2.88 inch.

C. Gate Posts: 4.0 inch diameter.

D. Top, Bottom and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.

E. Gate Frame: 1.66 inch diameter for fittings and truss rod fabrication.

F. Fabric: 2 inch diamond mesh interwoven wire, 6 gage thick, top salvage bottom selvage twisted tight.

G. Tension Wire: 6 gage thick steel, single strand, marcelled, spiraled or crimped, aluminum-coated tension wire conforming to ASTM A824.

H. Tension Band: 3/16 inch thick steel.

I. Tension Strap: 3/4 inch thick steel.

J. Tie Wire: Aluminum alloy steel wire.

2.3 ACCESSORIES

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; galvanized steel.

C. Hardware for Single Swinging Gates (If needed): 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; fork latch with gravity drop and padlock hasp; keeper to hold gate in fully open position.

D. Hardware for Double Swinging Gates (If needed): 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; drop bolt on inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.

2.4 GATES

A. General:
   1. Gate Types, Opening Widths and Directions of Operation: As indicated on Drawings.
   2. Factory assemble gates.
   3. Design gates for operation by one person.

B. Swing Gates:
   1. Fabricate gates to permit 180 degree swing.

C. Sliding Gates:
   1. Framing and Posts: ASTM F1184, Class 2 for internal rollers.
   2. Rollers for overhead and cantilever sliding gates: Bearing type. Furnish non-sealed bearings with grease fitting for periodic maintenance.

3. Secure rollers to post or frame without welding.

D. Cantilever Sliding Gates:
1. Fabricate gate leaf frames and tracks of aluminum conforming to ASTM B429/B429M alloy 6063-T6 or as required to meet performance requirements of ASTM F1184.
2. Frame Members: Minimum 2 inches (50 mm) 0.91 lb/ft (1.4 g/mm) aluminum tubing welded assembly forming rigid, one piece unit.
3. Install fabric securely stretched and held in center of tubing.
4. Brace cantilever overhang frames with 3/8 inch (10 mm) brace rods. For gate leaf sizes greater than 23 feet (7 m), fabricate with additional lateral support rail welded adjacent to top and bottom horizontal rails.
5. Provide minimum overhang for each leaf opening size as follows:

Opening	Overhang
Up to 10’-0” (3.0 m)	6’-6” (2.0 m)
10’-0” -14’-0” (3.0 m - 4.3 m)	7’-6” (2.3 m)
14’-1” -22’-0” (4.4 m - 6.7 m)	10’-0” (3.0 m)
22’-1” - 30’-0” (6.8 - 9.1 m)	12’-0” (3.7 m)

6. Track: Combined, integral track and rail.
7. Rail: Aluminum extrusion; minimum total weight of 3.72 lb/ft (5.5 g/mm); designed to withstand reaction load of 2,000 lbs (910 kg).
8. Roller Track Assembly: Two swivel type, zinc, die cast trucks having four, sealed lubricant ball bearing wheels minimum 2 inches (50 mm) diameter by 9/16 inches (14 mm) width designed for same reaction load as rail. Provide two side-rolling wheels for each gate leaf to maintain alignment of truck in track.
9. Fasten trucks to post brackets by minimum 7/8 inch (22 mm) diameter, 1/2 inch (13 mm) shank ball bolts.
10. Provide galvanized steel guide wheel assemblies consisting of two rubber wheels of minimum 4 inch (100 mm) diameter with oil-impregnated bearings for each supporting post.
11. Attach guide wheel assembly to post so bottom horizontal member rolls between wheels and permitting adjustment to maintain plumb gate frames and proper alignment.

2.5 FINISHES

A. Components and Fabric: Galvanized to ASTM A123/A123M for components; ASTM A153/A153M for hardware; ASTM A392 for fabric; 2.0 oz/sq ft coating.

B. Hardware: Galvanized to ASTM A153/A153M, 2.0 oz/sq ft coating.

C. Accessories: Same finish as framing.

PART 3 EXECUTION

3.1 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch.

C. Maximum Offset From Indicated Position: 1 inch.

D. Minimum distance from property line: 6 inches.

3.2 SCHEDULES

A. Property Perimeter: 6 feet high.

END OF SECTION

SECTION 32 91 19 - LANDSCAPE GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Final grade topsoil for finish landscaping.

B. Related Sections:
   1. Section 31 22 13 - Rough Grading: Site contouring.
   2. Section 31 23 17 - Trenching: Backfilling trenches.
   3. Section 32 05 13 - Soils for Exterior Improvements.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures

1.3 QUALITY ASSURANCE

A. Furnish each topsoil material from single source throughout the Work.

B. Perform Work in accordance with Illinois Department of Transportation Standard Specifications for Road and Bridge (SSRB) and Municipality.

PART 2 PRODUCTS

2.1 MATERIAL

A. In Conformance with Article 1081.05A Illinois Department of Transportation Standard Specifications for Road and Bridge Construction.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify building and trench backfilling have been inspected.

C. Verify substrate base has been contoured and compacted.

3.2 PREPARATION

A. Protect landscaping and other features remaining as final Work.

B. Protect fences, sidewalks, utilities, paving, and curbs.

3.3 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove contaminated subsoil.

C. Scarify surface to depth of 3 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.4 PLACING TOPSOIL

A. Place topsoil in areas where seeding, planting, is required to nominal depth of 6 inches. Place topsoil during dry weather.

B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.

C. Remove roots, weeds, rocks, and foreign material while spreading.

D. Manually spread topsoil close to fences, sidewalks, utilities, paving, and curbs to prevent damage.

E. Lightly compact placed topsoil.

F. Remove surplus subsoil and topsoil from site.

G. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.5 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Top of Topsoil: Plus or minus 1/2 inch.

3.6 PROTECTION OF INSTALLED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Prohibit construction traffic over topsoil.

END OF SECTION

SECTION 329219 - SEEDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fertilizing.
   2. Seeding.
   3. Mulching.
   4. Maintenance.

B. Related Sections:
   1. Section 312213 - Rough Grading: Rough grading of site.
   2. Section 312317 - Trenching: Rough grading over cut.
   3. Section 329119 - Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the Work of this section.

1.2 REFERENCES

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

1.3 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for seed mix, fertilizer, mulch, and other accessories.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

B. Perform Work according to Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

1.6 QUALIFICATIONS

A. Seed Supplier: Company specializing in manufacturing Products specified in this section with minimum three years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.8 MAINTENANCE SERVICE

A. Maintain seeded areas immediately after placement until grass is well established and exhibits vigorous growing condition.

PART 2 - PRODUCTS

2.1 SEED MIXTURE

A. Furnish materials according to Section 250.07 SSRB

B. Description:

1. Type 1: Lawn Mix
2. Type 1A: Salt Tolerant Mix
3. Type 3 Slope Mix

2.2 ACCESSORIES

A. Mulching Material: in conformance with Section 251 SSRB

B. Blanket as specified on plans and in conformance with Section 251.04 SSRB.

C. Fertilizer: Commercial grade; recommended for grass; of proportion as specified in Section 250.04 SSRB

D. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify prepared soil base is ready to receive the Work of this section.

3.2 FERTILIZING

A. Apply fertilizer at application rate recommended in Section 250.04 SSRB

B. Apply after smooth raking of topsoil.

C. Do not apply fertilizer at same time or with same machine used to apply seed.

D. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.3 SEEDING

A. Apply seed as specified in Section 250.06 SSRB

B. Do not seed areas in excess of that which can be mulched on same day.

C. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

3.4 SEED PROTECTION

A. Seed Protection as Specified in Section 251 SSRB

3.5 MAINTENANCE

A. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.

D. Water to prevent grass and soil from drying out.

E. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

F. Immediately reseed areas showing bare spots.

G. Repair washouts or gullies.

H. Protect seeded areas with warning signs during maintenance period.

END OF SECTION 329219

SECTION 33 01 31 - MANHOLE GRADE ADJUSTMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Raising manhole frames and covers.
   2. Replacing manhole frames and covers.

B. Related Sections:
   1. Section 03 41 00 - Precast Structural Concrete.
   2. Section 32 12 16 - Asphalt Paving.
   3. Section 32 91 19 - Landscape Grading.
   4. Section 32 92 19 - Seeding and Soil Supplements.
   5. Section 33 01 35 - Manhole Grout Sealing.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Repairing Manhole Frames and Covers:
   1. Basis of Measurement: By each.
   2. Basis of Payment: Includes removal of old frame and cover, installing new frame and cover, and joint sealant.

1.3 REFERENCES

A. In Conformance with IDOT Standard Frame and Grate Specifications

B. Municipality Subdivision and Development Control Regulations

C. STM International:
   1. ASTM 478 - Standard Specification for Standard Specification for Precast Reinforced Concrete Manhole Sections.
   2. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
   3. ASTM A48 – Standard Specification for Gray Iron Casting.
   4. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
   5. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   6. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manhole covers and riser rings construction, features, configuration, dimensions.

C. Manufacturer's Certificate: Certify Products meet or exceed IDOT Standards.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual grade adjustment elevation of manhole.

1.6 QUALITY ASSURANCE

A. Perform Work in Conformance with SSRBC Section 603, IDOT, & Municipality Standards.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 3 years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in undamaged, unopened container, bearing manufacturer’s original labels. Inspect for damage.

C. Protect materials from damage by storage in secure location.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Provide schedule of manhole grade adjustment.

PART 2 PRODUCTS

2.1 MANHOLE FRAMES AND COVERS

A. In Conformance with SSRBC Section 604.03, IDOT and Municipality as called out on plans.

B. Furnish materials in accordance with IDOT and Municipality Standards.

2.2 RISER RINGS

A. In Conformance with SSRBC Section 1043, IDOT and Municipality Subdivision and Development Control Regulations.

B. Furnish materials in accordance with IDOT and Municipality Standards.

C. Precast Concrete: Section 03 41 00.

D. Accessories:
   1. Joint Sealant: ASTM C990.
   2. Bolts: Stainless steel ASTM F593; galvanized ASTM F1554.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify and locate manholes requiring grade adjustment.

3.2 EXISTING WORK

A. Saw cut existing paving.

B. Excavate.

C. Clean manholes.

D. Remove existing manhole frames and covers.

E. Repair waterproofing.

3.3 RAISING MANHOLE FRAMES AND COVERS

A. Locate and raise manholes to grade as indicated on Drawings.

B. Use flat or tapered rubber manhole rings to achieve elevation indicated for frame and cover.

C. Do not adjust elevation more than 6 inches (150 mm) with rubber manhole rings.

D. Seal joints between manhole top, rubber rings, and frame with sealant.

E. Reinstall removed manhole frame and cover.

3.4 REPLACING MANHOLE FRAMES AND COVERS

A. Remove existing manhole frames and covers to enable reuse.

B. Deliver removed manhole frames and covers to Owner as maintenance materials in accordance with Section 01 70 00 - Execution and Closeout Requirements.

C. Install new frames and covers for manholes as indicated on Drawings. Adjust to match finished grade as indicated on Drawings. Seal joints between manholes and manhole frames.

3.5 PAVING RESTORATION

A. Restore bituminous paving areas in accordance with Section 32 12 16.

3.6 LANDSCAPING RESTORATION

A. Restore grassed areas in accordance with Section 32 91 19 and Section 32 92 19.

END OF SECTION

SECTION 33 05 13 - MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Modular precast concrete manhole and structures with tongue-and-groove joints covers, anchorage, and accessories.
2. Bedding and cover materials.

B. Related Sections:
1. Section 04 05 14 - Masonry Mortaring and Grouting: Mortar and grout.
2. Section 31 05 13 - Soils for Earthwork: Soil for backfill in trenches.
3. Section 31 05 16 - Aggregates for Earthwork: Aggregate for backfill in trenches.
4. Section 31 23 16 - Excavation: Excavating for manholes and structures.
5. Section 31 23 23 - Fill: Backfilling after manhole and structure installation.
6. Section 33 05 16 - Utility Structures.
7. Section 33 71 19 - Electrical Underground Ducts.

1.2 REFERENCES

A. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRB)

B. Municipality Subdivision and Development Control Regulations.

C. Standard Specifications for Water and Sewer main construction in Illinois Latest Edition (SSWSMC)

D. ASTM International:
1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
3. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes and Laterals.
4. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test

1.3 DESIGN REQUIREMENTS

A. SSRBC

B. SSWSMC

C. Municipality Subdivision and Development Regulations.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate manhole and structure locations, elevations, piping, sizes and elevations of penetrations.

C. Product Data: Submit cover and frame construction, features, configuration, dimensions.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with SSRBC, SSWSMC and Municipality Standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes and structures.

C. Store precast concrete manholes and structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.

D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

PART 2 PRODUCTS

2.1 MANHOLES AND STRUCTURES

A. SSRBC Section 1042 and 1043 and as called out on plan sheets.

B. Manhole and Structure Sections: Reinforced precast concrete in accordance with ASTM C478 with gaskets in accordance with ASTM C923.

C. Mortar and Grout: As specified in by IDOT and Municipality

2.2 FRAMES AND COVERS

A. Product Description: ASTM A48 Cast iron construction, machined flat bearing surface, removable lid as specified on plans.

2.3 COMPONENTS

A. Manhole and Structure Steps: Formed Plastic Coated Rebar MA Industries Model PS-1 rungs; 3/4 inch diameter. Formed integral with manhole and structure sections.

B. Base Pad: per IDOT and Municipality.

2.4 CONFIGURATION

A. Per IDOT and Municipality as called out on Plans.

B. Clear Inside Dimensions: As indicated on Drawings.

C. Design Depth: As indicated on Drawings.

D. Clear Cover Opening: As indicated on Drawings.

E. Pipe Entry: Furnish openings as indicated on Drawings.

F. Steps: per IDOT and Municipality and As indicated on Drawings.

2.5 BEDDING AND COVER MATERIALS

A. Bedding: Per Municipality and as indicated on Plans.

B. Cover: Per Municipality and as indicated on Plans.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify items provided by other sections of Work are properly sized and located.

C. Verify built-in items are in proper location, and ready for roughing into Work.

D. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.

C. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements, 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Vertical Adjustment of Existing Manholes and Structures:
   1. Where required, adjust top elevation of existing manholes and structures to finished grades shown on Drawings.
   2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.
   3. Remove concrete without damaging existing vertical reinforcing bars when removal of existing concrete wall is required. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement, as indicated Drawings.
   4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete in accordance with Section 03 30 00.

END OF SECTION

SECTION 331213 - WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe and fittings for domestic water service connections to buildings.
   2. Corporation stop assembly.
   3. Curb stop assembly.
   4. Bedding and cover materials.

B. Related Requirements:
   1. Section 31 23 16 - Excavation.
   2. Section 31 23 17 - Trenching.
   3. Section 33 13 00 - Disinfecting of Water Utility Distribution

1.2 REFERENCE STANDARDS

A. Title 77: Chapter I: Subchapter r: Part 89D Illinois Plumbing Code

B. Standard Specifications for Water and Sewer Construction in Illinois.

C. Municipal Subdivision and Development Control Regulations.

D. American Water Works Association:
   1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, and service saddles.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping mains, curb stops, connections, thrust restraints, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Municipality.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. During loading, transporting, and unloading of materials and products, exercise care to prevent any damage.

C. Store products and materials off ground and under protective coverings and custody, away from walls and in manner to keep these clean and in good condition until used.

PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS – SEE Plan Sheets

2.2 CORPORATION STOP ASSEMBLY – SEE Plan Sheets

2.3 CURB STOP ASSEMBLY – SEE Plan Sheets

2.4 BEDDING AND COVER MATERIALS – SEE Plan Sheets

2.5 ACCESSORIES – SEE Plan Sheets

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION - CORPORATION STOP ASSEMBLY

A. Make connection for each different kind of water main using suitable materials, equipment and methods approved by the Architect/Engineer.

B. Provide service clamps for mains other than of cast iron or ductile iron mains.

C. Screw corporation stops directly into tapped and threaded iron main at 10 and 2 o'clock position on main's circumference; locate corporation stops at least 12 inches (300 mm) apart longitudinally and staggered.

D. For plastic pipe water mains, provide full support for service clamp for full circumference of pipe, with minimum 2 inches (50 mm) width of bearing area; exercise care against crushing or causing other damage to water mains at time of tapping or installing service clamp or corporation stop.

E. Use proper seals or other devices so no leaks are left in water mains at points of tapping; do not backfill and cover service connection until approved by the Architect/Engineer.

3.4 BEDDING – SEE Plan Sheets

3.5 INSTALLATION - PIPE AND FITTINGS – SEE Plan Sheets

3.6 INSTALLATION - CURB STOP ASSEMBLY – SEE Plan Sheets

3.7 SERVICE CONNECTIONS

A. Install water service in accordance with ___(MUNICIPALITY)___ Requirements.

3.8 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00**.**

3.9 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting, testing.

B. Pressure test system in accordance with AWWA C600 and the Municipal Requirements:

1. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

END OF SECTION

SECTION 331416 - SITE WATER UTILITY DISTRIBUTION PIPING

1GENERAL

1.SUMMARY

a.Section Includes:

1)Pipe and fittings for Site water line, including domestic water line, fire water line.
2)Tapping sleeves and valves.
3)Valves and boxes.
4)Fire hydrants and yard hydrants.
5)Bedding and cover materials.

b.Related Requirements:

1)Section 033000 - Cast-in-Place Concrete: Concrete for thrust restraints.
2)Section 312316.13 - Trenching: Execution requirements for trenching.
3)Section 312323 - Fill: Requirements for backfill to be placed by this Section.

2.REFERENCE STANDARDS

a.Standard Specifications for Water and Sewer Construction in Illinois. Division IV Water Distribution.

b.IDOT Standard Specifications for road and Bridge Construction Sections:
1)1003 Fine Aggregate
2)1004 Coarse Aggregate
3)1001 Cement
4)1018 Mortar

c.American Water Works Association:

1)AWWA C600 – Installation of Ductile – Iron Mains and Their Appurtenances.

d.Municipal Standards as applicable

e.Illinois Environmental Protection Agency: Division of Public Water Supplies

3.SUBMITTALS

a.Product Data: Submit manufacturer information regarding pipe materials, pipe fittings, valves, hydrants.

4.CLOSEOUT SUBMITTALS

a.Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

5.QUALITY ASSURANCE

a.Perform Work according to Municipality& IEPA standards.

6.DELIVERY, STORAGE, AND HANDLING

a.Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

b.Storage:

1)Store materials according to manufacturer instructions.

c.Protection:

1)Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2)Provide additional protection according to manufacturer instructions.

7.EXISTING CONDITIONS

a.Field Measurements:

1)Verify field measurements prior to fabrication.

2PRODUCTS

1.PIPING

a.Pipe and Fittings: As Specified on Plans

b.Joints: As Specified on Plans

2.TAPPING SLEEVES AND VALVES

a.Tapping Sleeves: As Specified on Plans

3.VALVES AND HYDRANTS

a.Valves, Valve Boxes, and Fire Hydrants: As specified on Plans.

4.MATERIALS

a.Bedding and Cover: As Specified on Plans.

5.ACCESSORIES

a.Thrust Restraints: As specified on Plans.

3EXECUTION

1.EXAMINATION

a.Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

b.Verify that building service connections and municipal utility water main sizes, locations, and elevations are as indicated on Drawings.

2.PREPARATION

a.Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

b.As Specified on Plans.

c.Remove scale and dirt on inside and outside before assembly.

d.Prepare pipe connections to equipment with flanges or unions.

e.Protect and support existing distribution piping and appurtenances as Work progresses.

3.INSTALLATION

a.Bedding: As Specified on Plans.

b.Pipe and Fittings: As Specified on Plans

c.Meters and Boxes: As specified on plans.

d.Disinfection: As specified on Plans.

4.FIELD QUALITY CONTROL

a.Testing: As Specified on Plans.

END OF SECTION 331416

SECTION 33 31 00 - SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1. SUMMARY

a. Section Includes:

1) Sanitary sewerage piping.
2) Bedding and cover materials.

b. Related Requirements:

1) Section 221300 - Facility Sanitary Sewerage: Product and execution requirements for sanitary waste and vent piping at building.
2) Section 310513 - Soils for Earthwork: Soil for backfill in trenches.
3) Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.
4) Section 312316 - Excavation: Requirements for excavation and backfill as required by this Section.
5) Section 312316.13 - Trenching: Requirements for trenching as required by this Section.
6) Section 312323 - Fill: Requirements for backfilling as required by this Section.

2. DEFINITIONS

a. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

3. REFERENCE STANDARDS

a. Standard Specifications for Water and Sewer Construction in Illinois.

b. Illinois Environmental Protection Agency – Division of Water Pollution Control.

c. Municipal Subdivision and Development Control Regulations.

4. COORDINATION

a. Section 013000 - Administrative Requirements: Requirements for coordination.

5. PREINSTALLATION MEETINGS

a. As required by Municipality.

6. SUBMITTALS

a. Section 013300 - Submittal Procedures: Requirements for submittals.

b. Product Data: Submit manufacturer information indicating pipe material to be used, pipe accessories.

7. CLOSEOUT SUBMITTALS

a. Identify and describe discovery of uncharted utilities.

8. QUALITY ASSURANCE

a. Perform Work according to Standard Specifications for Water and Sewer Construction in Illinois.

9. DELIVERY, STORAGE, AND HANDLING

a. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

b. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

10. EXISTING CONDITIONS

a. Field Measurements:

1) Verify field measurements prior to fabrication.
2) Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

1. SANITARY SEWERAGE PIPING

a. Plastic Pipe:

1) Material: PVC.
2) Comply with ASTM D3034, SDR-26
3) End Connections: Bell and spigot with rubber-ring-sealed gasket joint.
4) Fittings: PVC.
5) Joints:

a) Elastomeric gaskets.
b) Comply with ASTM F477.

2. MANHOLES

a. As specified on Plan Sheets.

3. FLEXIBLE COUPLINGS

a. Fernco:

1) Substitutions: Upon approval of Engineer.

b. Description:

1) Material: Resilient, chemical-resistant, elastomeric PVC.
2) Attachment: Two [**Series-300**] stainless-steel clamps, screws, and housings.

4. FLEXIBLE PIPE BOOTS FOR MANHOLE PIPE ENTRANCES

a. Furnish materials according to Municipal standards and as shown on plans.

5. MATERIALS

a. Bedding and Cover:

1) Bedding: Fill Type per Municipal standards and as specified on plans.
2) Cover: Fill Type per Municipal standards and as specified on plans.
3) Soil Backfill from Above Pipe to Finish Grade: per Municipal standards and as specified on plans.

6. MIXES

a. Grout: As specified per Municipal standards and as specified on plans.

PART 3 EXECUTION

1. EXAMINATION

a. Verify that trench cut is ready to receive Work of this Section.

b. Verify that excavations, dimensions, and elevations are as indicated on drawings.

2. PREPARATION

a. Correct over-excavation as specified on plans.

b. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.

c. Protect and support existing sewer lines, utilities, and appurtenances.

d. Utilities:

1) Maintain profiles of utilities.
2) Coordinate with other utilities to eliminate interference.
3) Notify Architect/Engineer if crossing conflicts occur.

3. INSTALLATION

a. Bedding: As specified on plans and per Municipality.

b. Piping: As specified on plans and per Municipality.

c. Manholes: As specified on plans and per Municipality.

d. Backfilling: As specified on plans and per Municipality.

4. TOLERANCES

a. Per Municipal standards.

5. FIELD QUALITY CONTROL

a. Testing:

1) If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
2) Perform testing on Site sanitary sewage system according to plans and State and Municipality standards.

6. PROTECTION

a. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

b. Cap open ends of piping during periods of Work stoppage.

PART 4 END OF SECTION 333100

To: Prospective Bidders

From: Wold | Ruck Pate

Date: January 17, 2018

Comm. No: 173013

Subject: Addendum No. 1 for Re-Bid Documents for the **Village of Buffalo Grove Combined Are Fire Training Facility**

BIDS DUE JANUARY 25, 2018 9:30 AM.

This addendum forms a part of the Contract Documents dated (original issue date). Acknowledge receipt of this Addendum on the space provided on the Bid Form. Failure to do so may result in disqualification of Bid.

This Addendum consists of two (2) typed sheets and attachments:
Specifications Sections: 01 23 00
Drawings: A2.11

PRIOR APPROVALS

The following schedule amends designated specification sections to list additional acceptable manufacturers. Use of any product by any of these manufacturers will be permitted only if after review of shop drawings or detailed product data per Section 01 33 00, Architect determines that proposed materials or equipment are equivalent in performance, construction and appearance to product(s) specified.

Where anticipated product substitutions would alter the design or space requirements indicated on the Drawings, pay for cost of design and construction revisions including the cost of associated work by other contractors.

For complete requirements, see Specification Section 01 25 00 – Substitutions and Product Options.

Section No.	Item	Type	Acceptable Manufacturer
08 14 00	2.01	HM Doors and Frames	Mesker

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SPECIFICATION SECTIONS

1. **01 23 00 ALTERNATES**
   a. Reissued this addendum.

DRAWINGS

1. **A2.11 ENLARGED PLANS**
   a. At Drawing C1/A2.11 ENLARGED TOILET PLAN, remove note for tile at toilet room plumbing walls. Sheet reissued this addendum.
2. **S1.10 FOUNDATION PLAN AND DETAILS**
   a. Revise note at sections 8/S1.10, 9/S1.10, 11/S1.10, 13/S1.10 and 14/S1.10 "HELICAL PIER, BY OTHERS" to read "**HELICAL PIER BY FOUNDATION CONTRACTOR**" as consistent with Note D-S1.10.

END OF ADDENDUM #1

SECTION 01 23 00

ALTERNATES

PART 1: GENERAL

1.01 DESCRIPTION

A. This Section describes the limits of the requested alternates to the Contract work. Refer to the Product/Execution Articles of the appropriate Specifications and the Drawings for information pertaining to the work of each alternate.

B. Each proposal under an alternate shall include all incidental work and all adjustments necessary to accommodate the changes. All work shall meet the requirements of the Drawings, Specifications and appropriate details.

C. Submit each alternate proposal as an individual cost for the particular alternate and shall be proposed under the premise that no other alternates have been accepted. Should the work of an alternate called for by the Bid Form not affect the cost of the work, state "No Change" in the space provided. If an alternate is left blank, the Owner reserves the right to throw out the entire bid or interpret the alternate as "No Change".

D. Include taxes which are applicable to work involved in alternates as well as costs, if any, for increased coverage of bonds and insurance.

E. Any of the alternates may be accepted by Owner and will be used in determining the low bidder.

F. Owner may, at his option, vary the scope of the work by authorizing alternates which will add to the work, deduct from the work or substitute materials, equipment or methods.

G. Each Bidder shall examine the Drawings and Specifications to determine the extent to which his work is affected by bid alternates. Include in the space provided on the bid form the cost of any added or deducted work resulting from each alternate.

H. Contractor is responsible for providing work if applicable to each alternate, whether or not an added or deducted cost is included on his bid form.

PART 2: EXECUTION

2.01 IMPLEMENTATION

A. If the Owner elects to proceed on the basis of one or more of the alternates, make all modifications to the Work required in the furnishing and installation of the selected alternate or alternates subject to the approval of the Architect at no additional cost to the Owner except as proposed in the Bid.

B. Coordinate pertinent related work and modify surrounding work as required to properly integrate the work under each alternate, and to provide the complete construction required by Contract Documents.

C. If so stated in the Agreement, or modifications thereto, provide alternate materials, equipment and/or construction as specified.

2.02 ALTERNATES

A. Alternate No. 1 Building Canopy

1. Provide cost to add building canopy; including all associated concrete, site work, masonry, electrical, etc.

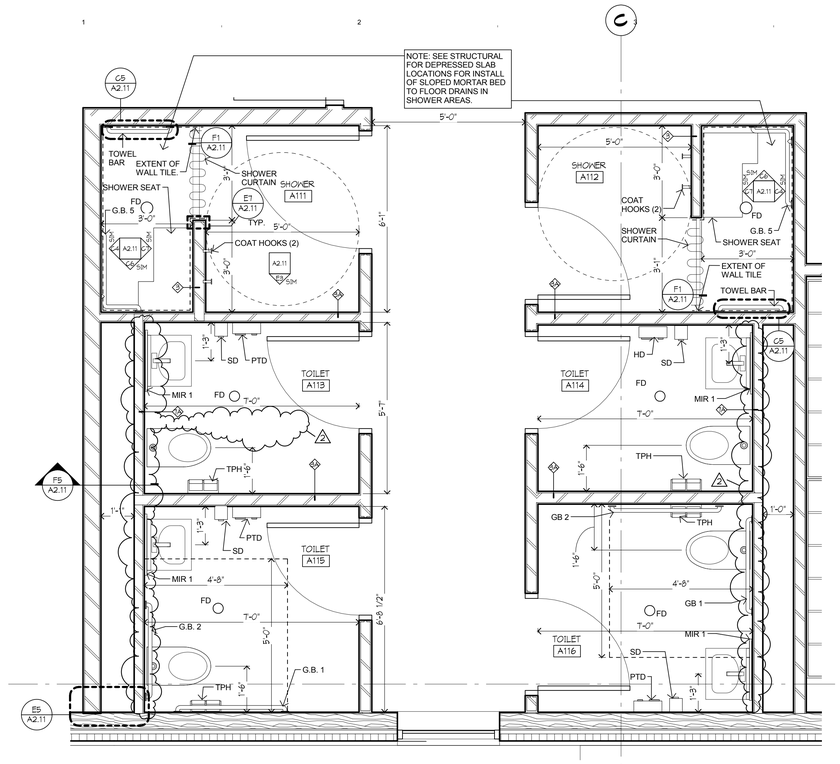
B. Alternate No. 2 Skylights

1. Provide cost to add skylights by Pre-Engineered Wood Building manufacturer at locations shown.

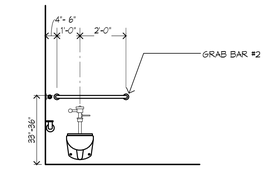
C. Alternate No. 3 Tornado Siren Relocation

1. Provide cost to relocate tornado siren as noted on the drawings. ***Tornado siren to be relocated proximate to existing location (approximately 15' to 20' south) as required to accommodate installation of new work.***

END OF SECTION 01 23 00

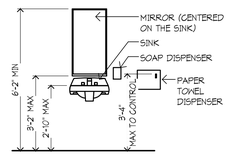


C1 ENLARGED TOILET PLAN
1/2" = 1'-0"

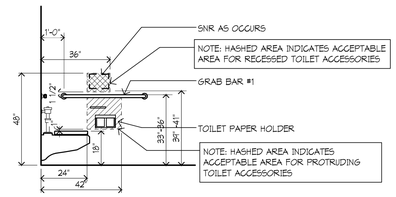


A4 ADULT HCAP WC
3/8" = 1'-0"

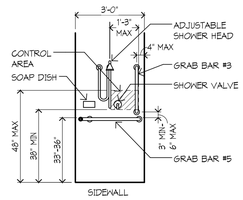
A5 ADULT WC
3/8" = 1'-0"



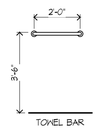
B4 LAV ELEV
3/8" = 1'-0"



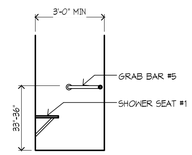
B5 ADULT HCAP WC
3/8" = 1'-0"



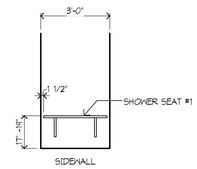
C4 TRANSFER SHOWER STALL
3/8" = 1'-0"



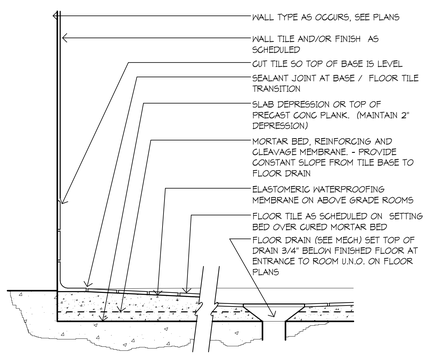
C5 TOWEL BAR
3/8" = 1'-0"



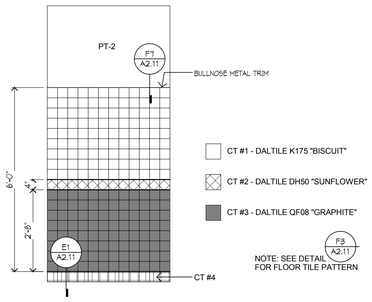
C6 TRANSFER SHOWER STALL
3/8" = 1'-0"



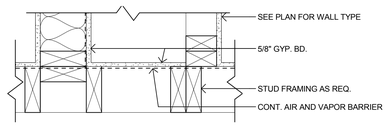
C7 TRANSFER SHOWER STALL
3/8" = 1'-0"



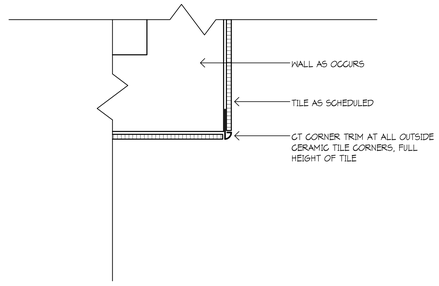
E1 TYP SHOWER ROOM SECTION
3" = 1'-0"



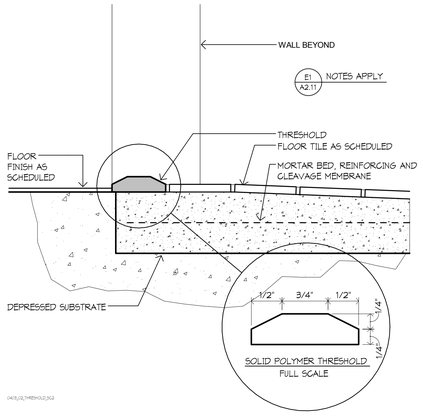
E3 WALL TILE PATTERN, TYP.
1/2" = 1'-0"



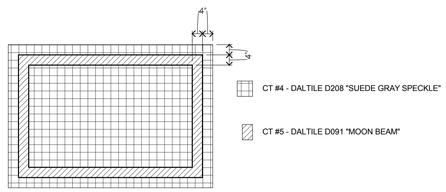
E5 TOLIET CHASE PLAN DETAIL
1 1/2" = 1'-0"



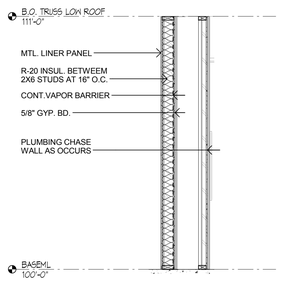
E7 PLAN AT CORNER TRIM
3" = 1'-0"



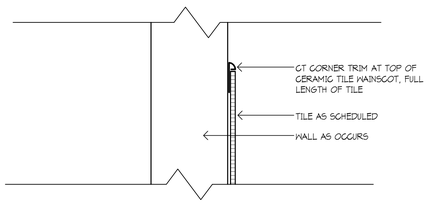
F1 TYP TOILET ROOM THRESHOLD
6" = 1'-0"



F3 FLOOR TILE PATTERN
1/2" = 1'-0"



F5 WALL SECTION AT TOILET CHASE
3/8" = 1'-0"



F7 SECTION AT CORNER TRIM
3" = 1'-0"

IL

A

Combined Area Fire Training Facility Re-Bid

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

WOLD | RUCK PATE
110 North Brockway, Suite 220
Palatine, Illinois 60067
woldac.com | 847 241 6100

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **ARCHITECT** under the laws of the State of **ILLINOIS**

Matthew J. Bickel
License Number: **001.020883** Date: **11-30-18**

Revisions

Description	Date	Num
Issued for Bid	**12-7-17**	**1**
Addendum #1	**1-17-18**	**2**

Comm: **173013**
Date: **December 7, 2017**
Drawn: **BDB**
Check: **MJB**
North

ENLARGED PLANS

Scale: **As indicated**

A2.11

To: Prospective Bidders

From: Wold | Ruck Pate

Date: January 22, 2018

Comm. No: 173013

Subject: Addendum No. 2 for Re-Bid Documents for the **Village of Buffalo Grove Combined Are Fire Training Facility**

BIDS DUE JANUARY 25, 2018 9:30 AM.

This addendum forms a part of the Contract Documents dated (12-7-17). Acknowledge receipt of this Addendum on the space provided on the Bid Form. Failure to do so may result in disqualification of Bid.

This Addendum consists of two (1) typed sheets and attachments:

SPECIFICATIONS

1. **00 11 13 BID AND CONTRACT DOCUMENTS**
   a. EXHIBIT B – SCHEDULE OF PRICES, Page 8 and 9 reissued this addendum.
2. **01 21 00 ALLOWANCES**
   a. Issued this addendum.
3. **01 22 00 UNIT PRICES**
   a. Issued this addendum.
4. **03 30 00 CAST-IN-PLACE-CONCRETE**
   a. Reissued this addendum.

DRAWINGS

1. **S1.10 FOUNDATION PLAN AND DETAILS**
   a. At DRAWING S1.10 KEYNOTES, amend keynote D-S1.10 to include, "PROVIDE BASE BID ASSUMING A 30 FT. TYPICAL PIER DEPTH FOR THE QUANTITY SHOWN ON THE FOUNDATION PLAN."

END OF ADDENDUM #2

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EXHIBIT B - SCHEDULE OF PRICES (cont.)

A. BASE BID

_____

_____Dollars ($_____).

B. ALTERNATE NO. 1 – BUILDING CANOPY

Add / Deduct _____

_____Dollars ($_____).

C. ALTERNATE NO. 2 – SKYLIGHTS

Add / Deduct _____

_____Dollars ($_____).

D. ALTERNATE NO. 3 – TORNADO SIREN RELOCATION

Add / Deduct _____

_____Dollars ($_____).

E. UNIT PRICE #1: HELICAL PIERS

State the basis of design for helical piers based on quantities and depth indicated on the Drawings: _____

_____

_____

Cost per LF to increase/decrease helical pier depth: $_____ per LF

Each Bidder shall attach a Schedule of Values showing bid breakdown and estimated itemized costs of base bid total costs. An example of which is shown on the following page

EXHIBIT B - SCHEDULE OF PRICES (cont.)

SCHEDULE OF VALUES

Scope					Base Price
Site Grading / Earthwork					
Site Utilities					
Site Concrete					
Site Paving					
Fencing					
Building Concrete					
Helical Piers					
Carpentry					
Pre-Engineered Wood Building					
Masonry Veneer					
Exterior Doors					
Interior Walls and Framing					
Interior Doors and Hardware					
Acoustic Ceilings					
Decorative Quartz Flooring					
Painting					
Tile					
Resilient Flooring					
Millwork and Countertops					
Toilet Room Accessories					
Plumbing					
HVAC					
Fire Protection					
Electrical					
Allowance #1					
General Conditions					
Overhead and Profit					
Insurance					
Bonds					
A. BASE BID					

SECTION 01 21 00

ALLOWANCES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.

1. Certain materials and / or labor are specified in the Contract Documents by lump sum allowances. In some cases, these allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and / or labor to a later date when additional information is available for evaluation.

B. Related Sections include the following:

1. Change Orders – Section 01 26 63.

1.03 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. The Architect will issue a Proposal Request for pricing on each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

PART TWO: PRODUCTS (Not Applicable)

PART THREE: EXECUTION

3.01 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Include the sum of $5,000.00 for additional helical piers in excess of the of quantities noted on the Drawings.

END OF SECTION 01 21 00

SECTION 01 22 00

UNIT PRICES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Details of Construction and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work specified in this section.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for unit prices.

1. In the space indicated on the Bid Form, submit unit prices as required by this section and listed in the Unit Price Schedule. Only one value for each unit price will be allowed.

2. A unit price is a price per unit of measurement for materials or services that will be added to or deducted from the Contract Sum by Change Order in the event the quantities of Work required by the Contract Documents are increased or decreased.

3. Unit prices include all necessary material, overhead, profit and applicable taxes.

4. Refer to individual Specification Sections for construction activities requiring the establishment of unit prices.

B. While unit prices are not to be used in the selection of the successful Bidder, they must be submitted and approved prior to execution of the Contract.

1. The Owner reserves the right to reject a unit price he deems unsatisfactory and to require a resubmittal.

2. The Owner reserves the right to reject the Contractor's measurement of quantities, and to have this Work measured by an independent surveyor.

C. The Owner reserves the right to throw out a bid that does not include a unit price or assign a unit price based on other bidders unit prices.

PART 2: PRODUCTS – (Not Applicable).

PART 3: EXECUTION

3.01 UNIT PRICE SCHEDULE

A. Unit Price #1: Helical Piers

1. State the amount on the Bid Form to increase or decrease the depth of helical piers based on final design submittal from the Contractor.

END OF SECTION 01 22 00

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 CONTRACT CONDITIONS

A. Drawings, Details of Construction, and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Section Includes: Providing all items, articles and materials listed, mentioned, or scheduled on the Drawings or herein, including all labor, materials, equipment, and incidentals necessary and required for the installation of all cast-in-place concrete indicated on the Drawings or specified herein.

B. Concrete footings***, including helical piers.***

1. Foundation contractor shall be responsible for additional soil boring(s) and design of helical pier system.

C. Concrete building frame members.

D. Floors and slabs on grade.

1. Including vapor barrier.

E. Concrete foundation walls.

F. Concrete curing.

1.03 RELATED REQUIREMENTS

~~*A. Section 01 45 33 - Structural Testing and Special Inspection*~~

B. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.

C. Section 03 20 00 - Concrete Reinforcing.

D. Section 07 92 00 - Joint Sealants: Products and installation for sealants for saw cut joints and isolation joints in slabs.

E. Section 05 12 00 - Embedded Structural Steel, Anchor Bolts

F. Section 07 21 00 - Insulation: Vapor barrier, vapor barrier, and None - N/A.

1.04 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2009).

B. ACI 301 - Specifications for Structural Concrete; American Concrete Institute International; 2010 (Errata 2012).

C. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (errata 2007).

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.

E. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.

F. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.

G. ACI 306.1 - Standard Specification for Cold Weather Concreting, American Concrete Institute; 1990

H. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).

I. ACI 308.1 - Standard Specification for Curing Concrete, American Concrete Institute; 1998

J. ACI 309R - Guide for Consolidation of Concrete, American Concrete Institute; 1996

K. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2011.

L. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Billet-Steel Bars for Concrete Reinforcement; 2015.

M. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2003

N. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.

O. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2014.

P. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

Q. ASTM C 157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete; 2006.

R. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method; 1997

S. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.

T. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete; 2012.

U. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2012.

V. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.

W. ASTM C 1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2007.

1.05 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Concrete mix designs for each mix used. On request, include field test data used to determine required average strength (if that method was used) and field test or trial mix data used to document required average compressive strength.

C. Product data for admixtures, curing materials and compounds, joint fillers, fiber reinforcing, vapor retarders, non-shrink grout, moisture vapor reducing admixture, and slab construction joint devices.

D. Cold weather concreting procedures.

E. Drawings showing construction and control joint locations and details for interior supported floor slabs and slabs on grade.

F. Certification of admixture conformance to chloride ion requirements.

G. Field quality control test results.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

I. Helical pier shop drawings and calculations.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

D. Pre-Installation Conference: Prior to installation of any concrete, a conference shall be held at the Project Site. General Contractor, ready-mix supplier, admixture supplier, concrete, formwork, and reinforcing subcontractors, Engineer, Special Inspectors, Independent Testing Laboratory, moisture vapor reducing admixture manfacturer or authorized representative, and other subcontractors whose work requires coordination with this Work shall attend. Specification requirements, submittals, materials, proposed mix designs, methods and procedures associated with this Work will be reviewed to assist in determining acceptable methods and procedures for achieving the specified concrete quality.

E. Source Limitations: Obtain each type of concrete moisture vapor reducing admixture from same manufacture.

1.07 MATERIAL DELIVERY, HANDLING, AND STORAGE

A. Materials shall be delivered in the Manufacturer's undamaged, unopened containers. Each container shall be clearly marked with the product name, manufacturer's name, batch number, component designation, and ratio of component mixtures.

B. Provide equipment and personnel to handle the materials by methods that prevent damage.

C. Promptly inspect shipments to assure that materials comply with requirements, quantities are correct, and materials are undamaged.

D. Store materials in accordance with the Manufacturer's instructions, with seals and label intact and legible. Maintain temperatures within the Manufacturer's recommended ranges.

E. Furnish delivery tickets with each load of concrete delivered to the Project. Information on each ticket shall be as required by ASTM C94 and shall also include: type of concrete (mix number), weights of all ingredients, maximum aggregate size, type, brand, and amount of admixture, total water in the batch, maximum amount of water that can be added at the site without exceeding design mix proportions, and amount of water added at site and initials of person adding water. Retain tickets until substantial completion unless directed otherwise.

1.08 NATIONAL VOLATILE ORGANIC COMPOUND (VOC) EMISSION STANDARDS

A. All products shall comply with the E.P.A. rulings establishing national v.o.c. emission standards for architectural coatings as listed in the Federal Register: September 11,1998 (Volume 63, Number 176), [Rules and Regulations] [Page 48848-48887].

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 03 10 00.

2.02 REINFORCEMENT

A. Comply with requirements of Section 03 20 00.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type.

B. Fine and Coarse Aggregates: ASTM C 33.

1. Maximum aggregate size is specified in mix design schedule.

C. Fly Ash: ASTM C618, Class F.

D. Water: Clean and not detrimental to concrete.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

D. Accelerating Admixture: ASTM C494/C494M Type C.

E. Water Reducing Admixture: ASTM C494/C494M Type A.

F. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than.05% chloride ions.

G. Do not use accelerating or retarding admixtures without written approval of the Architect.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Barrier: See Section 07 21 00 - Insulation

B. Non-Shrink Grout: ASTM C 1107; Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Conformance to ASTM C1107 shall occur with a minimum temperature range of 45 degrees F to 90 degrees F, a fluid consistency, and a minimum 30 minute working time.

2.06 BONDING AND JOINTING PRODUCTS

A. Slab Isolation Joint Filler: 1/4 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

B. Semi-Rigid Joint Filler: Two-component, semi-rigid, 100 % solids, minimum Shore A hardness of 80 per ASTM D2240.

2.07 CURING MATERIALS

A. All curing agents and sealers shall have no adverse affect on finishes, traffic topping, MVRA or other sealers. Coordinate with the appropriate finish manufacturer and receive written confirmation before applying.

B. Moisture-Retaining Cover: ASTM C 171; regular curing paper, white curing paper, white polyethylene film at temperatures above 60 degrees F., black polyethylene film at temperatures below 80 degrees F., clear polyethylene, or white burlap-polyethylene sheet at temperatures above 60 degrees F.

C. Curing and Sealing Compound: ASTM C1315, Type 1, Class A, VOC compliant, 25% minimum solids.

D. Exterior Concrete Curing Compound: Wax base, membrane forming curing compound, ASTM C309, Type II, white pigmented.

2.08 CONCRETE MIX DESIGN REQUIREMENTS

A. Submit concrete mix design for each type of concrete at least 30 days prior to the proposed start of placement. Mix designs must be reviewed prior to pouring concrete. Review is for conformance with specification requirements only. Contractor is responsible for performance.

B. Concrete shall conform to the requirements of ASTM C94 (Option A) unless other requirements of this project specification are more stringent.

C. Provide concrete with workability such that it will fill the forms, without voids or honeycombs, when properly vibrated, without permitting materials to separate or excess water to collect on the surface.

D. Slump at point of discharge: 5" max. for concrete without superplasticizer and 9" max. for concrete with superplasticizer.

E. Proportioning Normal Weight Concrete: ACI 301. Establish proportions based on the standard practices contained in ACI 211.1.

F. Determine required average strength as required by ACI 301.

G. Concrete Strength: Document that mixes produce required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

H. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

2.09 CONCRETE MIX DESIGN SCHEDULE

A. Normal Weight Concrete:

   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch.

   2. Fly Ash Content: Maximum 25 percent of cementitious materials by weight.

   3. Maximum Chloride Ion Content: 0.30 percent by weight of cement.

B. Normal Weight Concrete: Grade Beams

   1. Minimum Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4,000 psi.

   2. Water-Cement Ratio: Maximum 0.45 by weight.

   3. Maximum Aggregate Size: 1-1/2" Class 1S.

   4. Maximum Chloride Ion Content: 0.30 percent by weight of cement.

C. Normal Weight Concrete: Exterior Concrete, Garage Floors

   1. Exterior concrete includes: exterior aprons and stoop slabs, slabs at overhead doors and loading docks, exterior walls, piers, and columns, and other similar conditions.

   2. Minimum Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4,000 psi.

   3. Fly Ash Content: Maximum 25 percent of cementitious materials by weight.

   4. Water-Cement Ratio: Maximum 0.45 by weight.

5. Total Air Content: 4-1/2% to 7-1/2% percent, determined in accordance with ASTM C231.

6. Maximum Aggregate Size: 3/4" Class 4S.

7. Maximum Chloride Ion Content: 0.15 percent by weight of cement.

D. Normal Weight Concrete: Slabs on grade

1. Minimum Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4,000 psi.

2. Water-Cement Ratio: Maximum 0.45 by weight.

3. Maximum Aggregate Size: 3/4" Class 2S, well graded to achieve shrinkage limits specified.

4. Maximum 28-day shrinkage per ASTM C157: 0.05%

5. Maximum Chloride Ion Content:.30 percent by weight of cement.

2.10 SOURCE QUALITY CONTROL

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

B. Do not embed pipes other than non-aluminum electrical conduit or snow melting pipes in any structural concrete.

1. Any pipes embedded in concrete, even those meeting the guidelines given herein, are subject to acceptance by Architect. Remove any unacceptable pipes.

2. Outside diameter of pipes placed in slabs and walls shall not exceed 25% of the thickness of the slab or wall and shall be placed in groups of not more than 3. Space pipes within a group at not less than 4 diameters clear. Space groups of pipes at not less than 48 diameters clear.

3. Maximum total dimension or area of pipes and their fittings embedded in concrete beams and columns shall not exceed, at any location, 15% of least section dimension or 4% of the gross cross sectional area.

C. Where new concrete is to be bonded to existing or previously placed concrete, clean existing surface to remove dust, dirt, grease, oil, curing compounds and other items that would be detrimental to bonding. Saturate existing surface with clean water (8 hours minimum), remove excess water, and slush with a neat cement grout immediately before placing new concrete.

D. Protect existing concrete work to be exposed to view and other finished materials from damage and staining resulting from concreting operations. Cover sills, ledges and other surfaces with protective coverings as necessary to protect the work.

E. Slabs on Grade:

1. Verify subgrade compaction tests have been performed and are accepted.

2. Verify subgrade is level and within acceptable tolerances.

3. Verify subgrade is substantially dry with no freestanding water, muddy spots, or soft spots and is free from snow or ice.

4. Verify completion of all underfloor mechanical and electrical work.

5. Provide 3 inch minimum cover bottom and 3 inch minimum cover sides at electrical conduits and other embedded items.

F. Vapor Barrier Placement

1. Install in accordance with ASTM E1643 and manufacturer's written instructions.
   a. Place with longest dimension parallel with the direction of the concrete pour.
   b. Lap over footings and seal to foundation walls with vapor-proofing mastic.
   c. Overlap joints 6 inches minimum and seal with manufacturer's tape.
   d. Seal all penetrations including, but not limited to, pipes, conduits, columns, and piers with pipe boots in accordance with manufacturer's written instructions. No unsealed penetrations will be permitted.
   e. Repair damaged areas by applying patches of vapor barrier, overlapping damaged area 6" and sealing on all four sides with tape.

3.03 CONCRETE MIXING

A. Transit Mixers: Comply with ASTM C 94/C 94M.

B. Use cooled or heated water in accordance with ACI 306 and 305.

C. Air-entraining and chemical admixtures, if approved, shall be charged into mixer as a solution and dispensed by an automatic dispenser or similar metering device. Powdered admixtures shall be weighted or measured by volume as recommended by the manufacturer. Superplasticizer may be added at the job site to maintain slump.

D. Two or more admixtures may be used in same concrete, provided such admixtures are added separately during batching sequence. Admixtures used in combination shall retain full efficiency and have no deleterious effect on concrete or on properties of each other.

E. Ready mixed concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of rated capacities. Schedule and dispatch trucks from the batching point so that they shall arrive at the site of the work just before the concrete is required to avoid excessive mixing of concrete while waiting.

F. Discharge at the site shall begin within one (1) hour after charging. Concrete may be used as long as it is of such slump that it can be placed and properly consolidated without the addition of water to the batch (other than water added prior to the start of discharge as given below). If elapsed time since batching exceeds 90 minutes, or if drum has revolved more than 300 revolutions since batching, test air content, slump, and temperature for conformance to this specification prior to placing. In no case shall the time between batching and complete discharge exceed 120 minutes. Do not permit retempering of concrete. Discard concrete that has obtained its initial set.

G. Do not add water after the initial introduction of the mixing water for the batch, except at the start of discharge, subject to the conditions below. In this case, the producer may add water in an amount not exceeding that allowed to achieve the design water/cement ratio. The drum blades shall then be turned an additional 30 revolutions minimum at mixing speed. Water shall not be added to the batch at any later time. Reject concrete if water is added and these conditions are not met.

1. The measured slump of the concrete is less than that specified in the mix design.

2. No more than 60 minutes have elapsed from the time of batching.

3. The ready-mix plant is notified and approves.

4. Truck tickets indicate maximum amount of water to be added.

5. Water is added in a manner to control volume.

6. Special Inspector is notified, if concrete placement requires inspection.

H. Maximum concrete temperature delivered to Project site shall be 85 degrees F.

I. To use materials other than those accepted originally, or if the materials from the source originally accepted change in characteristics, make additional tests with proposed new materials that will verify production of concrete meeting with the stated requirements without causing objectionable change in the color or appearance of the structure. Pay the testing agency for these additional tests. Do not use concrete made from such different materials until the Architect has given his approval.

J. If, during the progress of the work, it is impossible to secure concrete of the required workability and strength with the materials being furnished by the Vendor, the Architect may order such changes in the proportions or materials, or both, as may be necessary to secure the desired properties, subject to the stated requirements. Make any changes so ordered without extra compensation.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 301. Follow recommended practice of ACI 304R.

B. Place concrete for floor slabs following recommended practices of ACI 302.1R.

C. Do not place in rain, sleet or snow unless exposed concrete surface is protected from moisture.

D. If, for any reason, the concrete pour is delayed for more than 45 minutes, bulkhead pour at last acceptable construction joint. Immediately remove excess concrete and clean all forms and in situ concrete surfaces.

E. Do not permit concrete to drop more than 4 feet from its point of release to mixers, hoppers, or conveyances. Use tremmies, chutes, or pumps as necessary to place columns and walls.

F. Deposit concrete in wall forms in layers not greater than 24 inches in depth. Consolidate each layer before the succeeding layer is placed.

G. Place concrete as near as possible to its final position to prevent segregation. Do not use vibrators to transport concrete.

H. Do not interrupt successive placement; do not permit cold joints to occur.

I. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

J. Immediately remove concrete spilled on existing surfaces.

K. Concrete at tops of forms: Strike concrete at top of wall, footing, and pier forms. Smooth and float to texture comparable to adjacent formed surfaces.

L. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 JOINTS

A. Vertical construction joints in walls shall be a maximum of 80 feet on center and shall be located as shown on structural drawings. Vertical control joints in wall shall be a maximum of 20 feet on center between construction joints and shall be located as shown on the structural drawings. If locations are not shown, locate joints at edges of piers integral with wall and near corners and in concealed locations where possible.

B. Locate construction joints for beams, slabs, joists and girders in the middle 1/3 of the span. Place so they do not compromise the strength of the structure. Offset joints in a girder at least twice the beam width from a beam-girder intersection.

C. Horizontal joints in walls and columns shall be at underside of slabs, beams and girders and at top of footings. At least 24 hours shall elapse between placing concrete in a wall or column and placing concrete in an area supported by the wall or column.

D. Reinforcing shall be continuous across construction joints. Provide dowels where detailed or requested. Joints in walls shall be keyed with longitudinal keys at least 1-1/2 inches deep unless detailed otherwise.

3.06 SLAB JOINTING

A. Locate slab on grade construction and control joints as given on Drawings and submit drawings showing proposed locations. Cut joints as soon as concrete has hardened sufficiently to prevent aggregate dislodgement. Use a "Soff Cut" saw to cut to a depth of 1 1/4" immediately after final finishing. Use a conventional saw to cut to a depth of one-fourth the slab thickness or as shown on the drawings. Complete sawing within 12 hours of placement.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

3.07 CONSOLIDATION

A. Consolidation of concrete shall conform to ACI 301, unless modified herein.

B. Follow recommended practices of ACI 309, unless modified herein.

C. Consolidate concrete using internal vibrators.

D. Maintain a spare vibrator at the Project Site during all placing operations.

3.08 CONCRETE FINISHING

A. Concrete Finish Schedule

1. Concealed walls, columns, beams, and slabs: As-cast rough form finish.

2. Exposed walls, columns, beams, and wall caps: Smooth form finish.

3. Exposed interior concrete floors and floors to receive carpeting: Troweled finish.

4. Floors to receive topping or mortar setting beds for tile or pavers: Scratched finish.

5. Exterior platforms, aprons, ramps, loading docks, and garage slabs: Broom finish.

6. Floors to receive thin-set ceramic tile, resilient flooring, and vinyl tile: Flat troweled finish.

B. Formed Surfaces

1. Repair surface defects, immediately after removing formwork.

2. Provide finishes per ACI 301 as scheduled and to the following tolerances.

3. Rough Form Finish: Rub down or chip off fins or other raised areas 1/2 inch or more in height. Rough form finish per ACI 301. Class C surface per ACI 117.

4. Smooth Form Finish: Rub down or chip off and smooth fins or other raised areas 1/8 inch or more in height. Smooth form finish per ACI 301. Class B surface per ACI 117.
   a. Where scheduled herein or noted on drawings provide the following improved surfaces and additional architectural finish.
      1) Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal. Class A surface per ACI 117

C. Unformed Surfaces

1. Provide finishes per ACI 301 as scheduled and to the following tolerances (F Numbers) per ACI 117 and measured according to ASTM E1155.
   a. Troweled Finish: Moderately flat tolerance.
      1) F(F): Specified Overall Value of 25; Minimum Localized Value of 15.
      2) F(L): Specified Overall Value of 20; Minimum Localized Value of 12.
   b. Flat Troweled Finish: Flat tolerance
      1) F(F): Specified Overall Value of 35; Minimum Localized Value of 21.
      2) F(L): Specified Overall Value of 25; Minimum Localized Value of 15.
   c. Scratched Finish: Conventional tolerance.
      1) F(F): Specified Overall Value of 20; Minimum Localized Value of 12.
      2) F(L): Specified Overall Value of 15; Minimum Localized Value of 10.
   d. Broom Finish: Moderately flat tolerance.
      1) F(F): Specified Overall Value of 25; Minimum Localized Value of 15.
      2) F(L): Specified Overall Value of 20; Minimum Localized Value of 12.
   e. Floated Finish: Conventional tolerance.
      1) F(F): Specified Overall Value of 20; Minimum Localized Value of 12.
      2) F(L): Specified Overall Value of 15; Minimum Localized Value of 10.
   f. Non-Slip Finish: Broom finish or a troweled finish with a "dry shake" abrasive application, wet abrasive prior to installation, and apply at a rate not less than 25 pounds per 100 square feet. Moderately flat tolerance.
      1) F(F): Specified Overall Value of 25; Minimum Localized Value of 15.
      2) F(L): Specified Overall Value of 20; Minimum Localized Value of 12.

2. Clean exposed concrete to remove laitance, efflorescence and stains.

3.09 CURING AND PROTECTION

A. Comply with requirements of ACI 308.1 as amended by this section. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature above 55° F for the period necessary for hydration of cement and hardening of concrete as follows:

1. Normal concrete: Not less than 7 days.

C. Curing may be terminated earlier than the minimum time above if at least one of the following conditions is met:

1. At least 4 field cylinders for each pour, prepared and cured according to ASTM C31 alongside the concrete they represent, reach 70% of the specified 28-day strength.

2. The concrete temperature is maintained above 50°F and laboratory cylinders reach 85% of the specified 28-day strength.

D. Formed Surfaces: Cure by moist curing with forms in place for full curing period. If forms are removed during the curing period, cure by one of the methods specified for unformed surfaces.

1. Keep steel forms heated by the sun and all wood forms wet during the curing period.

E. Unformed Surfaces: Apply curing materials as soon as finishing operations are complete and the concrete's sufficiently hard to be undamaged by the curing process.

1. Waterproof paper or polyethylene film: Use appropriate color of film based on ambient temperature. Sprinkle concrete with water as necessary during application of covering. Lap edges and ends at least 6 inches, and seal laps. Weight down covering to prevent movement. Patch holes and tears that occur during the curing period.

2. Curing Compounds: Apply strictly according to the manufacturer's instructions using low pressure spray equipment.
   a. Maximum 300 square feet per gallon for curing and sealing compound.

3. Use the following methods:
   a. Interior floors and stairs exposed in the finished work or receiving mastic applied adhesives: Cure using a curing and sealing compound.
      1) For surfaces exposed in the finished work, provide a second coat of acrylic curing and sealing compound immediately prior to substantial completion. Clean floors, and apply sealer strictly according to manufacturer's instructions.
   b. Interior surfaces receiving adhesive applied finishes: Cure using wet curing methods or by covering with waterproof paper or polyethylene film.
      1) Curing and sealing compound may be used upon receipt of a letter from the adhesive manufacturer that this compound is compatible with the adhesive.
   c. Exterior concrete: Cure using exterior concrete curing compound.
   d. All other unformed surfaces: Cure using a strippable curing compound, by wet curing methods, or by covering with waterproof paper or polyethylene film.

4. Protect concrete from excessive changes in temperature during the curing period and at the termination of the curing process. Changes in the temperature of the concrete shall be as uniform as possible and shall not exceed 5° F in any one hour or 50° F in any 24 hour period.

3.10 HOT WEATHER CONCRETING

A. Apply recommended practices of ACI 305R when wind, temperature and humidity conditions cause evaporation rates (using Figure 2.1.5 of ACI 305R) exceeding the following:

1. 0.2 lb/sq ft/hr for concrete with Portland cement only.

2. 0.1 lb/sq ft/hr for concrete with Portland cement and fly ash.

3. 0.05 lb/sq ft/hr for concrete with Portland cement and silica fume.

B. Determine and document expected evaporation rate for the duration of concrete pour.

C. Wet or fog forms and reinforcing immediately prior to placement to bring temperature to ambient conditions.

D. Maintain surface moisture during the period immediately after placement and before final finishing by using wind breaks, fog sprayers, evaporation retarders, or shade (individually or in combination) to prevent plastic shrinkage cracking.

1. Use evaporation retarders according to manufacturer's instructions. Do not use as a finishing aid.

3.11 COLD WEATHER CONCRETING

A. Concrete placed during cold weather shall conform to the requirements of ACI 306.1.

B. Cold weather is defined as 3 or more successive days when the average daily outdoor temperature is less than 40 degrees F.

C. All surfaces, including subgrade and reinforcing shall be above 35 degrees F. prior to placing concrete. Surfaces shall not be more than 10 degrees warmer than the minimum concrete temperatures required by ACI 306.1.

D. Maintain cold weather protection for the following duration but not less than the duration specified in "Curing and Protection" above:

1. Maintain protection for a minimum of 48 hours after placement of concrete.

2. Maintain protection for columns and supported slabs until at least 4 field cylinders, prepared and cured in accordance with ASTM C31, reach 85 percent of the specified 28-day strength, or, laboratory cured cylinders reach the specified 28-day strength.

E. Submit detailed procedures for cold weather concreting for engineer's information only.

F. Follow recommended practices of ACI 306R. Subject to other requirements of this section, a non-chloride accelerator may be used to normalize initial set and for early strength gain.

3.12 FIELD QUALITY CONTROL

A. Provide free access to concrete operations at project site and cooperate with appointed firm.

B. Structural Testing and Special Inspection

1. Structural Testing and Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provisions of Section 01 45 33.

2. Personnel Qualifications
   a. Testing Technician: Technical I - ACI Certified Concrete Field Testing Technician, Grade I, employed by a testing laboratory with C.C.R.L. certification at the National Bureau of Standards, under the direct supervision of a licensed civil/structural engineer. The licensed engineer shall review and approve all reports.
   b. Special Inspector – Structural I: ICC Certified Concrete Inspector, ACI Concrete Construction Inspector, or a graduate civil/structural engineer, or other personnel acceptable to the Structural Engineer of Record (SER), with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed structural engineer, as defined in Section 01 45 33. The licensed engineer shall review and approve all inspection reports.

3. The Owner will provide the following tests and inspections:
   a. Tests for cast in place concrete. Qualifications: Technical I.
      1) Compression test specimens: ASTM C31. One set of four standard cylinders of concrete for each compressive strength test. Mold and store cylinders for laboratory cured specimens.
      2) Compressive strength tests: ASTM C39. One set of four cylinders for each day's pour between one and 25 cubic yards. If a day's pour exceeds 25 cubic yards, one set of four cylinders for each additional 50 cubic yards, or fraction thereof. One specimen tested at 7 days for information, two at 28 days for acceptance, and one specimen retained in reserve for later testing if required. (When frequency of testing will provide less than five strength tests for a given class of concrete, conduct at least five strength tests from randomly selected batches. If fewer than five batches are used, conduct one test from each batch.)
      3) Slump: ASTM C143. One test at point of discharge for each set of compression test specimens; additional tests when concrete consistency appears to have changed.
      4) Air entrainment: ASTM C231. Test the first batch of air entrained concrete and one additional test for each set of compression test specimens.
      5) Concrete temperature: Test hourly when air temperature is below 40°F or above 80°F and each time a set of compression test specimens is made.

b. Concrete mix verification. Qualifications: Technical I. Verify the following:
    1) Mixer truck trip ticket conforms to approved mix design.
    2) Total water added to mix on site does not exceed that allowed by concrete mix design.
    3) Concrete quality is indicative of adequate mixing time, consistency, and relevant time limits.

c. Observe preparation for and placement of all concrete, excluding slabs on grade, strip footings without transverse reinforcement, and unbonded topping slabs. Additional exclusions may be noted on the structural drawings. Special Inspector must be present during entire concrete pour. Qualifications: Structural I. Verify the following:
    1) Acceptable general condition of concrete base prior to placement.
    2) Proper surface preparation at bonded topping slabs.
    3) Concrete conveyance and depositing avoids segregation and contamination.
    4) Concrete is properly consolidated.
    5) Reinforcement remains at proper location.

d. Observe protection and curing methods for all concrete, excluding slabs on grade, strip footings without transverse reinforcement, and unbonded topping slabs Additional exclusions may be noted on the structural drawings. Observations to be made periodically during the curing period. Qualifications: Structural I. Verify the following:
    1) Specified curing procedures are followed.
    2) Specified hot and cold weather procedures are followed.

e. Observe all bolts installed in concrete. Qualifications: Structural I. Verify the following:
    1) Specified size, type, spacing, configuration, embedment, and quantity.
    2) Proper concrete placement and consolidation around all bolts.

C. Contractor Requirements:

1. Provide services of an independent laboratory to perform the following:
    a. Make and test additional cylinders to determine time for form removal.
    b. Make and test additional cylinders to determine termination of curing procedures.
    c. Make and test additional cylinders to determine termination of cold weather practices.

2. Provide the services of a qualified technical representative to instruct the construction team in proper batching, mixing, placement, and finishing of fiber reinforced concrete.

D. Slab Testing: Cooperate with manufacturer of specified moisture vapor reduction admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

3.13 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

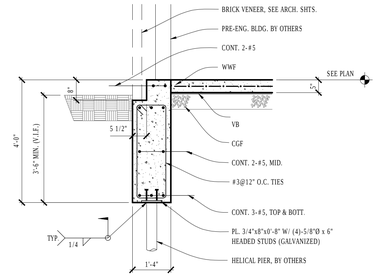
B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

C. Acceptance criteria for concrete strength tests shall be as outlined in section 5.6 of ACI 318. If concrete does not meet acceptance criteria, investigation generally following the provisions of section 5.6.5 of ACI 318 will be used at the discretion of the Structural Engineer of Record. Contractor shall reimburse Owner for all costs associated with this investigation. If, in the judgment of the Structural Engineer of Record, the structural adequacy cannot be shown by this investigation, the Contractor shall remove and replace the concrete in question.

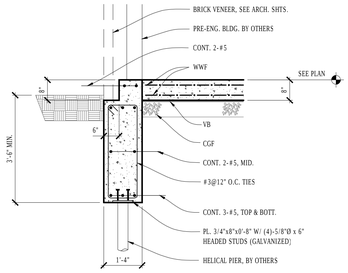
3.14 CLEAN-UP

A. Perform concrete washout only in designated area as required by either Division 31 section Erosion Control or the project NPDES permit.

END OF SECTION



9 S1.10 SECTION
SCALE: 1/2" = 1'-0"



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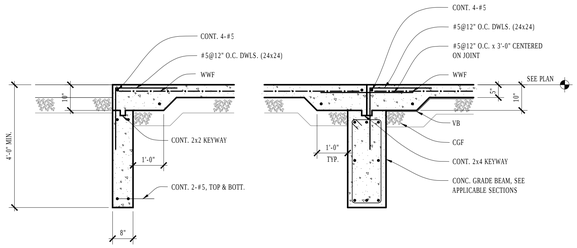

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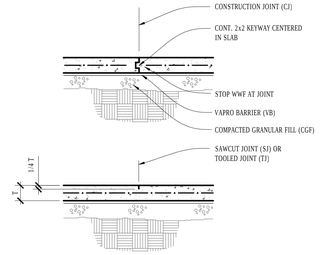
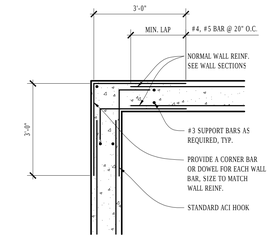


SEE PLAN FOR JOINT TYPES & LOCATIONS
400 SQ. FT. SLAB AREA WITHIN JOINTS MAX., U.N.

3 S1.10 TYP. SLAB JOINTS
SCALE: NONE



1 S1.10 TYP. BEAM CORNER
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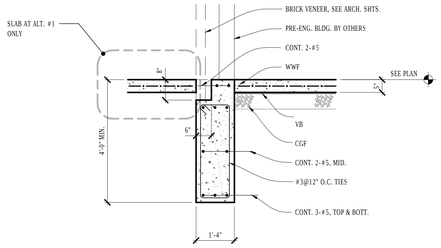

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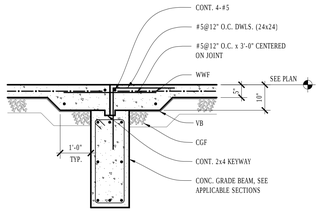

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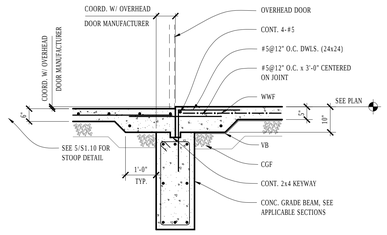

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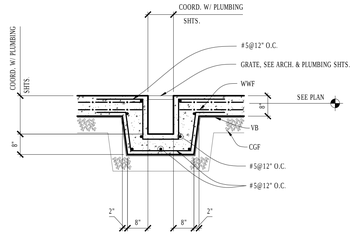
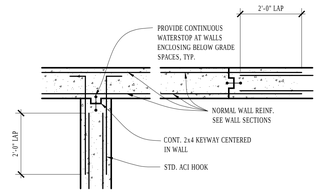
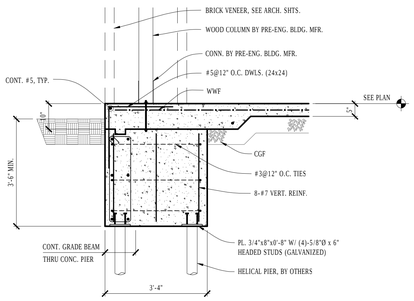


4 S1.10 TRENCH DRAIN
SCALE: NONE

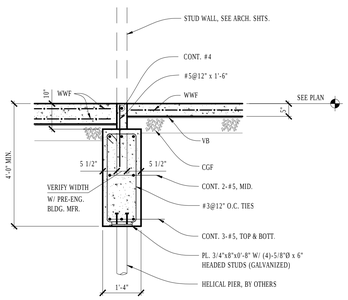


PROVIDE CONCRETE WALL JOINTS @ 40'-0" O.C., MAX.

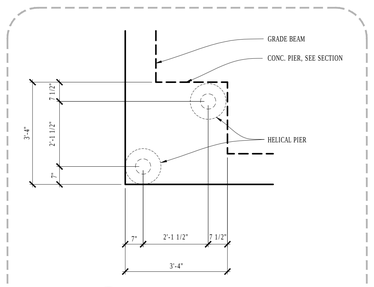
2 S1.10 TYP. BEAM JOINTS
SCALE: NONE



14 S1.10 SECTION
SCALE: 1/2" = 1'-0"

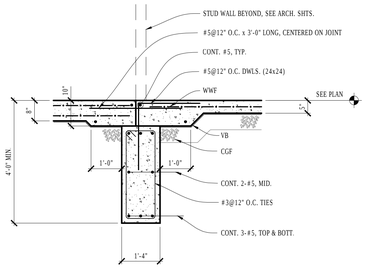


11 S1.10 SECTION
SCALE: 1/2" = 1'-0"

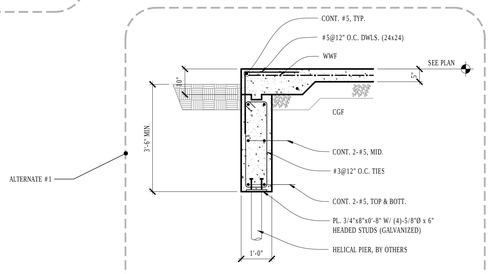


15 S1.10 DETAIL
SCALE: 1/2" = 1'-0"

ALTERNATE #1

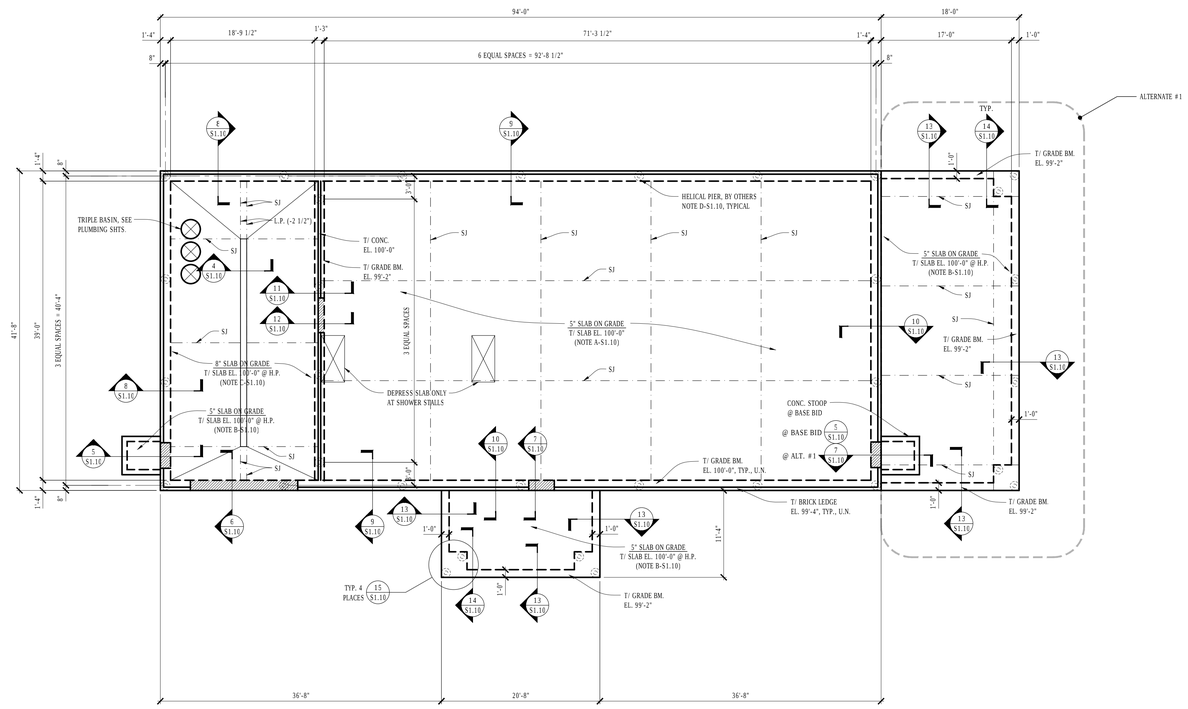


12 S1.10 SECTION
SCALE: 1/2" = 1'-0"



ALTERNATE #1

13 S1.10 SECTION
SCALE: 1/2" = 1'-0"



DRAWING S1.10 GENERAL NOTES:

- INDICATES TOP OF FOUNDATION WALL TO BE DEPRESSED, SEE APPLICABLE SECTION

DRAWING S1.10 KEYNOTES:

A-S1.10: PROVIDE 5" SLAB ON GRADE REINFORCED WITH 6x6-W2.1xW2.1 WELDED WIRE FABRIC. PLACE SLAB ON VAPOR BARRIER OVER 6" OF COMPACTED GRANULAR FILL. SLOPE SLAB TO FLOOR DRAINS. SEE ARCHITECTURAL AND PLUMBING SHEETS FOR DRAIN LOCATIONS AND SLOPE.

B-S1.10: PROVIDE 5" SLAB ON GRADE REINFORCED WITH 6x6-W2.1xW2.1 WELDED WIRE FABRIC. PLACE SLAB OVER 6" OF COMPACTED GRANULAR FILL. SLOPE SLAB TO DRAIN AWAY FROM BUILDING. SEE ARCHITECTURAL SHEETS FOR DRAINAGE SLOPE.

C-S1.10: PROVIDE 8" SLAB ON GRADE REINFORCED WITH 2 LAYERS OF 6x6-W2.9xW2.9 WELDED WIRE FABRIC. PLACE SLAB ON VAPOR BARRIER OVER 6" COMPACTED GRANULAR FILL. SLOPE SLAB TO FLOOR DRAINS. SEE ARCHITECTURAL AND PLUMBING SHEETS FOR DRAIN LOCATIONS AND SLOPE.

D-S1.10: HELICAL PIER BY FOUNDATION CONTRACTOR. EACH PILE SHALL HAVE AN ALLOWABLE VERTICAL DESIGN CAPACITY OF 40 k WITH A MINIMUM FACTOR OF SAFETY OF 2. PILES SHALL BE PLACE AT CENTERLINE OF FOUNDATION WALL, U.N.O.. ADDITIONAL PIERS SHALL BE ADDED AS REQUIRED TO ACHIEVE LOADS INDICATED. PROVIDE BASE BID ASSUMING A 30 FT. TYPICAL PIER DEPTH FOR THE QUANTITY SHOWN ON THE FOUNDATION PLAN.

2

N

FOUNDATION PLAN
SCALE: 1/8" = 1'-0"

Combined Area Fire Training Facility Re-Bid

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

WOLD | RUCK PATE
110 North Brockway, Suite 220
Palatine, Illinois 60067
woldac.com | 847 241 6100

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **ENGINEER** under the laws of the State of **Illinois**

Engineers Name
License Number: **081-005394** Date **Issue Date**

Revisions

Description	Date	Num
Issued for Bid	12-7-17	1
Addendum No. 2	01-22-18	2

Comm: **173013**
Date: **December 7, 2017**
Drawn: **PW**
Check: **KA**

North

FOUNDATION PLAN AND DETAILS

Scale: **As Indicated**

S1.10

IL

A

To: Prospective Bidders

From: Wold | Ruck Pate

Date: January 23, 2018

Comm. No: 173013

Subject: Addendum No. 3 for Re-Bid Documents for the **Village of Buffalo Grove Combined Are Fire Training Facility**

BIDS DUE JANUARY 25, 2018 9:30 AM.

This addendum forms a part of the Contract Documents dated (12-7-17). Acknowledge receipt of this Addendum on the space provided on the Bid Form. Failure to do so may result in disqualification of Bid.

This Addendum consists of two (1) typed sheets and attachments:

SPECIFICATIONS

1. **00 11 13 BID AND CONTRACT DOCUMENTS**
   a. The Bid Proposal due date is to be ***Thursday***, January 25th, 2018.

END OF ADDENDUM #3

Wold Architects and Engineers
110 North Brockway Street, Suite 220
Palatine, IL 60067
woldae.com | 847 241 6100

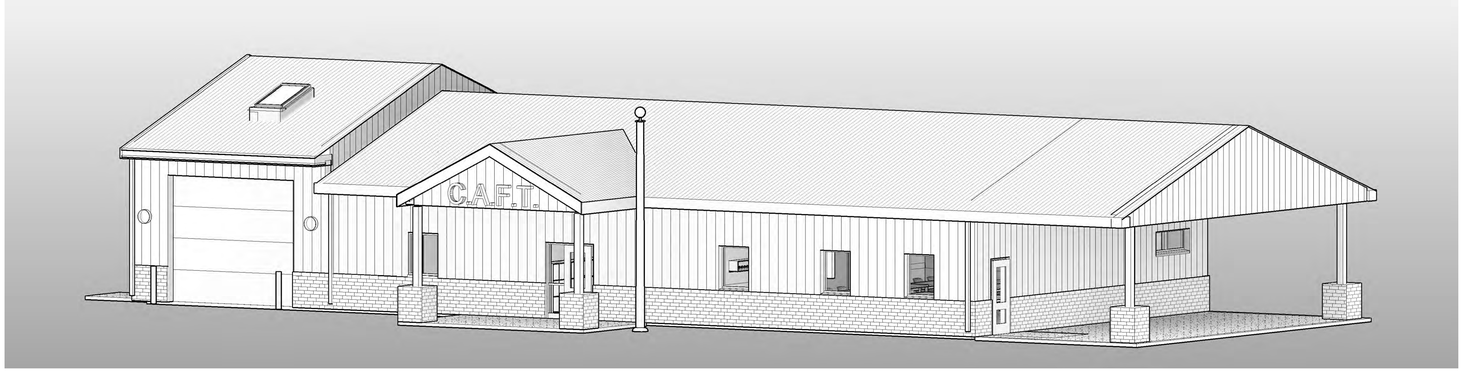
PLANNERS
ARCHITECTS
ENGINEERS

Combined Area Fire Training Facility Re-bid

Village of Buffalo Grove

Buffalo Grove, IL

IL



CIVIL

C1.0	EXISTING CONDITION PLANS
C2.0	DEMOLITION AND GEOMETRIC PLAN
C3.0	GRADING AND UTILITY PLAN
C4.0	STANDARD CONSTRUCTION NOTES
C5.0	STANDARD CONSTRUCTION DETAILS

ARCHITECTURAL

A0.01	SITE PLAN AND CODE PLAN
A1.10	FLOOR, REFLECTED CEILING AND ROOF PLANS
A2.10	EXTERIOR ELEVATIONS
A2.11	ENLARGED PLANS
A3.10	WALL SECTIONS
A4.11	SCHEDULES AND DETAILS
A4.12	DETAILS
A4.13	DETAILS

STRUCTURAL

S0.10	STRUCTURAL GENERAL NOTES
S1.10	FOUNDATION PLAN AND DETAILS

MECHANICAL

F001	FIRE PROTECTION GENERAL NOTES AND SYMBOLS
F100	FIRE PROTECTION PLAN
M001	MECHANICAL GENERAL NOTES AND SYMBOLS
M100	MAIN LEVEL HVAC PLAN
M200	MECHANICAL SCHEDULES
M300	MECHANICAL DETAILS
P001	PLUMBING GENERAL NOTES, SYMBOLS AND DETAILS
P100	MAIN LEVEL PLUMBING PLANS
P200	PLUMBING RISER DIAGRAMS
P300	PLUMBING SCHEDULES

ELECTRICAL

E101	ELECTRICAL PLANS
E201	ELECTRICAL SCHEDULES

ISSUED FOR BID
12-7-17

Set No: _____
Comm No: 173013

Combined Area Fire Training Facility Re-Bid
851 Krause Drive
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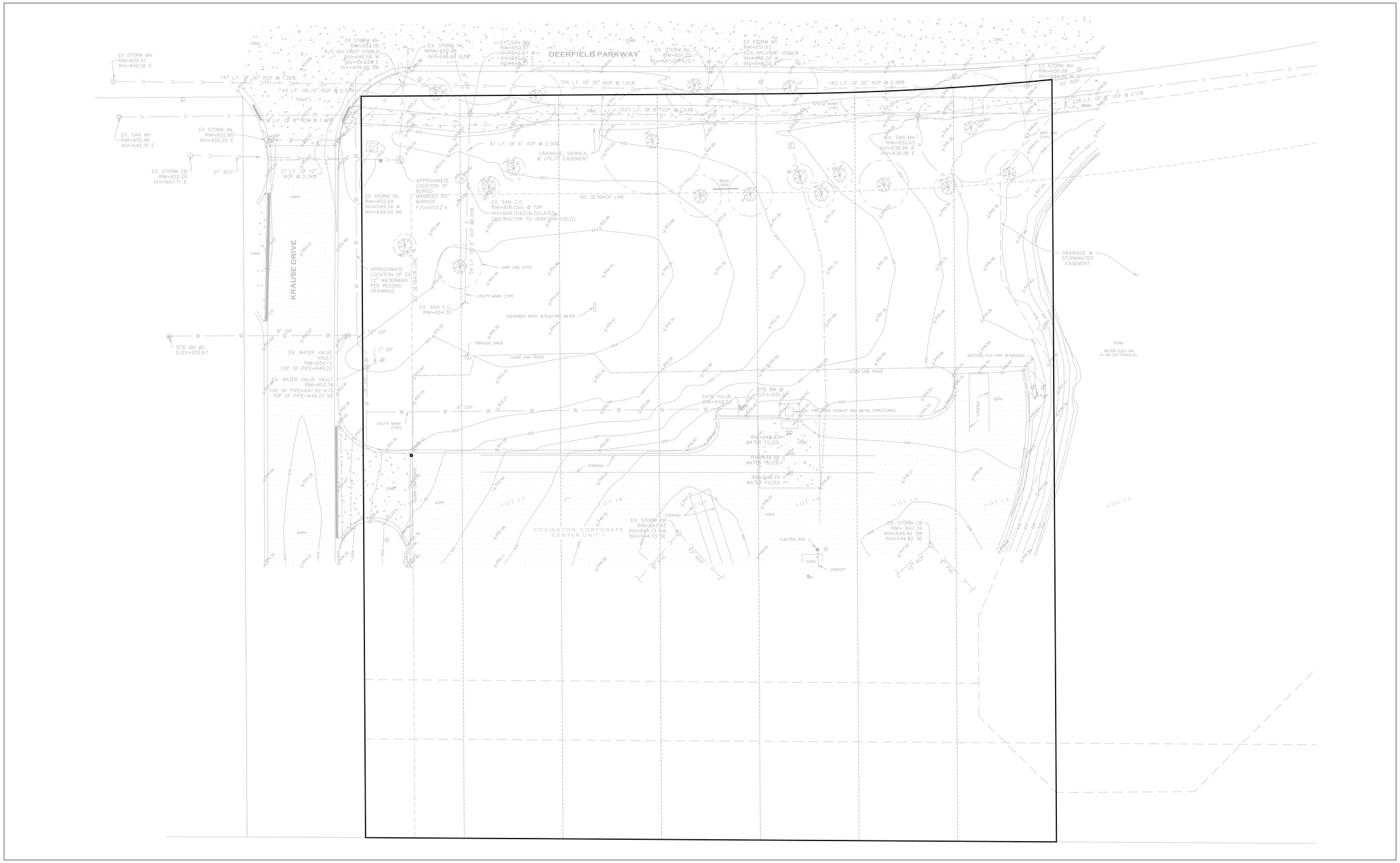

1 **EXISTING CONDITION PLAN**
SCALE: 1" = 20'

NOTES

1. FIELD WORK WAS COMPLETED APRIL 26, 2017.
2. ONLY THOSE TREES BEING 6" DIAMETER AND LARGER ARE SHOWN HEREON.
3. PROPERTY LINES, SETBACKS, AND EASEMENTS SHOWN HEREON ARE APPROXIMATE AND FOR INFORMATIONAL PURPOSES ONLY. PLEASE REFER TO A CURRENT PLAT OF SURVEY FOR ALL BOUNDARY INFORMATION AND DATA.
4. SURVEYOR WAS NOT PROVIDED TITLE WORK OR DEED FOR THE PREMISES SHOWN HEREON.
5. THE IMPROVEMENTS/UTILITIES SHOWN HEREON WERE LOCATED AT THE TIME OF THE SURVEY AND ARE NOT A REPRESENTATION OF ANY PHYSICAL STRUCTURES OR FEATURES THAT MAY HAVE BEEN OBSTRUCTED BY SNOW, ICE, LANDSCAPING, OR BRUSH.
6. SURFACE INDICATIONS OF UTILITIES ON THE SURVEYED AREA HAVE BEEN SHOWN, INCLUDING UTILITIES FLAGGED OR PAINTED ON SITE. PUBLIC AND/OR PRIVATE RECORDS HAVE NOT BEEN SEARCHED TO PROVIDE ADDITIONAL INFORMATION. OVERHEAD WIRES AND POLES (IF ANY) HAVE BEEN SHOWN, HOWEVER THEIR FUNCTION AND DIMENSIONS HAVE NOT BEEN SHOWN.
7. OTHER THAN VISIBLE OBSERVATIONS NOTED HEREON, THIS SURVEY MAKES NO STATEMENT REGARDING THE ACTUAL PRESENCE OR ABSENCE OF ANY SERVICE OR UTILITY LINE.
8. SURVEY COMPLETED FOR:
   VILLAGE OF BUFFALO GROVE
   51 RAUPP BLVD
   BUFFALO GROVE, IL 60023

BENCHMARKS

ELEVATIONS SHOWN ARE RELATIVE TO NAVD 88.

SOURCE BENCHMARK:
LAKE COUNTY BENCHMARK ID # SMC 28. PLEASE REFER TO LAKE COUNTY BENCHMARK RECOVERY SHEET FOR LOCATION AND DESCRIPTION.
ELEVATION= 643.28'

SITE BENCHMARK #1:
NORTHWESTERLY UPPER FLANGE BOLT ON FIRE HYDRANT SHOWN HEREON.
ELEVATION= 651.37'

SITE BENCHMARK #2:
NORTHEASTERLY UPPER FLANGE BOLT ON FIRE HYDRANT SHOWN HEREON.
ELEVATION= 655.67'

ISSUED FOR RE-BID
12-07-2017

Combined Area Fire Training Facility Re-Bid
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Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

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3697 Darlene Ct.
Aurora, IL 60504
Office 630.554.6655
Fax 630.554.7788
www.meritcorp.com

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed under the laws of the State of Illinois.

DATE: 12-6-2017
JAMES P. MEIER — LICENSED PROFESSIONAL ENGINEER
Registration Number: 062-051277
EXP. DATE: NOVEMBER 30, 2019

Revisions

Description	Date	Num
Issued for Bid	12-7-17	1

Comm: 173013
Date: 7-7-2017
Drawn: CLS
Check: JPM
North

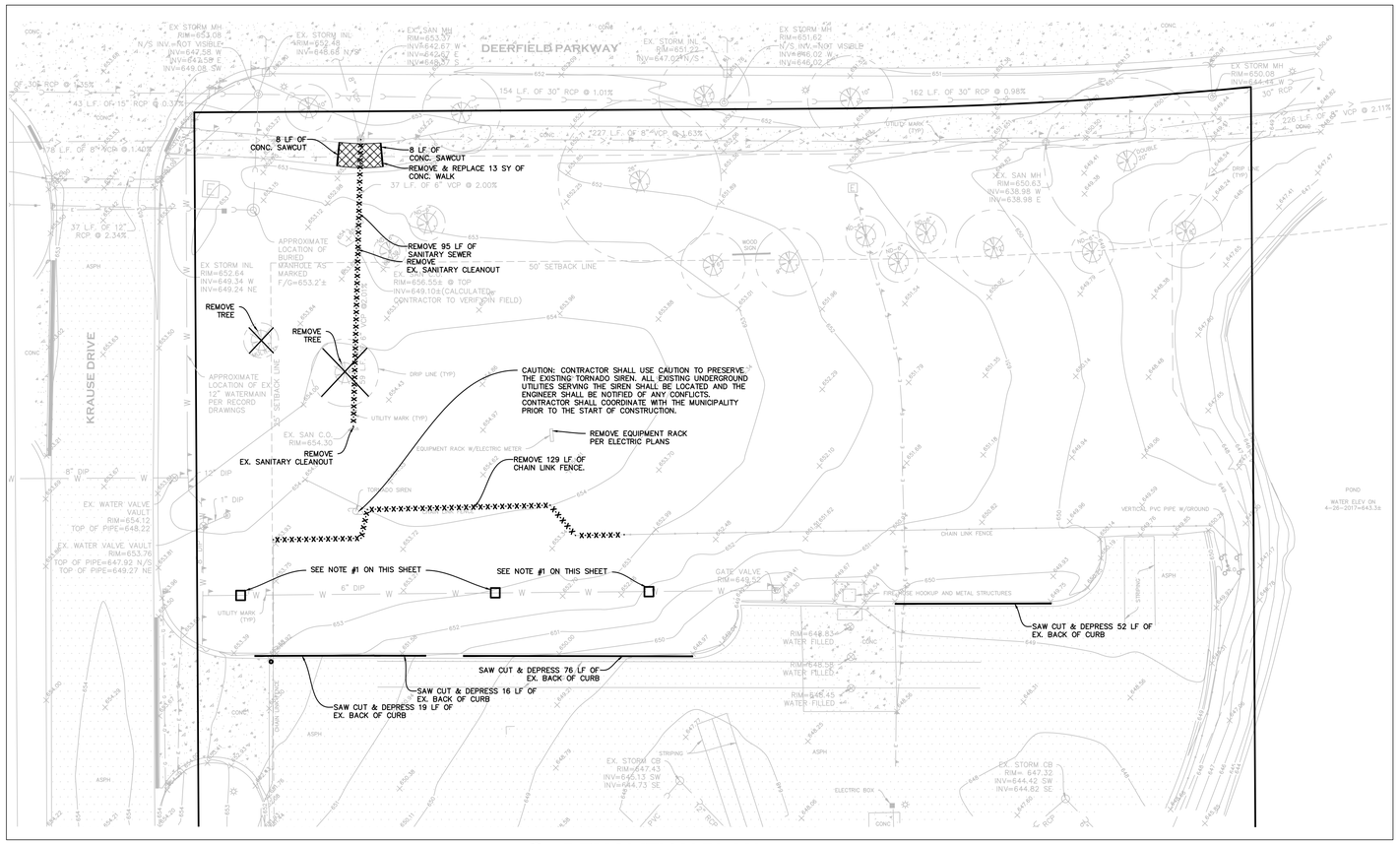
EXISTING CONDITION PLAN

Scale:

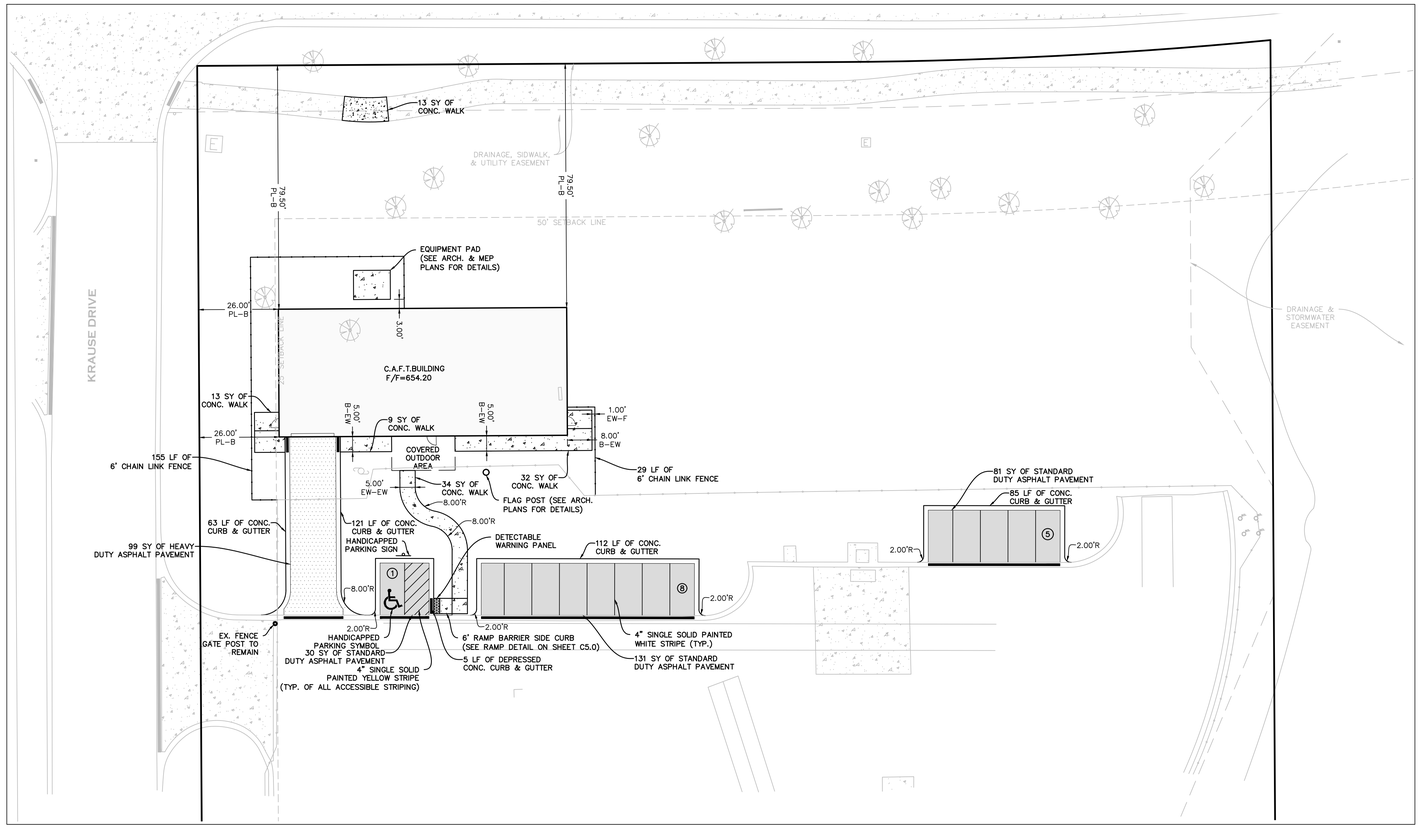
C1.0

IL

A



2 DEMOLITION PLAN
SCALE: 1" = 20'



3 GEOMETRIC PLAN
SCALE: 1" = 20'

DEMOLITION LEGEND

- REMOVE ITEM
- SAWCUT BACK OF CURB
- FULL DEPTH SAWCUT PAVEMENT
- REMOVE ASPHALT PAVEMENT

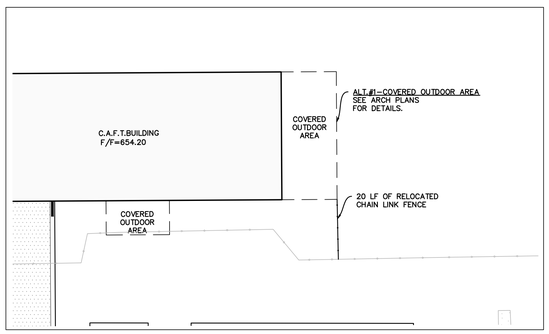
NOTE:

1. CONTRACTOR SHALL POT HOLE THE EXISTING WATERMAIN AND REPORT THE TOP OF PIPE ELEVATION TO THE ENGINEER.

LEGEND

- DEPRESSED CURB AND GUTTER (SEE DETAILS ON SHEET C5.0)
- STANDARD DUTY ASPHALT PAVEMENT (SEE DETAILS ON SHEET C5.0)
- CONCRETE PAVEMENT (SEE DETAILS ON SHEET C5.0)
- HEAVY DUTY ASPHALT PAVEMENT (SEE DETAIL ON SHEET C5.0)

PL	PROPERTY LINE
ES	EDGE OF STRIPE
CS	CENTER OF STRIPE
B	BUILDING
BC	BACK OF CURB
EW	EDGE OF WALK
R	RADIUS
F	FENCE



ALTERNATE #1 PLAN
SCALE: 1" = 20'

ISSUED FOR RE–BID
12–07–2017

Combined Area Fire Training Facility Re-Bid

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

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Palatine, Illinois 60067
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3697 Darlene Ct. Aurora, IL 60504
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Fax 630.554.7788
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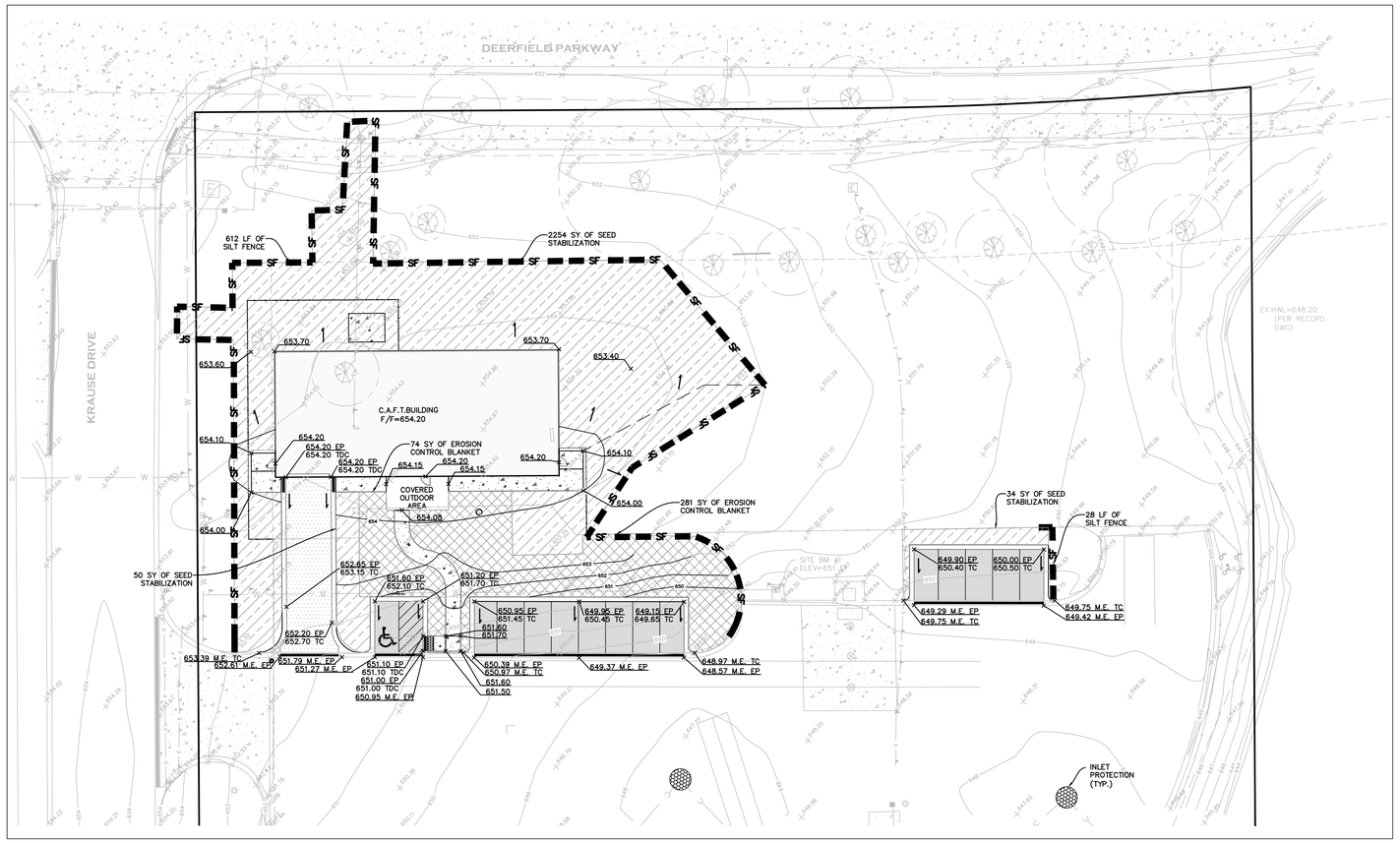
Revisions		
Description	Date	Num
Issued for Bid	12-7-17	1

Comm: 173013
Date: 7-7-2017
Drawn: CLS
Check: JPM
North

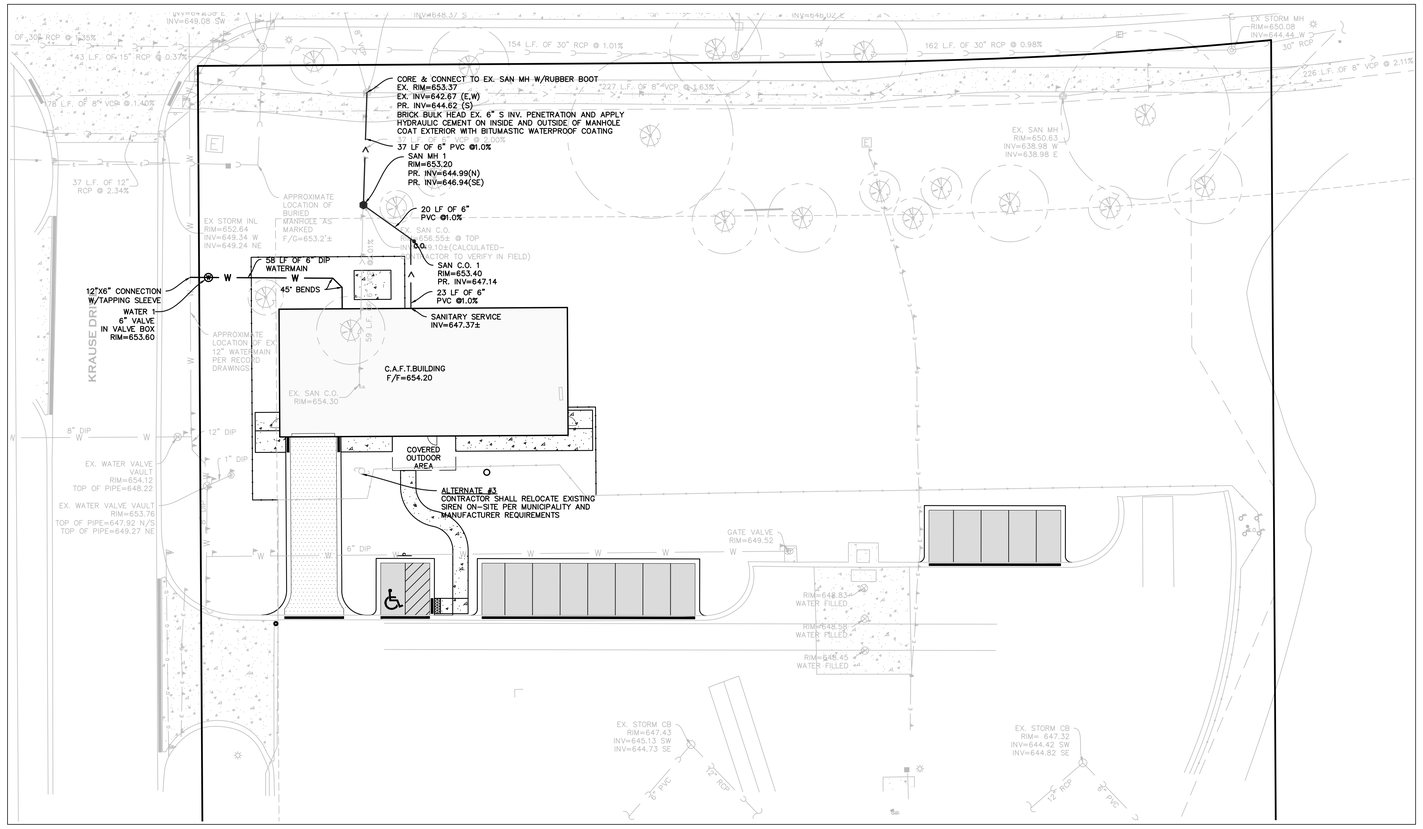
DEMOLITION PLAN GEOMETRIC PLAN

Scale:

C2.0



4 **GRADING & SOIL EROSION CONTROL PLAN**
SCALE: 1" = 20'



5 **UTILITY PLAN**
SCALE: 1" = 20'

GRADING LEGEND

720	GRADING CONTOUR
	EMERGENCY OVERLAND FLOOD ROUTE
	DRAINAGE FLOW ARROW
T/F	TOP OF FOUNDATION
G/F	GARAGE FLOOR
EP	EDGE OF PAVEMENT
TC	TOP OF CURB
TDC	TOP OF DEPRESSED CURB
M.E.	MATCH EXISTING
	DEPRESSED CURB AND GUTTER
	INLET PROTECTION (SEE SHEET #)
SF	SILT FENCE
	EROSION CONTROL BLANKET (SEE SHEET C5.0)
	FINAL STABILIZATION

GRADING PLAN NOTE:

1. ALL PERVIOUS DISTURBED AREAS SHALL RECEIVE A MINIMUM 6" OF TOPSOIL AND IDOT CLASS 1 SEED.

UTILITY & STORM LEGEND

T T	TELEPHONE LINE
E	ELECTRIC LINE
G	GAS LINE
<	SANITARY LINE
W	WATER LINE
	SANITARY MANHOLE
	VALVE VAULT
	FIRE HYDRANT
	BUFFALO BOX
	GAS VALVE
C.O.	CLEAN OUT
C C	STORM SEWER
	STORM MANHOLE/INLET
	STORM CATCH BASIN
	STORM FLARED END SECTION

ISSUED FOR RE-BID
12-07-2017

Combined Area Fire Training Facility Re-Bid

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Description	Date	Num
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Comm: 173013
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North

GRADING PLAN
UTILITY PLAN

Scale:

C3.0

Combined Area Fire Training Facility Re-Bid

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GENERAL SITE IMPROVEMENTS

1. COPIES OF THE REFERENCED STANDARD SPECIFICATIONS, CONSTRUCTION PLANS AND DETAILS ARE ALL TO BE CONSIDERED AS PART OF THE CONTRACT. INCIDENTAL ITEMS OR ACCESSORIES NECESSARY TO COMPLETE THIS WORK MAY NOT BE SPECIFICALLY NOTED BUT ARE CONSIDERED A PART OF THIS CONTRACT.

2. THE GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND GENERAL REQUIREMENTS (IF ANY) APPLY TO THE WORK SPECIFIED IN THE PLANS.

3. EASEMENTS FOR EXISTING UTILITIES, BOTH PUBLIC AND PRIVATE, AND UTILITIES WITHIN PUBLIC RIGHTS-OF-WAY ARE SHOWN ON THE PLANS ACCORDING TO INFORMATION AVAILABLE IN THE RECORDS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING THE EXACT LOCATION OF THESE UTILITY LINES IN THE FIELD AND FOR THEIR PROTECTION FROM DAMAGE DUE TO CONSTRUCTION OPERATIONS. IF EXISTING UTILITY LINES OF ANY NATURE ARE ENCOUNTERED WHICH CONFLICT IN LOCATION WITH NEW CONSTRUCTION, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE DEVELOPER'S REPRESENTATIVE SO THE CONFLICT MAY BE RESOLVED. THE CONTRACTOR SHALL CALL 811 OR J.U.L.I.E. (800-892-0123) PRIOR TO CONSTRUCTION.

4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL PRIVATE AND PUBLIC UTILITIES EVEN THOUGH THEY MAY NOT BE SHOWN IN THE PLANS. ANY UTILITY THAT IS DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR AT HIS OWN EXPENSE, TO THE SATISFACTION OF THE UTILITY OWNER.

5. RELOCATING UTILITIES SHALL BE THE RESPONSIBILITY OF THE OWNERS EXCEPT WHEN NOTED IN THE PLANS. THE CONTRACTOR SHALL COORDINATE WITH THESE OWNERS WHEN MOVING IS NECESSARY.

6. EXPENSE IN CONNECTING PROPOSED UTILITIES TO EXISTING UTILITIES SHALL BE INCIDENTAL TO THE CONTRACT. PRIOR TO ALL UTILITY WORK, ALL CONNECTION LOCATIONS, DEPTHS AND SIZES SHALL BE FIELD VERIFIED. IF THERE ARE ANY DISCREPANCIES OR CONFLICTS, THE CONTRACTOR SHALL NOTIFY THE ENGINEER.

7. THE CONTRACTOR SHALL COORDINATE WITH ALL UTILITY OWNERS. THE CONTRACTOR SHALL NOTIFY ALL UTILITY OWNERS PRIOR TO CONSTRUCTION.

8. ALL FIELD TILE ENCOUNTERED DURING CONSTRUCTION OPERATIONS SHALL BE CONNECTED TO THE PROPOSED STORM SEWER SYSTEM OR EXTENDED TO OUTLET INTO A PROPOSED DRAINAGE SWALE. IF THIS CANNOT BE ACCOMPLISHED, THEN IT SHALL BE REPAIRED WITH NEW PIPE OF SIMILAR SIZE AND MATERIAL TO THE ORIGINAL LINE AND PUT IN ACCEPTABLE OPERATING CONDITION. A RECORD OF THE LOCATION OF ALL FIELD TILE OR DRAIN PIPE ENCOUNTERED SHALL BE KEPT BY THE CONTRACTOR AND SUBMITTED TO THE MUNICIPALITY UPON COMPLETION OF THE PROJECT.

9. WHENEVER ANY LOOSE MATERIAL IS DISPOSED IN THE FLOW LINE OF GUTTERS, DRAINAGE STRUCTURES OR DITCHES SUCH THAT THE NATURAL FLOW LINE OF WATER IS OBSTRUCTED, THE LOOSE MATERIAL SHALL BE REMOVED AT THE CLOSE OF EACH WORKING DAY. AT THE CONCLUSION OF CONSTRUCTION OPERATIONS, ALL DRAINAGE STRUCTURES AND FLOW LINES SHALL BE FREE FROM DIRT AND DEBRIS. THIS WORK SHALL BE CONSIDERED INCIDENTAL TO THE CONTRACT.

10. REMOVED DRIVEWAY PAVEMENT, SIDEWALK AND CURBS AND CURB AND GUTTER SHALL BE DISPOSED OF OFF-SITE AT LOCATIONS PROVIDED BY THE CONTRACTOR AT HIS OWN EXPENSE.

11. BEFORE APPROPRIATE ACCEPTANCE BY THE OWNER AND/OR THE MUNICIPALITIES AND FINAL PAYMENT, ALL WORK SHALL BE INSPECTED AND APPROVED BY THE MUNICIPALITIES AND THE OWNER OR HIS REPRESENTATIVES. FINAL PAYMENT WILL BE MADE AFTER ALL OF THE CONTRACTOR'S WORK HAS BEEN APPROVED AND ACCEPTED. THE CONTRACTOR SHALL GUARANTEE HIS WORK FOR A PERIOD OF ONE YEAR FROM THE DATE OF ACCEPTANCE AND SHALL BE HELD RESPONSIBLE FOR ANY DEFECTS IN MATERIAL OR WORKMANSHIP OF THIS WORK DURING THAT PERIOD.

12. TRAFFIC CONTROL DEVICES IN CONFORMANCE WITH I.D.O.T. STANDARDS SHALL BE INSTALLED AND PROVIDED WHENEVER CONSTRUCTION FOR UTILITIES IS WITHIN A PUBLIC RIGHT OF WAY AREA. ORDINANCES OF THE MUNICIPALITY MAY ALSO GOVERN TRAFFIC CONTROL. THE COST OF PROVIDING, INSTALLING AND MAINTAINING NECESSARY TRAFFIC CONTROL DEVICES SHALL BE INCIDENTAL TO THE CONTRACT.

13. ALL PROPOSED ELEVATIONS SHOWN ON PLANS ARE FINISHED SURFACE ELEVATIONS UNLESS OTHERWISE SPECIFIED.

14. UPON AWARDING OF THE CONTRACT AND WHEN REQUIRED BY THE MUNICIPALITY, THE CONTRACTOR SHALL FURNISH ALL LABOR, MATERIAL AND PERFORMANCE BOND IN THE AMOUNT REQUIRED BY THE MUNICIPALITY TO GUARANTEE COMPLETION OF THE WORK. THE UNDERWRITER SHALL BE ACCEPTABLE TO THE MUNICIPALITY. THE CONTRACTOR SHALL NOT COMMENCE WORK UNTIL ALL REQUIRED INSURANCE IS OBTAINED AND ACCEPTED.

15. ALL PERMITS, BONDS AND EVIDENCE OF INSURANCE AS REQUIRED BY UTILITY COMPANIES AND THE MUNICIPALITY SHALL BE OBTAINED BY THE CONTRACTOR AND THE COST OF THESE PERMITS AND BONDS SHALL BE BORNE BY THE CONTRACTOR AND SHALL BE INCIDENTAL TO THE CONTRACT.

16. THE CONTRACTOR SHALL COLLECT AND REMOVE ALL CONSTRUCTION DEBRIS, EXCESS MATERIALS, TRASH, OIL AND GREASE RESIDUE, MACHINERY, TOOLS AND OTHER MISCELLANEOUS ITEMS WHICH ARE PRESENT UPON COMPLETION OF CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ACQUIRING ANY AND ALL PERMITS NECESSARY FOR THE HAULING AND DISPOSAL REQUIRED FOR CLEAN-UP AS DIRECTED BY THE MUNICIPALITY OR OWNER. BURNING ON THE SITE IS NOT PERMITTED.

17. NO CONSTRUCTION PLAN SHALL BE USED FOR CONSTRUCTION UNLESS SPECIFICALLY MARKED FOR CONSTRUCTION. PRIOR TO COMMENCEMENT OF CONSTRUCTION, THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS AFFECTING THE WORK WITH THE ACTUAL CONDITIONS AT THE JOB SITE. IN ADDITION, THE CONTRACTOR MUST VERIFY ALL LINE AND GRADE STAKES PROVIDED BY THE OWNER. IF THERE ARE ANY DISCREPANCIES WITH WHAT IS SHOWN ON THE CONSTRUCTION PLANS, HE MUST IMMEDIATELY REPORT TO THE OWNER BEFORE DOING ANY WORK OR ASSUME FULL RESPONSIBILITY. IN THE EVENT OF DISAGREEMENT BETWEEN THE CONSTRUCTION PLANS, SPECIFICATIONS AND/OR SPECIAL DETAILS, THE CONTRACTOR SHALL SECURE WRITTEN INSTRUCTION FROM THE OWNER PRIOR TO PROCEEDING WITH ANY PART OF THE WORK AFFECTED BY OMISSIONS OR DISCREPANCIES. FAILING TO SECURE SUCH INSTRUCTION, THE CONTRACTOR WILL BE CONSIDERED TO HAVE PROCEEDED AT HIS OWN RISK AND EXPENSE. IN THE EVENT OF ANY DOUBT OR QUESTIONS ARISING WITH RESPECT TO THE TRUE MEANING OF THE CONSTRUCTION PLANS OR SPECIFICATIONS, THE DECISION OF THE OWNER SHALL BE FINAL.

18. NOTIFICATION OF COMMENCING CONSTRUCTION: A. THE CONTRACTOR SHALL NOTIFY THE OWNER AND/OR HIS REPRESENTATIVE AND THE AFFECTED GOVERNMENTAL AGENCIES IN WRITING AT LEAST THREE FULL WORKING DAYS PRIOR TO COMMENCEMENT OF CONSTRUCTION. IN ADDITION, THE CONTRACTOR SHALL NOTIFY, AS NECESSARY, ALL TESTING AGENCIES. B. FAILURE OF CONTRACTOR TO ALLOW PROPER NOTIFICATION TIME WHICH RESULTS IN TESTING COMPANIES TO BE UNABLE TO VISIT SITE AND PERFORM TESTING WILL CAUSE CONTRACTOR TO SUSPEND OPERATION (PERTAINING TO TESTING) UNTIL TESTING AGENCY CAN SCHEDULE TESTING OPERATIONS. THE COST OF SUSPENSION OF WORK SHALL BE BORNE BY THE CONTRACTOR.

19. ALL CONTRACTORS SHALL KEEP ACCESS AVAILABLE AT ALL TIMES FOR EMPLOYEES AND EMERGENCY VEHICLES. AT NO TIME SHALL ACCESS BE DENIED TO EMPLOYEES OF THE SITE.

20. THE CONTRACTOR SHALL PROVIDE ELECTRONIC COPIES AND 2 SETS OF COPIES OF "RECORD" DRAWINGS TO THE MUNICIPALITIES AND OWNER PRIOR TO ANY REQUEST FOR FINAL INSPECTION. SAID PLANS SHALL INDICATE THE FINAL LOCATIONS AND LAYOUT OF ALL IMPROVEMENTS AND SHALL INCLUDE VERIFICATION OF ALL BUILDING PADS, INVERTS, RIMS AND SPOT GRADE ELEVATIONS AND INCORPORATE ALL FIELD DESIGN CHANGES APPROVED BY THE MUNICIPALITY. MYLAR DRAWINGS SHALL BE PROVIDED WHEN THE COPIES ARE APPROVED BY THE MUNICIPALITY.

21. THE CONTRACTOR SHALL VIDEO RECORD THE WORK AREA PRIOR TO CONSTRUCTION FOR THE PURPOSE OF DOCUMENTING EXISTING CONDITIONS.

EARTHWORK

1. ALL SITE WORK, GRADING AND EMBANKMENT CONSTRUCTION WITHIN THE LIMITS OF THIS PROJECT SHALL BE DONE IN ACCORDANCE WITH THE "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION IN ILLINOIS" (STANDARD SPECIFICATIONS), THE MOST RECENT EDITION.

2. EARTH EXCAVATION SHALL INCLUDE CLEARING, STRIPPING AND STOCKPILING TOPSOIL, REMOVING UNSUITABLE MATERIALS, THE CONSTRUCTION OF EMBANKMENTS, NON-STRUCTURAL FILLS, FINAL SHAPING AND TRIMMING TO THE LINES, GRADES AND CROSS-SECTIONS SHOWN ON THE PLANS. THIS WORK SHALL BE PERFORMED IN ACCORDANCE WITH APPLICABLE PROVISIONS OF SECTION 200 OF THE STANDARD SPECIFICATIONS. ALL UNSUITABLE OR EXCESS MATERIAL SHALL BE DISPOSED OF BY THE CONTRACTOR.

3. TOPSOIL EXCAVATED SHALL BE STOCKPILED ON THE SITE OR IN AREAS DESIGNATED BY THE OWNER UNTIL SUCH TIME THAT THIS TOPSOIL CAN BE USED FOR FINAL GRADING.

4. THE CONTRACTOR IS REFERRED TO SOILS INVESTIGATION FOR THE SITE AND ALL ADDENDA THERETO, SHOWING THE RESULTS OF SUBSURFACE INVESTIGATION MADE ON THIS SITE. COPIES OF SAID SOILS REPORTS ARE ON FILE WITH THE OWNER AND ARE AVAILABLE FOR INSPECTION. THE RECOMMENDATIONS OF SOIL INVESTIGATIONS AS STATED IN SAID REPORT ARE HEREBY INCORPORATED INTO THESE CONSTRUCTION NOTES BY REFERENCE AND SHALL BE FOLLOWED BY THE CONTRACTORS. THE GRADING OPERATIONS ARE TO BE CLOSELY SUPERVISED AND INSPECTED, PARTICULARLY DURING THE REMOVAL OF UNSUITABLE MATERIAL AND THE CONSTRUCTION OF EMBANKMENTS, BY THE SOILS ENGINEER OR HIS REPRESENTATIVE.

5. THE GRADING AND CONSTRUCTION OF THE IMPROVEMENTS SHALL NOT CAUSE PONDING OF STORM WATER. ALL AREAS ADJACENT TO THESE IMPROVEMENTS SHALL BE GRADED TO ALLOW POSITIVE DRAINAGE.

6. ALL TESTING, INSPECTION AND SUPERVISION OF SOILS QUALITY, UNSUITABLE REMOVAL AND ITS REPLACEMENT AND OTHER SOILS RELATED OPERATIONS SHALL BE ENTIRELY THE RESPONSIBILITY OF THE SOILS ENGINEER AND THE OWNER.

7. THE PROPOSED GRADING ELEVATIONS SHOWN ON THE PLANS ARE FINISH GRADE. A MINIMUM OF SIX (6) INCHES OF TOPSOIL IS TO BE PLACED IN OPEN AREAS BEFORE FINISH GRADE ELEVATIONS ARE ACHIEVED.

8. THE CONTRACTOR WILL USE CARE WHEN GRADING NEAR TREES, SHRUBS AND BUSHES WHICH ARE NOT TO BE REMOVED SO AS NOT TO CAUSE INJURY TO ROOTS OR TRUNKS. SHOULD THE EXISTING BECOME DAMAGE OR DIE, CONTRACTOR SHALL REPLACE IN KIND AT THE CONTRACTOR'S OWN EXPENSE AND SHALL BE INCIDENTAL TO THE CONTRACT. SEE LANDSCAPE PLANS FOR TREES THAT ARE NOT TO BE REMOVED.

9. THE CONTRACTOR SHALL USE CARE IN GRADING OR EXCAVATING NEAR ANY AND ALL EXISTING ITEMS WHICH ARE NOT INDICATED TO BE REMOVED. ANY DAMAGE DONE TO THESE EXISTING ITEMS BY CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY HIM AT HIS OWN EXPENSE.

10. UNSUITABLE MATERIAL ENCOUNTERED IN EXCAVATING FOR PAVEMENT SUBGRADES SHALL BE REMOVED AND REPLACED WITH SUITABLE MATERIAL TO THE LIMITS APPROVED BY THE OWNER. UNSUITABLE MATERIAL THAT IS EXCAVATED, AS DIRECTED BY THE SOILS ENGINEER AND OWNER, SHALL BE DISPOSED OF AT THE CONTRACTOR'S OWN EXPENSE AND SHALL BE INCIDENTAL TO THE CONTRACT.

11. THE EARTHWORK CONTRACTOR SHALL BE RESPONSIBLE FOR BACKFILLING OF ALL CURBS, AS SOON AS THE CONCRETE HAS SET SUFFICIENTLY, TO THE REQUIRED ELEVATION WITH SUITABLE MATERIAL WHICH SHALL BE COMPACTED UNTIL FIRM AND SOLID, AND NEATLY GRADED.

12. THE PAVEMENT SUBGRADE SHALL BE GRADED WITHIN +/- 0.10' (AVERAGING ZERO) OF PROPOSED SUBGRADE AS SHOWN ON THE PLANS AND SET BY THE ENGINEER IN THE FIELD. ALL FILL DEPOSITED IN THE AREAS SHALL BE CLEAN CLAY COMPACTED TO 95% OF THE MAXIMUM DENSITY SHOWN ON THE DRY WEIGHT CURVES DETERMINED BY THE MODIFIED PROCTOR ANALYSIS.

13. WASTE EXCAVATION SHALL BE DISPOSED OF BY THE CONTRACTOR AT HIS OWN EXPENSE AND AT A LOCATION PROVIDED BY THE CONTRACTOR WHICH LOCATION BE APPROVED BY OWNER.

14. SUITABLE EXCAVATION IS CLASSIFIED AS EXCAVATION CAPABLE OF 3,000 PSF BEARING WHEN COMPACTED TO 95% MODIFIED PROCTOR.

15. SUITABLE EMBANKMENT IS CLASSIFIED AS EMBANKMENT CAPABLE OF 3,000 PSF BEARING WHEN COMPACTED TO 95% MODIFIED PROCTOR, TO BE USED WITHIN PAVEMENT AREAS. SUITABLE EMBANKMENT CONTAINS 15% COMPACTION FACTOR.

16. UNCLASSIFIED EXCAVATION IS CLASSIFIED AS EXCAVATION NOT NECESSARILY CAPABLE OF A 3,000 PSF BEARING WHEN COMPACTED.

17. UNCLASSIFIED EMBANKMENT IS CLASSIFIED AS EMBANKMENT NOT REQUIRING 3,000 PSF BEARING WHEN COMPACTED. THIS FILL IS TO BE USED IN AREAS OUTSIDE ROADWAY LIMITS AND PAD AREAS.

18. UNCLASSIFIED EMBANKMENT SHALL BE COMPACTED TO NATURAL COMPACTION. SUITABLE EMBANKMENT SHALL BE COMPACTED TO 95% MODIFIED PROCTOR.

19. EARTHWORK QUANTITIES SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO BIDDING. ANY DISCREPANCIES IN QUANTITIES SHALL BE REPORTED TO OWNER.

20. ALL UNDERCUTTING SHALL BE DONE AT THE DIRECTION OF THE OWNER OR HIS REPRESENTATIVE. THE UNDERCUT SHALL BE CROSS-SECTIONED BY THE OWNER'S REPRESENTATIVE AFTER THE UNDERCUTTING HAS BEEN DONE TO DETERMINE QUANTITY.

21. ALL UTILITY SPOIL PILES SHALL BE CLEANED UP BY THE UTILITY CONTRACTOR. MATERIAL SHALL NOT BE REMOVED FROM THE SITE WITHOUT THE APPROVAL OF THE OWNER AND LOCATION OF DISPOSAL ON THE SITE SHALL BE APPROVED BY OWNER.

22. EXCAVATION BELOW TOPSOIL FOR PAVEMENT SHALL BE TO 2' BEHIND CURB OR PAVEMENT EDGE IN CUT AREA. EXCAVATION BELOW TOPSOIL FOR PADS SHALL BE 5' BEYOND BUILDING LIMITS.

23. TOPSOIL PRESENT IN CUT AREAS SHALL BE STOCKPILED OR USED AS UNCLASSIFIED EMBANKMENT ON SITE OR DISPOSED OF AT THE DIRECTION OF THE OWNER. STOCKPILE LOCATIONS SHALL BE APPROVED BY OWNER OR AS SHOWN ON THE PLANS.

24. IF REQUIRED, BORROW EXCAVATION SHALL BE OBTAINED OFF-SITE. ON-SITE BORROW AREAS SHALL BE DETERMINED BY THE OWNER. PRIOR TO BORROW EXCAVATION, THE CONTRACTOR SHALL HAVE THE AREA CROSS-SECTIONED BY AN AUTHORIZED AGENT OF THE OWNER AND SHALL HAVE THE AREA CROSS-SECTIONED BY THE SAME AFTER THE BORROW AREA HAS BEEN EXCAVATED. IF BORROW MATERIAL IS REQUIRED, THE COST OF OBTAINING, TRANSPORTING, AND PLACEMENT OF THE BORROW MATERIAL ALONG WITH ANY FILLING OF BORROW PITS, IF REQUIRED, SHALL BE AGREED UPON BETWEEN OWNER AND CONTRACTOR PRIOR TO COMMENCEMENT OF BORROW WORK.

25. BERMING FOR LANDSCAPING SHALL BE ROUGH GRADED TO WITHIN 8" OF FINISHED GRADES AS SHOWN ON LANDSCAPE PLANS.

GENERAL PAVING AND SURFACING

1. ALL PAVING OPERATIONS SHALL BE CONSTRUCTED IN CONFORMANCE WITH THE "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION IN ILLINOIS" (STANDARD SPECIFICATIONS), LATEST EDITION AND WITH THE REQUIREMENTS OF THE MUNICIPALITY.

2. FINE GRADING: A. PRIOR TO THE CONSTRUCTION OF THE CURB AND GUTTER AND THE PLACEMENT OF THE BASE MATERIAL, THE STREETS SHALL BE FINE GRADED TO WITHIN 0.1 FOOT OF FINAL SUBGRADE ELEVATION, TO A LIMIT OF TWO (2) FEET BEYOND THE BACK OF CURB.

3. THE CONTRACTOR SHALL PROOF ROLL THE SUBGRADE AND BASE BEFORE PAVEMENT CONSTRUCTION PROCEEDS. THE SUBGRADE AND BASE WILL NOT BE APPROVED AND ACCEPTED BY THE MUNICIPALITY OR APPROVED FOR PAYMENT WITHOUT PROOF ROLLING. PROOF ROLLING SHALL BE DONE WITH A RUBBER TIRED VEHICLE HAVING A GROSS WEIGHT OF NOT LESS THAN 30,000 POUNDS (15 TONS). IF THE SUBGRADE OR BASE HAS FAILURES OR PUMPING AS INDICATED BY PROOF ROLLING, THE SUBGRADE OR BASE SHALL EITHER REMOVED AND REPLACED WITH GRANULAR MATERIAL TO A DEPTH AS DIRECTED BY THE OWNER OR OTHER CORRECTIVE MEASURES AS DIRECTED BY THE OWNER.

4. THE FOLLOWING APPLICATION RATES ARE TO BE USED DURING PAVING: A. BITUMINOUS MATERIAL (TACK COAT) ON EXISTING BITUMINOUS CONCRETE SURFACES (PRIME TO BE RC-70) = 0.10 GAL./SQ.YD. B. BITUMINOUS MATERIAL (PRIME COAT) ON AGGREGATE BASE (PRIME TO BE MC-30) = 0.50 GAL./SQ.YD. C. BITUMINOUS CONCRETE SURFACE AND BINDER COURSES. (BINDER COURSE SHALL BE B MIXTURE). (SURFACE COURSE SHALL BE C MIXTURE) = 115 LBS./SQ.YD. ALL MATERIAL SHALL BE CLASS I BITUMINOUS AND SHALL BE VIRGIN MATERIAL. RECYCLED MATERIALS FOR BINDER MAY BE PERMITTED OUTSIDE PUBLIC RIGHT OF WAY UPON APPROVAL OF THE OWNER.

5. PAVEMENT: THE PAVEMENT MATERIALS SHALL BE DETAILED ON THE ENGINEERING PLANS. THICKNESSES SPECIFIED SHALL BE CONSIDERED TO BE THE MINIMUM COMPACTED THICKNESS.

6. GENERAL: THE PAVING CONTRACTOR SHALL: A. REPAIR ANY BASE COURSE AND BINDER COURSE FAILURES PRIOR TO THE INSTALLATION OF THE FINAL BITUMINOUS CONCRETE SURFACE COURSE. B. SWEEP THE BINDER COURSE PRIOR TO THE INSTALLATION OF THE FINAL BITUMINOUS CONCRETE SURFACE COURSE.

7. ACCEPTANCE: A. PRIOR TO THE PLACEMENT OF THE BASE COURSE, THE SUBGRADE MUST BE APPROVED BY THE OWNER. B. PRIOR TO PLACEMENT OF THE SURFACE COURSE, THE CONTRACTOR, WHEN REQUIRED, SHALL OBTAIN SPECIMENS OF THE BINDER COURSE WITH A CORE DRILL WHERE DIRECTED, FOR THE PURPOSE OF THICKNESS VERIFICATION.

8. WHEN REQUESTED BY THE OWNER, DOCUMENTATION FOR THICKNESS AND AREAS OF PLACEMENT FOR THE BASE COURSE AND BITUMINOUS CONCRETE SHALL BE SUBMITTED FOR VERIFICATION.

9. ALL NOTES AND CONDITIONS SHOWN ON THE PLANS SHALL APPLY.

SANITARY DISTRIBUTION SYSTEM NOTES

1. ALL SANITARY SEWER CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE "STANDARD SPECIFICATIONS FOR WATER AND SEWER MAIN CONSTRUCTION IN ILLINOIS" (STANDARD SPECIFICATIONS), 1996, AND THE REQUIREMENTS OF THE I.E.P.A., O.S.H.A. AND THE MUNICIPALITY.

2. THE CONTRACTOR SHALL NOTIFY PUBLIC WORKS A MINIMUM OF TWO (2) WORKING DAYS PRIOR TO THE CONSTRUCTION OF THE SEWER.

3. ALL SANITARY SEWERS SHALL BE DEFLECTION TESTED AND LOW-PRESSURE AIR TESTED IN ACCORDANCE WITH SECTION 31-1.11 OF THE STANDARD SPECIFICATIONS. ALL MANHOLES SHALL BE VACUUM TESTED AS PER ASTM C-1244-02.

4. TELEVISION TESTING ALL SANITARY SEWERS SHALL BE TELEVISED WITH DVD EQUIPMENT AND A WRITTEN REPORT SUBMITTED BEFORE ACCEPTANCE. TESTING SHALL BE WITNESSED AND APPROVED BY THE MUNICIPALITY.

5. IF THE SANITARY SEWER INSTALLATION FAILS TO MEET THE TEST REQUIREMENTS SPECIFIED, THE CONTRACTOR SHALL DETERMINE THE CAUSE OR CAUSES OF THE DEFECT AND SHALL, AT HIS OWN EXPENSE, REPAIR OR REPLACE ALL MATERIALS AND WORKMANSHIP AS MAY BE NECESSARY TO COMPLY WITH THE REQUIREMENTS.

6. CLASS 1-A BEDDING AND BACKFILL SHALL BE INSTALLED IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS AND IN ACCORDANCE WITH ASTM D2321. IT SHALL CONSIST OF A MINIMUM OF 4" OF COMPACTED CA-11 CRUSHED GRAVEL OR STONE BELOW THE PIPE AND SHALL HAVE TAMPED CA-6 CRUSHED GRAVEL TO A MINIMUM 12" ABOVE THE TOP OF THE PIPE. BACKFILL UNDER PAVEMENT SHALL EXTEND THE FULL TRENCH DEPTH ABOVE THE TOP OF PIPE.

7. SANITARY SEWER MANHOLES SHALL BE 4'-0" INSIDE DIAMETER. REINFORCED CONCRETE SECTIONS MEETING ASTM C-478 AND HAVE AN ECCENTRIC CONE INSTALLED TO LINE UP WITH THE MANHOLE STEPS. ALL MANHOLE STEPS SHALL BE IN CONFORMANCE WITH MUNICIPAL STANDARDS.

8. ALL MANHOLE JOINTS SHALL BE SEALED WITH BITUMINOUS MASTIC.

9. NOT MORE THAN 2 RINGS OF 2 INCH MINIMUM SIZE UP TO A MAXIMUM OF 12 INCHES OF PRECAST ADJUSTING RINGS SHALL BE USED TO ADJUST FRAME ELEVATIONS.

10. ALL MANHOLE LIDS MUST BE STAMPED "SANITARY" AND BE SET WITH PREFORMED BUTYL MASTIC.

11. ALL MANHOLES SHALL BE THOROUGHLY CLEANED OF DIRT AND DEBRIS AND ALL VISIBLE LEAKAGE ELIMINATED BEFORE FINAL INSPECTION AND ACCEPTANCE.

12. "NO-SHEAR" TYPE MISSION COUPLINGS SHALL BE USED WHEN CONNECTING SEWER PIPES OF DISSIMILAR MATERIALS.

13. ALL FLOOR DRAINS SHALL CONNECT TO THE SANITARY SEWER.

14. ANY UNSUITABLE MATERIAL ENCOUNTERED SHALL BE REMOVED AND REPLACED WITH COMPACTED CA-6 CRUSHED GRAVEL OR STONE.

15. WATERMAINS SHALL BE SEPARATED FROM SANITARY SEWERS AND STORM SEWERS IN ACCORDANCE WITH I.E.P.A. REQUIREMENTS AS SPECIFIED IN "WATER DISTRIBUTION SYSTEM" SECTION.

16. THE CONTRACTOR SHALL FURNISH "AS-BUILT" DRAWINGS OF SANITARY SEWERS AND SERVICES AT THE COMPLETION OF THE CONSTRUCTION.

17. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DEWATERING NECESSARY TO CONSTRUCT TRENCHES AND TO INSTALL THE SANITARY SEWER. ANY DEWATERING SHALL BE CONSIDERED INCIDENTAL TO THE CONTRACT.

18. WATER PUMPED OR OTHERWISE DISCHARGED FROM THE SITE DURING ANY CONSTRUCTION DEWATERING SHALL BE FILTERED AND DIRECTED TO THE STORM SEWER IF POSSIBLE.

19. CERTIFICATION: IT SHALL BE THE RESPONSIBILITY OF THE PIPE MANUFACTURERS TO CERTIFY THAT PIPE AND JOINT MATERIALS FURNISHED ARE CAPABLE OF MEETING THE LOWER PRESSURE AIR TEST, INFILTRATION TEST, AND EXFILTRATION TEST, ARE MANUFACTURED IN CONFORMANCE WITH THE A.S.T.M., A.N.S.I., A.W.W.A., OR A.A.S.H.O. TEST(S) SPECIFIED.

20. ALL SANITARY PIPE, JOINTS AND FITTINGS SHALL BE INSTALLED AND BACKFILLED PER THE CORRESPONDING MANUFACTURER SPECIFICATIONS. SHOULD THERE BE ANY DISCREPANCIES BETWEEN MANUFACTURERS SPECIFICATIONS AND FEDERAL, STATE, OR LOCAL CODES, CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO BIDDING AND ORDERING THE MATERIAL.

21. ALL NOTES AND CONDITIONS SHOWN ON THE PLANS SHALL APPLY.

WATER DISTRIBUTION SYSTEM

1. ALL WATER MAIN CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE "STANDARD SPECIFICATIONS FOR WATER AND SEWER MAIN CONSTRUCTION IN ILLINOIS" (STANDARD SPECIFICATIONS), 1996, AND THE REQUIREMENTS OF THE I.E.P.A., O.S.H.A. AND THE MUNICIPALITY.

2. ALL WATER MAIN SHALL BE DUCTILE IRON CLASS 52, WITH MECHANICAL JOINTS AS SHOWN ON THE PLANS. ALL WATER SERVICES LEADS SHALL BE TYPE "K" COPPER UNLESS OTHERWISE SPECIFIED ON THE PLANS.

3. ALL TEES, BENDS, VALVES, AND FIRE HYDRANTS SHALL BE ADEQUATELY SUPPORTED WITH A CONCRETE BASE, AND SUPPORTED LATERALLY WITH POURED IN PLACE THRUST BLOCKING AGAINST UNDISTURBED EARTH.

4. DISINFECTION OF THE WATER MAINS - UPON COMPLETION OF THE NEWLY LAID WATER MAINS, THE WATER MAINS SHALL BE DISINFECTED IN ACCORDANCE WITH THE AMERICAN WATER WORKS ASSOCIATION PROCEDURE DESIGNATION AWWA C-651-99, LATEST EDITION. THE CONTRACTOR IS RESPONSIBLE FOR COLLECTING SAMPLES AND HAVING BACTERIOLOGICAL TESTING PERFORMED AS REQUIRED BY THE I.E.P.A.. THE CONTRACTOR SHALL FURNISH TO THE MUNICIPALITY THE REQUIRED DOCUMENTATION, TEST RESULTS, ETC., REQUIRED BY THE I.E.P.A. FOR PLACING THE WATER MAINS OR SERVICE LINES IN SERVICE AND/OR SECURING AN OPERATING PERMIT.

5. WATER MAINS AND WATER SERVICE LINES SHALL BE PROTECTED FROM SANITARY SEWERS, STORM SEWERS, COMBINED SEWERS, HOUSE SEWER SERVICE CONNECTIONS AND DRAINS IN ACCORDANCE WITH "TITLE 35: ENVIRONMENTAL PROTECTION AGENCY SUBTITLE F: PUBLIC WATER SUPPLIES, CHAPTER II: ENVIRONMENTAL PROTECTION AGENCY, PARTS 651-654 TECHNICAL POLICY STATEMENTS, SECTION 653.119."

6. WHENEVER POSSIBLE, A WATER MAIN MUST BE LAID AT LEAST TEN FEET HORIZONTALLY FROM ANY EXISTING OR PROPOSED DRAIN OR SEWER LINE. SHOULD LOCAL CONDITIONS EXIST WHICH WOULD PREVENT A LATERAL SEPARATION OF TEN FEET, A WATER MAIN MAY BE LAID CLOSER THAN TEN FEET TO A STORM OR SANITARY SEWER PROVIDED THAT THE WATER MAIN INVERT IS AT LEAST EIGHTEEN INCHES ABOVE THE CROWN OF THE SEWER, AND IS EITHER IN A SEPARATE TRENCH OR IN THE SAME TRENCH ON AN UNDISTURBED EARTH SHELF LOCATED TO ONE SIDE OF THE SEWER. IF IT IS IMPOSSIBLE TO OBTAIN PROPER HORIZONTAL OR VERTICAL SEPARATION AS DESCRIBED ABOVE, THEN THE SEWER MUST ALSO BE CONSTRUCTED OF WATER MAIN TYPE MATERIAL (DUCTILE IRON PIPE WITH SLIP-ON OR MECHANICAL JOINTS, ETC.) AND PRESSURE TESTED TO THE MAXIMUM EXPECTED SURCHARGE HEAD TO ASSURE WATER TIGHTNESS BEFORE BACKFILLING.

7. WATER VALVES AND FIRE HYDRANTS SHALL BE OPERATED BY MUNICIPAL PERSONNEL, ONLY.

8. ALL WATERMAIN PIPE, JOINTS AND FITTINGS SHALL BE INSTALLED AND BACKFILLED PER THE CORRESPONDING MANUFACTURER SPECIFICATIONS. SHOULD THERE BE ANY DISCREPANCIES BETWEEN MANUFACTURERS SPECIFICATIONS AND FEDERAL, STATE, OR LOCAL CODES, CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO BIDDING AND ORDERING THE MATERIAL.

9. ALL NOTES AND CONDITIONS SHOWN ON THE PLANS SHALL APPLY.

EROSION CONTROL NOTES

1. ALL CONSTRUCTION ACTIVITIES THAT INVOLVES EARTHWORK SHALL MEET THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PHASE II REQUIREMENTS:

A) SUBMITTAL OF A NOTICE OF INTENT (NOI) TO IEPA.
B) POSSESSION OF A COMPLETED AND SIGNED STORMWATER POLLUTION PREVENTION PLAN (SWPPP) AND A GRAPHIC EROSION AND SEDIMENT CONTROL (ESC) PLAN.
C) IMPLEMENTATION OF THE SWPPP.
D) SUBMITTAL OF AN INCIDENCE OF NONCOMPLIANCE (ION) IF AN EVENT OCCURS.
E) WEEKLY REPORTS AFTER ½" RAINFALL OR 5" SNOWFALL.
F) DOCUMENTATION OF CHANGES TO ESC PLAN
G) SUBMITTAL OF A NOTICE OF TERMINATION (NOT) WHEN FINAL STABILIZATION IS ACHIEVED.

2. ANY WETLAND MITIGATION SHALL BEGIN PRIOR TO ANY GRADING WORK AND SHALL BE IN ACCORDANCE WITH THE APPROVED MITIGATION PERMIT PLAN AND REQUIREMENTS.

3. IN ORDER TO PROTECT AND ENSURE AGAINST FLOODING, ALL TOP OF FOUNDATIONS SHALL BE SET A MINIMUM OF ONE (1) FOOT ABOVE THE HIGH WATER LEVEL OF ADJACENT STORMWATER MANAGEMENT FACILITIES SUCH AS RETENTION/DETENTION PONDS.

4. THE CONTRACTOR SHALL MAINTAIN EXISTING POSITIVE DRAINAGE FROM OFF-SITE AT ALL TIMES DURING CONSTRUCTION.

5. WITHIN THE LIMITS OF PROPOSED GRADING THE SOIL SHALL BE COMPACTED TO NOT LESS THAN THE FOLLOWING PERCENTAGES OF MODIFIED PROCTOR DRY DENSITY IN ACCORDANCE WITH ASTM D 1557-78:

UNDER STRUCTURES. BUILDING SLABS, STEPS AND PAVEMENTS. COMPACT 6 INCH MAXIMUM LIFTS OF SUBGRADE. BACKFILL OR FILL MATERIAL AT 95% MODIFIED PROCTOR DRY DENSITY.

UNDER WALKWAYS. COMPACT 6 INCH MAXIMUM LIFTS OF DRY SUBGRADE, BACKFILL, OR FILL MATERIAL AT 95% MODIFIED PROCTOR DRY DENSITY.

UNDER LAWN OR UNPAVED AREAS. COMPACT 6 INCH MAXIMUM LIFTS OF SUBGRADE, BACKFILL, OR FILL MATERIAL AT 85% MODIFIED PROCTOR DRY DENSITY.

6. ALL EROSION CONTROL WORK SHALL COMPLY WITH "ILLINOIS PROCEDURES AND STANDARDS FOR URBAN SOIL EROSION AND SEDIMENTATION CONTROL."

7. STRIPPING OF VEGETATION, GRADING OR OTHER SOIL DISTURBANCE, ESPECIALLY IN DESIGNATED WETLAND AREAS, SHALL BE DONE IN A MANNER WHICH WILL MINIMIZE SOIL EROSION, AND SHALL BE IN ACCORDANCE WITH THE APPROVED DRAWINGS, MITIGATION AND PERMIT REQUIREMENTS.

8. THE CONTRACTOR SHALL TAKE PRECAUTIONARY MEASURES TO MINIMIZE EARTHWORK IN AREAS WHERE TREES ARE TO BE SAVED AS SHOWN ON THE PLANS OR DETERMINED IN THE FIELD.

9. THE EXTENT OF THE AREA WHICH IS EXPOSED AND FREE OF VEGETATION AND THE DURATION OF ITS EXPOSURE SHALL BE KEPT WITHIN PRACTICAL LIMITS AS DIRECTED BY THE CITY.

10. SEDIMENTATION SHALL BE RETAINED ON SITE. SEDIMENT FENCE SHALL BE INSTALLED ALONG THE PERIMETER OF ALL REGRADED AREAS OR AS REQUIRED TO PREVENT SEDIMENT FROM ENTERING AND/OR LEAVING THE SITE.

11. DUST PRODUCED FROM THE SITE SHALL BE KEPT TO A MINIMUM DURING DRY PERIODS BY SPRAYING WATER AS REQUIRED TO THE CITY'S SATISFACTION AND IS TO BE CONSIDERED INCIDENTAL.

12. ALL MUD SHALL BE REMOVED FROM ALL TIRES BEFORE LEAVING THE SITE AND THE ROADS SHALL BE KEPT CLEAN AND CLEAR OF MUD AND DEBRIS AT ALL TIMES.

13. CULVERTS AND DRAINAGE DITCHES SHALL BE KEPT CLEAN AND CLEAR OF OBSTRUCTIONS DURING THE CONSTRUCTION PERIOD.

14. SILT FENCES SHALL BE INSPECTED FREQUENTLY AND MAINTAINED OR REPLACED AS REQUIRED TO MAINTAIN BOTH THEIR EFFECTIVENESS AND INTEGRITY.

15. WATER COURSES AND DRAINAGE SWALES ADJACENT TO CONSTRUCTION ACTIVITIES SHALL BE MONITORED AS NECESSARY, FOR EVIDENCE OF SILT INTRUSION AND OTHER ADVERSE ENVIRONMENTAL IMPACTS. ANY PROBLEMS OR DEFICIENCIES SHALL BE CORRECTED IMMEDIATELY UPON THEIR DISCOVERY.

16. THE CONTRACTOR SHALL INSTALL ALL EROSION CONTROL ITEMS PRIOR TO COMMENCEMENT OF ANY WORK.

17. THE CONTRACTOR SHALL INSTALL TEMPORARY ORANGE FENCE AROUND ALL TREES TO REMAIN AND WETLAND AREAS TO BE MITIGATED.

18. ALL EROSION CONTROL MEASURES MUST BE INSPECTED EVERY 7 CALENDAR DAYS AND AFTER EACH 1/2" RAIN EVENT.

19. ALL DROP INLETS ON AND ADJACENT TO THE SITE MUST HAVE A SEDIMENT TRAPPING OR CONTAINMENT DEVICE INSTALLED DURING CONSTRUCTION ACTIVITIES. FILTER FABRIC ON ITS OWN IS NOT AN APPROVED METHOD. A MANUFACTURE'S SPECIFICATION SHOULD BE USED FOR PREFABRICATED DROP INLET PROTECTION AND SHOULD BE AS RESTRICTIVE AS THE ILLINOIS URBAN MANUAL STANDARD 861 FOR INLET PROTECTION.

20. STOCKPILES OF SOIL AND OTHER BUILDING MATERIALS TO REMAIN IN PLACE MORE THAN THREE (3) DAYS SHALL BE FURNISHED WITH EROSION AND SEDIMENT CONTROL MEASURES (I.E. PERIMETER SILT FENCE). STOCKPILES, NOT BEING ACTIVELY WORKED AND TO REMAIN IN PLACE FOR 14 DAYS OR MORE SHALL RECEIVE TEMPORARY SEEDING.

21. IN AREAS WHERE WORK IS COMPLETE, PERMANENT STABILIZATION SHALL OCCUR WITHIN 7 DAYS OF COMPLETION, AND IN AREAS WHERE WORK HAS TEMPORARILY CEASED FOR 14 DAYS OR MORE, TEMPORARY STABILIZATION SHALL OCCUR BY THE 7TH DAY AFTER WORK HAS CEASED.

22. THE SITE SHOULD BE PHASED IN A WAY THAT REDUCES THE AMOUNT OF STRIPPED, UNSTABILIZED AREAS WITHIN THE SITE AT ANY ONE TIME. MASS GRADING THE ENTIRE SITE SHOULD BE AVOIDED AS TO PREVENT EROSION ONSITE AND SEDIMENTATION ISSUES DOWNSTREAM.

23. THE CONDITION OF THE CONSTRUCTION SITE FOR WINTER SHUTDOWN SHALL BE ADDRESSED EARLY IN THE FALL GROWING SEASON SO THAT SLOPES AND OTHER BARE EARTH AREAS MAY BE STABILIZED WITH TEMPORARY AND/OR PERMANENT VEGETATIVE COVER FOR PROPER EROSION AND SEDIMENT CONTROL. ALL OPEN AREAS THAT ARE TO REMAIN IDLE THROUGHOUT THE WINTER SHALL RECEIVE TEMPORARY EROSION CONTROL MEASURES INCLUDING TEMPORARY SEEDING, MULCHING AND/OR EROSION CONTROL BLANKET PRIOR TO THE END OF THE FALL GROWING SEASON. THE AREAS TO BE WORKED BEYOND THE END OF THE GROWING SEASON MUST INCORPORATE SOIL STABILIZATION MEASURES THAT DO NOT RELY ON VEGETATIVE COVER SUCH AS EROSION CONTROL BLANKET AND HEAVY MULCHING.

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed under the laws of the State of Illinois.

DATE: 12-6-2017
JAMES P. MEIER LICENSED PROFESSIONAL ENGINEER

Registration Number: 062-051277
EXP. DATE: NOVEMBER 30, 2019

Revisions		
Description	Date	Num
Issued for Bid	12-7-17	1

Comm: 173013
Date: 7-7-2017
Drawn: CLS
Check: JPM

North

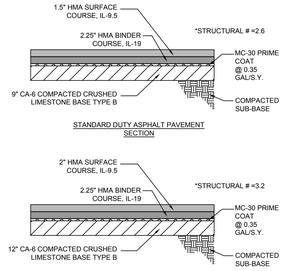
STANDARD CONSTRUCTION NOTES

ISSUED FOR RE-BID
12-07-2017

Scale:

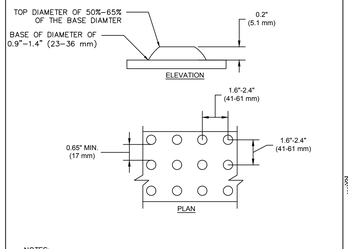
C4.0

IL



ASPHALT PAVEMENT SECTIONS

MC - SITE5
REVISED: 10/2016

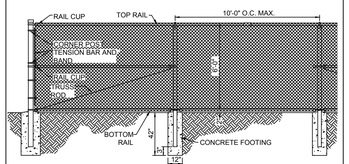


NOTES:

1. ALL DETECTABLE WARNINGS SHALL COMPLY WITH ADA STANDARDS FOR ACCESSIBLE DESIGN AND THE ILLINOIS ACCESSIBILITY CODE.
2. DETECTABLE WARNING SURFACES SHALL CONTRAST VISUALLY WITH ADJACENT WALKING SURFACES EITHER LIGHT-ON-DARK, OR DARK-ON-LIGHT.
3. DETECTABLE WARNING SURFACES SHALL HAVE A MINIMUM DEPTH OF 2".

DETECTABLE WARNINGS

MC - SITE12
REVISED: 6/2013



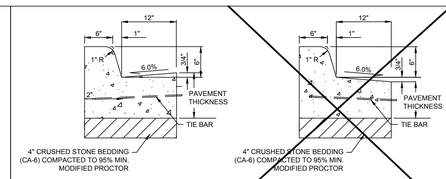
CHAIN LINK FENCE SECTION DETAIL

MC - SITE10
REVISED: 7/2012

NOTES:
1. INSTALL CONTRACTION JOINTS EVERY 5'-0" O.C.
2. INSTALL EXPANSION JOINTS EVERY 45'-0" O.C.
3. INSTALL (3) #5 REBARS, 20' LONG ACROSS TRENCH CROSSINGS (TYP).
4. CONCRETE THICKNESS SHALL BE INCREASED TO 6" AT ALL DRIVEWAYS.
5. P.C.C. SHALL BE CLASS SI, 3500 PSI @ 14 DAYS, SIX BAG MIX.
6. SIDEWALK SHALL HAVE A BROOM FINISH.

PCC SIDEWALK

MC - SITE3
REVISED: 7/2012



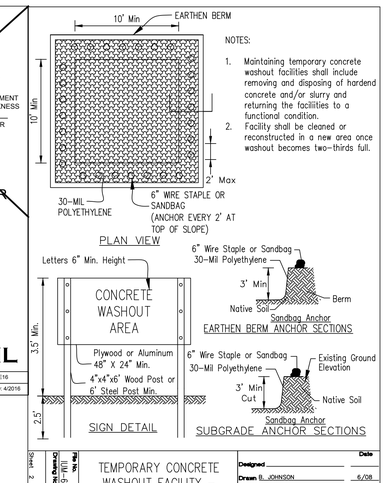
NOTES:

1. LONGITUDINAL JOINT TIE BARS SHALL BE NO. 6 AT 24" CENTERS IN ACCORDINACE WITH DETAILS FOR LONGITUDINAL CONSTRUCTION JOINT.
2. BOTTOM SLOPE OF COMBINATION CURB AND GUTTER CONSTRUCTED ADJACENT TO PCC PAVEMENT SHALL BE THE SAME SLOPE AS THE SUBBASE OR 6% WHEN SUBBASE IS OMITTED.
3. A MINIMUM CLEARANCE OF 2" BETWEEN THE END OF THE TIE BAR AND THE BACK OF THE CURB SHALL BE MAINTAINED.
4. INSTALL CONTRACTION JOINTS NAD EXPANSION JOINTS PER IDOT STANDARD 606001-02.
5. ALL CONCRETE CURB CONSTRUCTION SHALL BE PER THE IDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, TALTEST REVISIONS.

B-6.12 CURB AND GUTTER DETAIL

NOT TO SCALE

MC - SITE16
REVISED: 4/2016



NOTES:

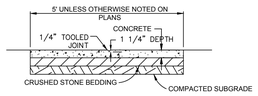
1. Maintaining temporary concrete washout facilities shall include removing and disposing of hardend concrete and/or slurry and returning the facilities to a functional condition.
2. Facility shall be cleaned or reconstructed in a new area once washout becomes two-thirds full.

Sheet 2 of 2	File No. IL/IL-554ET
	Drawing No.

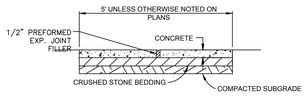
TEMPORARY CONCRETE WASHOUT FACILITY - EARTHEN TYPE

	Date
Designed	
Drawn B. JOHNSON	6/08
Checked	
Approved	

CONTRACTION JOINT



EXPANSION JOINT

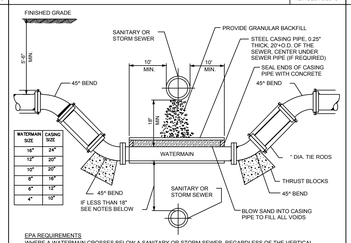


NOTES:

1. REFER TO IDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 2012, SECTION 423.06.

CONCRETE JOINT

MC - SITE15
REVISED: 12/2016

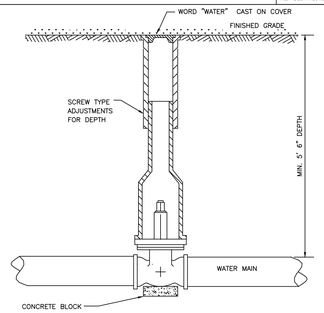


WATERMAIN SIZE	CASING SIZE
16"	24"
12"	20"
10"	20"
8"	18"
6"	12"
4"	10"

EPA REQUIREMENTS
WHERE A WATERMAIN CROSSES BELOW A SANITARY OR STORM SEWER, REGARDLESS OF THE VERTICAL SEPARATION, BOTH THE WATERMAIN AND THIS SEWER MUST BE CONSTRUCTED OF WATERMAIN TYPE MATERIALS, AND CONSTRUCTION MUST EXTEND ON EACH SIDE OF THE CROSSING UNTIL THE NORMAL DISTANCE FROM THE WATERMAIN TO THE SEWER IS AT LEAST 10 FEET. THE SEWER MUST BE CONSTRUCTED OF SLIP-ON OR MECHANICAL JOINT CAST IRON OR DUCTILE IRON PIPE, ASBESTOS CEMENT PRESSURE PIPE, PRE-STRESSED CONCRETE PIPE OR PVC PIPE MEETING WATERMAIN STANDARDS. AS AN ALTERNATE, EITHER THE WATERMAIN OR THE SEWER CAN BE INSTALLED INSIDE A CASING PIPE WHICH EXTENDS AT LEAST 10 FEET HORIZONTALLY FROM THE WATERMAIN. THE VERTICAL DISTANCE BETWEEN THE BOTTOM OF THE CASING PIPE AND TOP OF THE WATERMAIN IS LESS THAN 18" ABOVE THE TOP OF THE SANITARY OR STORM SEWER AND WHERE THE HORIZONTAL DISTANCE BETWEEN THE WATERMAIN AND THE SANITARY OR STORM SEWER IS LESS THAN 10'. **ALSO SEE "IEPA WATER AND SEWER SEPARATION REQUIREMENTS" FOR ADDITIONAL REQUIREMENTS

WATERMAIN CASING PIPE AND SEWER SEPARATION

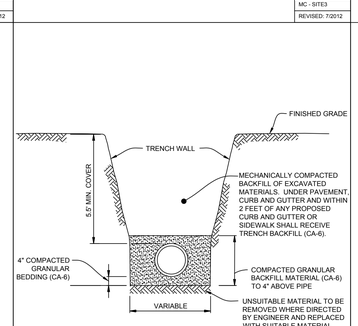
MC - W1
REVISED: 7/2012



NOTE:
RESTRAINT GLANDS REQUIRED ON EACH SIDE OF VALVE IF STUBBED FOR FUTURE CONNECTION OR PIPE BEND WITHIN TWO PIPE LENGTHS OF VALVE

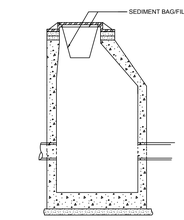
VALVE BOX INSTALLATION

MC - W8
REVISED: 7/2012



WATER MAIN/SERVICE TRENCE DETAIL

MC - W9
REVISED: 7/2013

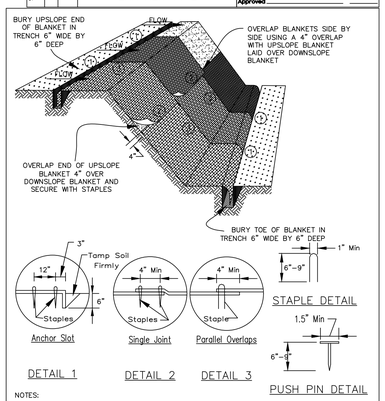


NOTES:

1. FIL TER BAG SHALL BE MAINTAINED UNTIL THE AREA TRIBUTARY TO THE STRUCTURE HAS STABILIZED GROUND COVER, AS DETERMINED BY ENGINEER.

INLET PROTECTION

MC - SE10
REVISED: 1/2014



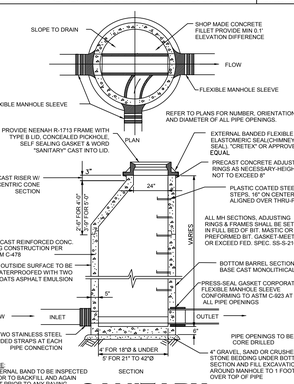
NOTES:

1. Staples shall be placed in a diamond pattern at 2 per s.y. for stiched blankets. Non-stiched shall use 4 staples per s.y. of material. This equates to 200 staples with stiched blanket and 400 stapels with non-stiched blanket per 100 s.y. of material.
2. Staple or push pin lengths shall be selected based on soil type and conditions. (minimum staple length is 6")
3. Erosion control material shall be placed in contact with the soil over a prepared seedbed.
4. All anchor slots shall be stapled at approximately 12" intervals.

Sheet 1 of 1	File No. IL/IL-530
	Drawing No.

EROSION CONTROL BLANKET INSTALLATION DETAILS

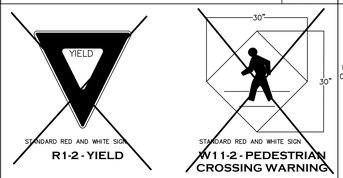
	Date
Designed	
Drawn B. JOHNSON	11/08
Checked	
Approved	

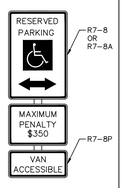


NOTE:
EXTERNAL BAND TO BE INSPECTED PRIOR TO BACKFILL AND AGAIN JUST PRIOR TO ANY PAVING OPERATIONS.

SANITARY MANHOLE

MC - SAN9
REVISED: 7/2012



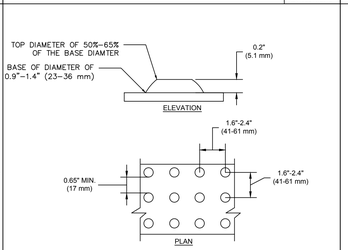


ACCESSIBLE SPACE SIGNAGE

NOTES:

1. ALL SIGNS SHALL FOLLOW THE MUTCD, MOST RECENT EDITION, UNLESS OTHERWISE SPECIFIED BY THE LOCAL DEPARTMENT OF TRANSPORTATION OR MUNICIPALITY STANDARDS.
2. ALL SIGNS SHALL BE MOUNTED AT A HEIGHT AND LOCATION AS SPECIFIED BY THE MUTCD, LOCAL D.O.T. OR LOCAL MUNICIPALITY STANDARDS.

MC - SITE2
REVISED: 7/2012



NOTES:

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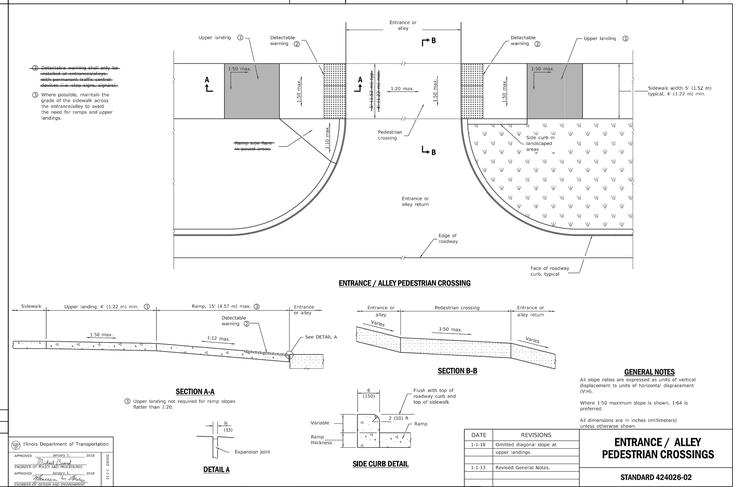
2. DETECTABLE WARNING SURFACES SHALL CONTRAST VISUALLY WITH ADJACENT WALKING SURFACES EITHER LIGHT-ON-DARK, OR DARK-ON-LIGHT.
3. DETECTABLE WARNING SURFACES SHALL HAVE A MINIMUM DEPTH OF 2".

DETECTABLE WARNINGS

MC - SITE12
REVISED: 6/2013



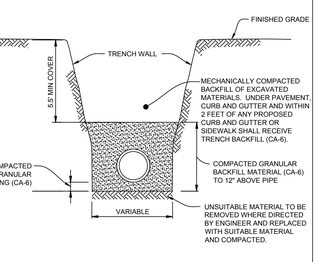
GENERAL NOTES
All slope rates are expressed as units of vertical displacement to units of horizontal displacement (V:H).
Where 1:50 maximum slope is shown, 1:64 is preferred.
All dimensions are in inches (millimeters) unless otherwise shown.

Illinois Department of Transportation
APPROVED _____ 2016
Director of Highways, Bureau of Design and Environment
APPROVED _____ 2016
Engineer of Design and Environment

DATE	REVISIONS
1-1-08	Omitted diagonal slope at upper landings.
1-1-13	Revised General Notes.

ENTRANCE / ALLEY PEDESTRIAN CROSSINGS

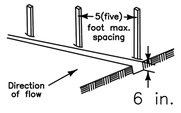
STANDARD 424026-02



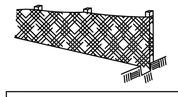
SANITARY SEWER TRENCH DETAIL

MC - SAN 14
REVISED: 7/2012

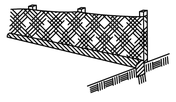
1. Set posts and excavate or slit-trench a 6-inch deep trench upslope along the line of the post



2. Attach the geotextile filter fabric to each post with a minimum of 3 (three) fasteners per post and extend to the bottom of the trench. Acceptable fasteners include staples, zip ties, or wire ties

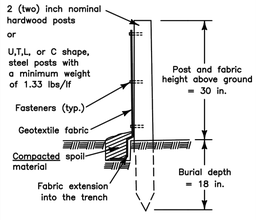


3. Backfill and compact the excavated spoil materials



Geotextile Requirement	Test Method	MARV
Grab strength - Machine direction - X-machine direction	ASTM D 4632	 550 N 450 N
Permittivity	ASTM D 4491	0.05 sec-1
Apparent opening size*	ASTM D 4751	0.60 mm
Ultraviolet stability (retained strength)	ASTM D 4355	70% after 500 hours

Note:
Value for apparent opening size represents maximum average roll value.



SILT FENCE DETAIL

DATE: 4/21/08 BY: KAW
REVISED: BY:

LAKE COUNTY
STORMWATER MANAGEMENT COMMISSION

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	
CEREAL RYE OR WHEAT													TEMPORARY SEEDING DATES
OATS													
PERENNIAL RYEGRASS													
NON IRRIGATED													PERMANENT SEEDING DATES
IRRIGATED													
DORMANT SEEDING													

OPTIMAL SEEDING DATES

Species	Lbs./Acre	Lbs./1000 ft.2	Seeding Dates
Oats	90	2	Early spring – July 1
Cereal Rye	90	2	Early spring – Sept. 30
Wheat	90	2	Early spring – Sept. 30
Perennial Ryegrass	25	0.6	Early spring – Sept. 30

ISSUED FOR RE-BID
12-07-2017

Combined Area Fire Training Facility Re-Bid
851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

Wold
RUCK PATE
WOLD | RUCK PATE
110 North Brockway, Suite 220
Palatine, Illinois 60067
woldac.com | 847 241 6100

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www.meritcorp.com

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed under the laws of the State of Illinois.

DATE: 12-6-2017
JAMES P. MEIER LICENSED PROFESSIONAL ENGINEER
Registration Number: 062-051277 EXP. DATE: NOVEMBER 30, 2019

Revisions		
Description	Date	Num
Issued for Bid	12-7-17	1

Comm: 173013
Date: 7-7-2017
Drawn: CLS
Check: JPM
North

STANDARD CONSTRUCTION DETAILS

Scale:

C5.0

A

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BUILDING # 1 (FULLY SPRINKLER)

CODE ANALYSIS (IBC 2006)

1. OCCUPANCY CLASSIFICATIONS — SECTION 302

A. SECTION 304, BUSINESS: GROUP B
B. SECTION 311, STORAGE: GROUPS S-2 (LOW-HAZARD)

2. INCIDENTAL USE AREAS — TABLE 508

STORAGE ROOMS OVER 100 S.F. — 1 HR OR PROVIDE AUTOMATIC FIRE-EXTINGUISHING SYSTEM

3. MIXED OCCUPANCIES — SECTION 508

A. NO SEPARATION IS REQUIRED BETWEEN OCCUPANCIES PER SECTION 508.3.2

4. CONSTRUCTION TYPE / FIRE RESISTANCE — TABLE 601 / 602

A. TYPE V-B

BUILDING ELEMENT	FIRE RESISTANCE
STRUCTURAL FRAME	0 HR
EXT. BEARING WALLS	0 HR
INT. BEARING WALLS	0 HR
EXT. NON-BEARING WALLS	0 HR 30 FT.
INT. NON-BEARING WALLS	0 HR
FLOOR CONSTRUCTION	0 HR
ROOF CONSTRUCTION	0 HR
VERTICAL SHAFTS AND ELEVATOR SHAFTS	N/A
CORRIDORS (TABLE 1017.1 / 708)	1 HR

5. GENERAL BUILDING HEIGHT AND AREA — SECTION 503 / 504

A. ALLOWABLE HEIGHT AND AREAS

GROUP	ALLOWABLE HEIGHT WITH SPRINKLER TABLE 503	ALLOWABLE AREA TABLE 503	MOST RESTRICTIVE NON-SEPARATED OCCUPANCY 508.3
B	3 STORIES / 60 FT.	9,000 S.F.	X
S-2	3 STORIES / 60 FT.	13,500 S.F.	

6. ALLOWABLE AREA MODIFICATIONS — SECTION 506

A. GROUP B

1. EQUATION 5-1 : ALLOWABLE BUILDING AREA PER STORY
**506.3 AREA INCREASE FOR SPRINKLER SYSTEM 1(s)#3

A(a) = [A(t) + [A(t) * I(f)] + [A(t) * I(s)]]
A(a) = 9,000 + [9,000 * 0.25] + [9,000 * 3]

A(a) = 38,250 SF

2. EQUATION 5-2 : AREA INCREASE DUE TO FRONTAGE
I(f) = [F/P - 0.25] * W/30
I(f) = [136/272 - 0.25] * 30/30
I(f) = 0.25

B. ACTUAL AREA

GROUP	BASEMENT	MAIN LEVEL	* MEZZANINE
B	N/A	3,948 SF	N/A
TOTALS:	3,948 SF		

C. MIXED OCCUPANCY RATIO — 508.4.2

N/A - NON SEPARATED OCCUPANCIES PER 508.3.2

7. MEANS OF EGRESS — CHAPTER 10

A. BUILDING OCCUPANT LOAD — TABLE 1004.1.1

1. MAIN LEVEL

FUNCTION	S.F. / OCCUPANT	S.F. / SPACE	OCCUPANCY / SPACE
STORAGE, MECH	300 GROSS	304 SF	2
*ASSEMBLY - LOOSE TABLES & CHAIRS	15 NET	1,165 SF	78
BUSINESS	100 GROSS	312 SF	4
PARKING GARAGE	200 GROSS	792 SF	4
TOTAL LOWER LEVEL			88

*A BUILDING OR TENANT SPACE USED FOR ASSEMBLY PURPOSES WITH AN OCCUPANT LOAD OF LESS THAN 50 PERSONS SHALL BE CLASSIFIED AS A GROUP B OCCUPANCY PER SECTION 303.1 EXCEPTION 1.

8. MEANS OF EGRESS — CHAPTER 10

B. EGRESS WIDTH — 1005.3.1, 1005.3.2

1. MAIN LEVEL OCCUPANCY 88

A. OTHER

FACTOR	REQUIRED WIDTH	DR WIDTH	# DOORS REQUIRED
.15	13.2"	/ 32" *	1

* MINIMUM DOOR WIDTH TO BE 36" TO ACHIEVE 32" CLEAR WIDTH PER 1008.1.1.

** MINIMUM STAIRWAY WIDTH TO BE 44" (INCLUDING LANDING WIDTH) UNLESS SERVING LESS THAN 50 OCCUPANTS PER 1009.4 FOR ACCESS TO UNOCCUPIED ROOFS- 1204.3.1

B. TRAVEL DISTANCES/ EXIT SYSTEMS

1. COMMON PATH OF TRAVEL (TABLE 1014.3) = 100 FT.
(TO A POINT WHERE OCCUPANT HAS TWO MEANS OF EGRESS.)

2. EXIT ACCESS TRAVEL DISTANCE — TABLE 1016.1
(TRAVEL DISTANCE TO AN EXIT OR A RATED EXIT SYSTEM.)

OCCUPANCY	W/ SPRINKLER
B	300
S-2,	400

3. CORRIDORS — 1017

A. MINIMUM WIDTH (TABLE 1017.2) = 44" OR 36" FOR LESS THAN 50 OCCUPANTS
MINIMUM WIDTH 72" FOR GROUP E OVER 100 OCCUPANTS.

B. DEAD ENDS (1017.3).
20' IN GROUPS A AND H AND ALL OTHER GROUPS WITH NON-SPRINKLERED CONSTRUCTION;
50' IN ALL GROUPS EXCEPT A AND H WITH SPRINKLERED CONSTRUCTION;
OR
LENGTH = 2.5 TIMES THE LEAST WIDTH OF THE DEAD-END CORRIDOR.

9. WALL AND CEILING FINISHES — TABLE 803.5

SPRINKLERED / NON-SPRINKLERED

GROUP	EXIT ENCLOSURES AND EXIT PASSAGEWAYS	CORRIDORS	ROOMS AND ENCLOSED SPACES
B	B / A	C / B	C / C
S	C / B	C / B	C / C

10. FIRE PROTECTION — CHAPTER 9

A. BUILDING SHALL BE FULLY SPRINKLERED IN ACCORDANCE WITH NFPA-13 AND VILLAGE ORDINANCE: 15.04.020 SEC. 903.2 AND 903.1.2

11. PLUMBING FIXTURE COUNT — TABLE 2902.1

A. "B" OCCUPANCY

1. OCCUPANTS	MEN			WOMEN		TOTAL	
	44			44		88	
2. FIXTURE RATIO	WC	URINAL	LAV	WC	LAV	DRINKING FOUNTAINS	SERVICE SINK
	1:25 1ST 50 THEN 1:50	2/3 OF WC	1:40 1ST 80 THEN 1:80	1:25 1ST 50 THEN 1:50	1:40 1ST 80 THEN 1:80	1:100	1
3. FIXTURES REQUIRED	2	NONE	2	2	2	1	1
4. ACTUAL FIXTURES	2*	0	2	2*	2	1	1

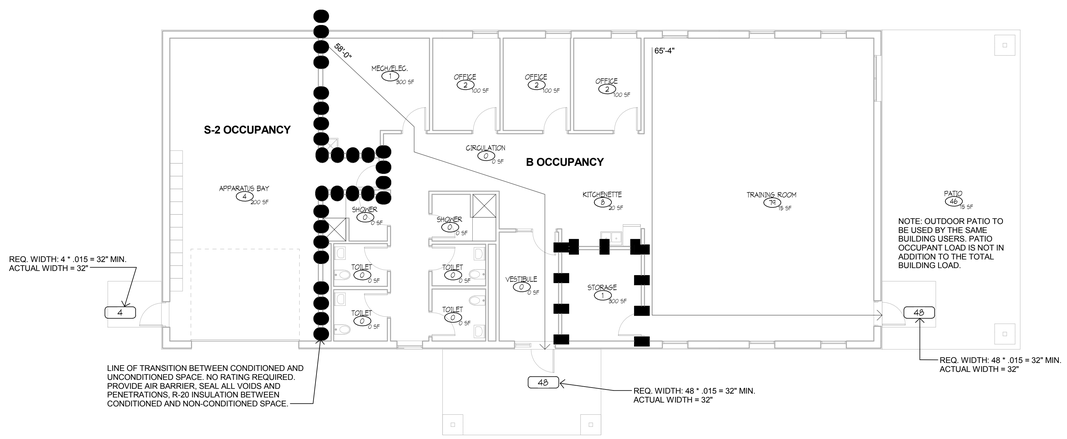
* 4 UNISEX TOILET ROOMS ARE BEING SUBSTITUTED FOR SHARED TOILET ROOMS.

12. ENERGY CODE

THE ENERGY CODE USED FOR THIS PROJECT IS

2015 INTERNATIONAL ENERGY CONSERVATION CODE

D3 SITE PLAN
1/16" = 1'-0" 0 12' 24'



F3 CODE PLAN
1/8" = 1'-0" 0 6' 12'

CODE LEGEND

MAIN PATH OF EGRESS
EXIT LOAD
OCCUPANT LOAD
OCCUPANT FACTOR

NEW 1 HOUR FIRE BARRIER
(SHAFT ENCLOSURES: 707.3.1, INCIDENTAL USE AREAS: 509, OCCUPANCY SEPARATIONS: 508.4, STAIR/ VERTICAL EXIT ENCLOSURES: 1022.2, /707 /711)

OPENINGS:	60 MIN. (SHAFT ENCLOSURES) 45 MIN. (INCIDENTAL USE AREAS, OCCUPANCY SEPARATIONS)
GLAZING:	60 MIN. OPENINGS: 100 SQ IN MAX, 38" MAX HT, 10" MAX WIDTH 45 MIN. OPENINGS: 1296 SQ IN MAX, 54" MAX HT, 54" MAX WIDTH
DUCTWORK:	40 MIN. FIRE DAMPER (NOT REQUIRED WITH DUCTED HVAC) 40 MIN FIRE/ SMOKE DAMPER (AT SHAFT ENCLOSURES)

NEW ZERO RATED CORRIDOR
(1018.1 WITH SPRINKLER SYSTEM)

OPENINGS:	0 MIN.
GLAZING:	0 MIN.
DUCTWORK:	CORRIDOR CANNOT BE USED AS SUPPLY, RETURN, EXHAUST, RELIEF OR VENTILATION AIR DUCTS.
NOTE:	RETURN AIR PLENUMS ARE ALLOWED. (1018.5.1)

Combined Area Fire Training Facility Re-Bid

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woldac.com | 847 241 6100

EFFECTIVE CODE REFERENCES

2006 INTERNATIONAL BUILDING CODE (AS AMENDED)
2006 INTERNATIONAL MECHANICAL AND FUEL GAS CODE
2005 NATIONAL ELECTRICAL CODE
2014 ILLINOIS PLUMBING CODE
2006 INTERNATIONAL FIRE CODE
2014 INTERNATIONAL COMMERCIAL ENERGY CODE
1997 ILLINOIS ACCESSIBILITY CODE

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **ARCHITECT** under the laws of the State of **ILLINOIS**

Matthew J. Bickel
License Number: **001.020883** Date **11-30-18**

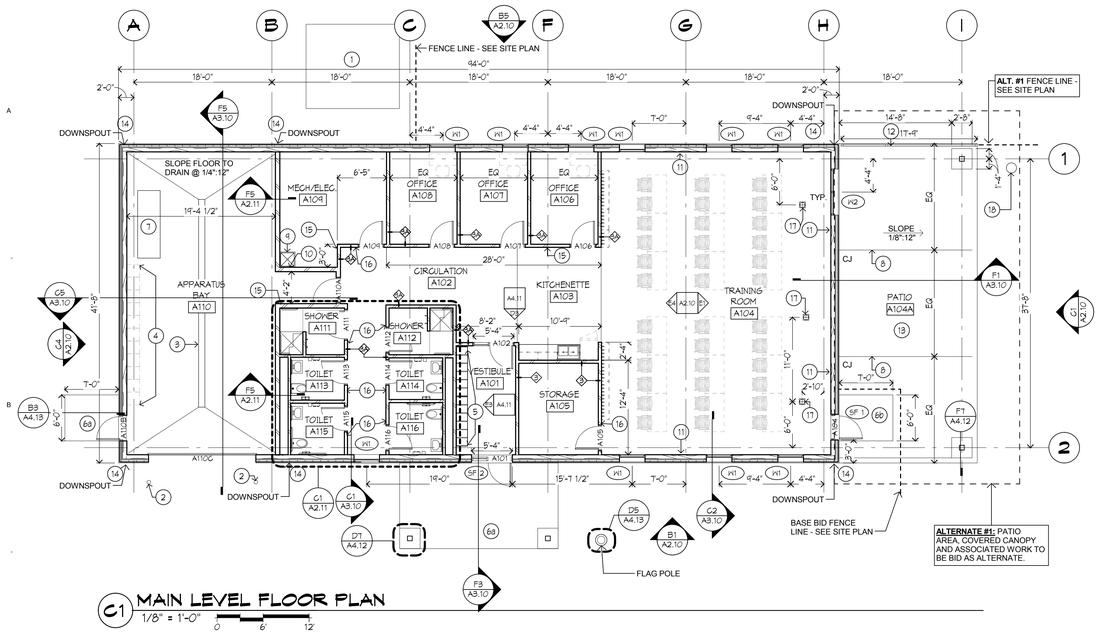
Revisions		
Description	Date	Num
Issued for Bid	**12-7-17**	**1**

Comm: **173013**
Date: **December 7, 2017**
Drawn: **BDB**
Check: **MJB**

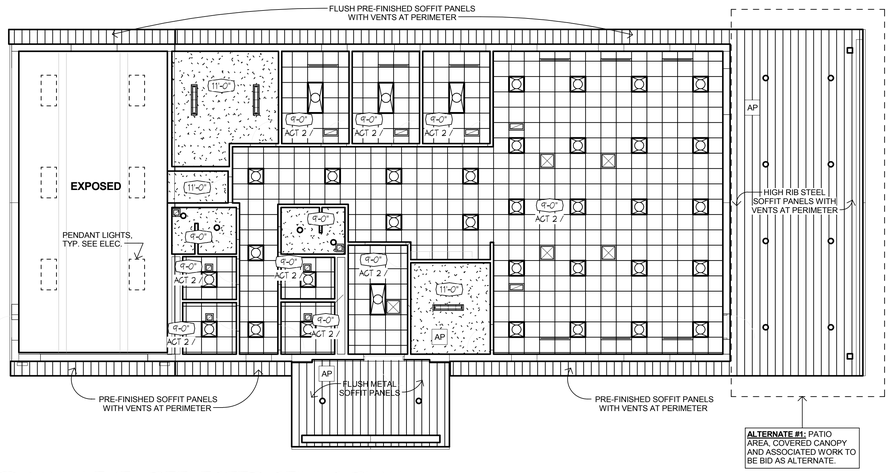
SITE PLAN AND CODE PLAN

Scale: **As indicated**

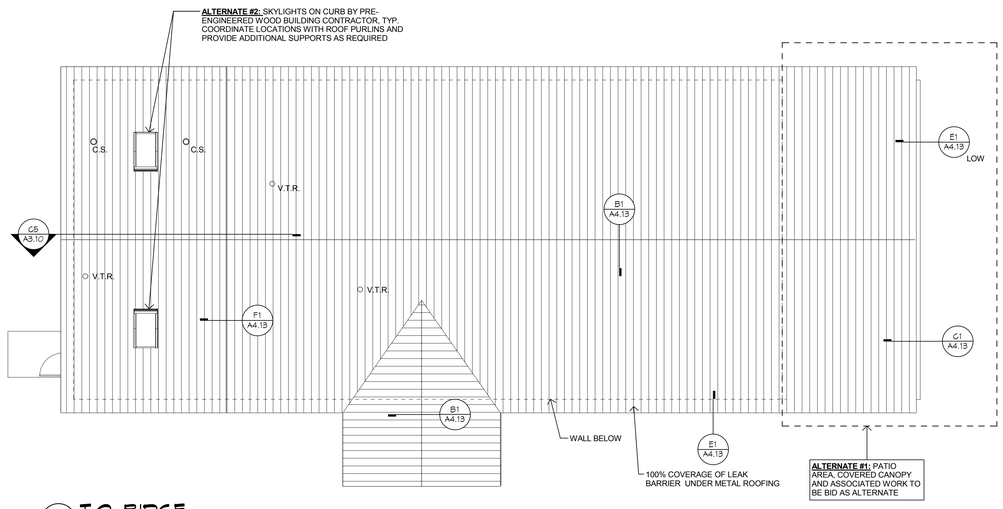
A0.01



C1 MAIN LEVEL FLOOR PLAN
1/8" = 1'-0"



D1 MAIN LEVEL REFLECTED CEILING PLAN
1/8" = 1'-0"



F1 T.O. RIDGE
1/8" = 1'-0"

FLOOR PLAN GENERAL NOTES:

1. ALL PLAN DIMENSIONS ARE NOMINAL TO FACE OF WALL. WALL THICKNESS ARE SHOWN NOMINAL. SEE WALL TYPES FOR ACTUAL THICKNESS.
2. ALL GYP. WALLS ARE TO BE 5 INCHES THICK UNLESS OTHERWISE NOTED.
3. COORDINATE SIZE AND LOCATION OF ALL DUCT AND SHAFT OPENINGS IN WALLS AND FLOORS W/ MECH. AND ELEC. PROVIDE ALL REQUIRED LINTELS FOR OPENINGS. SEE LINTEL SCHEDULE.
4. FIELD VERIFY ALL MILLWORK OPENINGS.
5. SET FLOOR DRAINS 3/4" BELOW FINISHED CONCRETE FLOORS UNLESS OTHERWISE NOTED. PROVIDE CONSISTENT SLOPE FROM WALL TO DRAIN BY SLOPING CONCRETE, MIN. 1/4" PER FOOT.
6. VERIFY LOCATION, SIZE AND QUANTITY OF ALL MECHANICAL AND ELECTRICAL EQUIPMENT PADS.
7. ALL DOOR/SIDELITE OPENINGS TO BEGIN 4" FROM ADJACENT WALL UNLESS OTHERWISE NOTED.
8. ALL GYP. WALLS ARE CENTERED ON GRID UNLESS OTHERWISE NOTED.
9. FIRE RATED WALLS ARE INDICATED ON CODE PLANS.

RCP GENERAL NOTES

1. FOR WALLS THAT PENETRATE CEILINGS SEE WALL TYPES SHOWN ON THE FLOOR PLAN.
2. SPRINKLER HEADS ARE NOT SHOWN. LOCATE ALL SPRINKLER HEADS IN THE CENTER OF CEILING TILES.
3. FOR DIFFUSER AND RETURN GRILL SIZES, SEE MECHANICAL PLANS.
4. FOR LIGHT FIXTURE TYPES, SEE ELECTRICAL LIGHTING PLANS.
5. CEILINGS HEIGHTS INDICATED ON PLAN (E.G. 9'-0") ARE FROM FINISHED FLOOR OF LEVEL OF PLAN SHOWN OR INDICATED AS 10'-0".
6. ACOUSTICAL TILE CEILING GRID IS TO BE CENTERED IN RECTANGULAR ROOM OR CENTERED BETWEEN LONGEST WALLS OF IRREGULARLY SHAPED ROOMS UNLESS OTHERWISE NOTED.
7. VERIFY GYP. BD. CONTROL JOINT LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION.

RCP LEGEND

- CANLIGHT
- 4' STRIP LIGHT FIXTURE
- 2 X 2 LIGHT FIXTURE (IN CEILING GRID)
- 2 X 4 LIGHT FIXTURE (IN CEILING GRID)
- AIR DIFFUSER (IN CEILING GRID)
- RETURN AIR GRILLE (IN CEILING GRID)
- AP — ACCESS PANEL
- LINEAR DIFFUSER (IN CEILING GRID)
- PTD. GYPSUM BOARD CEILING / SOFFIT
- PENDANT LIGHT FIXTURE

ROOF PLAN GENERAL NOTES

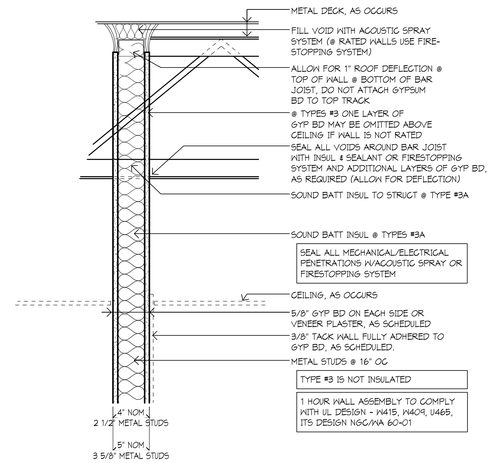
1. MECHANICAL ITEM LOCATIONS ARE SHOWN FOR REFERENCE ONLY. REFER TO MECH. DRAWINGS FOR EXTENT OF MECH. EQUIP. AND SIZE AND LOCATION OF ALL ROOF PENETRATIONS.
2. ALL MECHANICAL AND ELECTRICAL ROOFTOP EQUIPMENT, PIPING, CONDUIT, ETC. TO BE PAINTED.
3. REFER TO EXTERIOR ELEVATIONS FOR LOCATION OF OVERFLOW SCUPPERS AND OUTFLOWS.

ROOF LEGEND

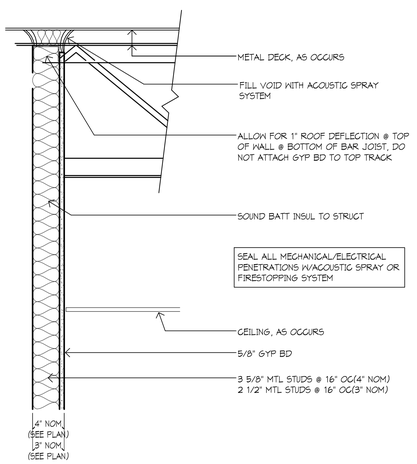
- VENT STACK, PIPE OR CONDUIT
- COMBUSTION STACK
- SKYLIGHT

FLOOR PLAN KEY NOTES:

1. CONC. EQUIPMENT PAD. COOR. WITH MECHANICAL
2. CONCRETE FILLED STEEL PIPE BOLLARD - SEE DETAIL F3/A4.12
3. TRENCH DRAIN - SEE MECH.
4. EQUIPMENT STORAGE LOCKERS (N.I.C.)
5. BOOT LOCKERS
6a. CONC. STOOP - SEE STRUCT.
6b. CONC. STOOP - SEE STRUCT. OMIT STOOP FOR WORK ASSOCIATED WITH ALTERNATE #1.
7. TRIPLE BASIN - SEE MECH.
8. CONTROL JOINT TO BE TOOLED.
9. MOP SINK - SEE MECH.
10. SHELF AND MOP HOLDER.
11. PROVIDE BLOCKING IN WALLS FOR OWNER PROVIDED TV MOUNTING HARDWARE.
12. DECORATIVE FENCING. (ALTERNATE #1)
13. CONCRETE PATIO SLOPED AT 1/8":12" - SEE STRUCT.
14. SPLASH BLOCK - SEE DETAIL E5/A4.13
15. FIRE EXTINGUISHER
16. 6X9 ADA PLAQUE SIGNAGE
17. ELECTRICAL FLOOR BOX. FACE OF BOX TO BE FLUSH WITH FINISHED CONCRETE FLOOR.
18. ALTERNATE #3: RELOCATE EXISTING TORNADO SIREN AND POLE. SEE CIVIL DRAWINGS FOR EXISTING LOCATION.

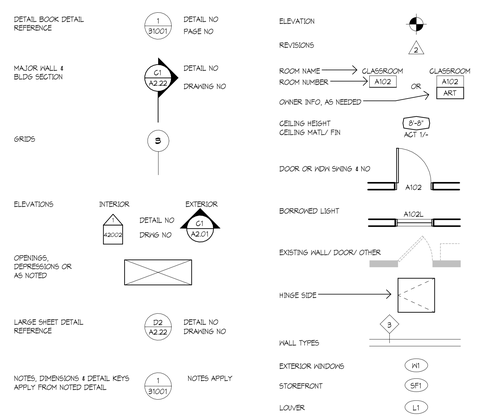


B7 WALL TYPES #3,3A
1 1/2" = 1'-0"



D7 WALL TYPES #7A
1 1/2" = 1'-0"

SYMBOLS



SYMBOLS
1 : 1

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Matthew J. Bickel
License Number: 001.020883 Date: 11-30-18

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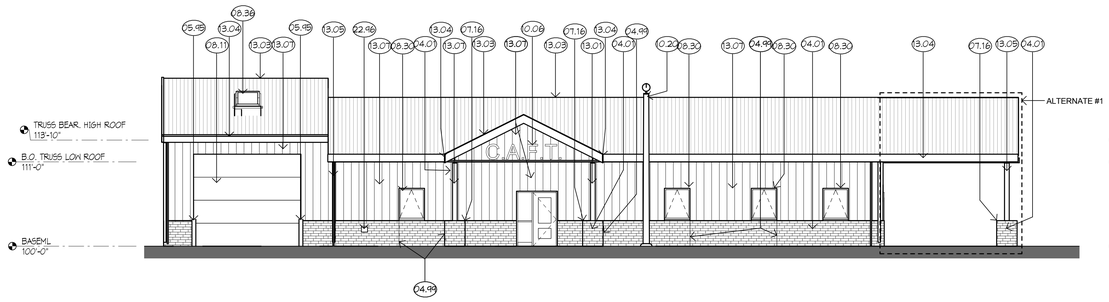
Comm: 173013
Date: December 7, 2017
Drawn: BDB
Check: MJB
North

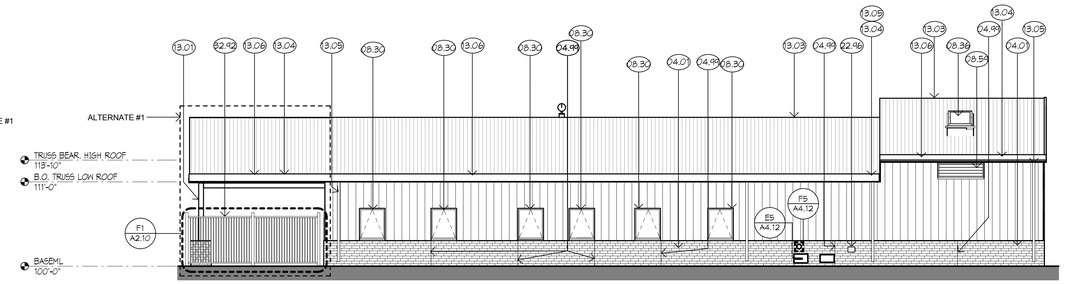
FLOOR, REFLECTED CEILING AND ROOF PLANS

Scale: As indicated

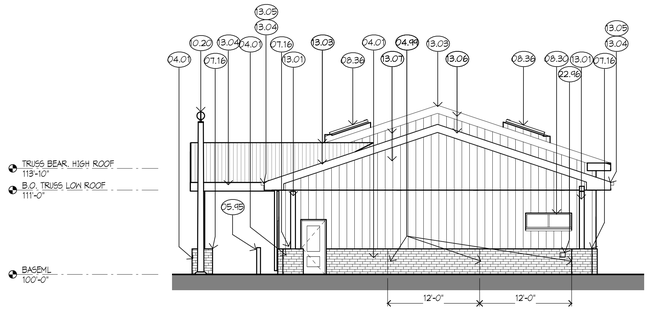
A1.10



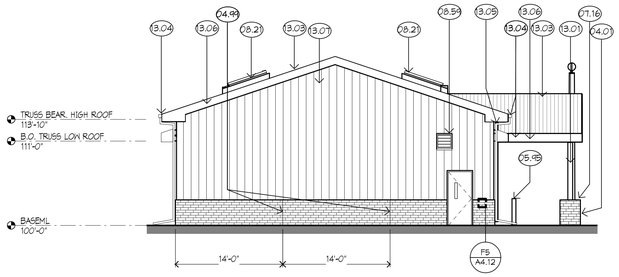
B1 SOUTH ELEVATION
1/8" = 1'-0"



B5 NORTH ELEVATION
1/8" = 1'-0"

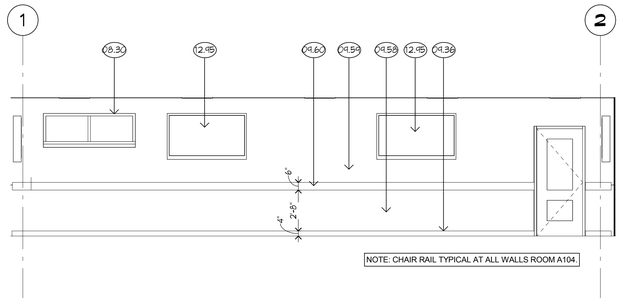


C1 EAST ELEVATION
1/8" = 1'-0"

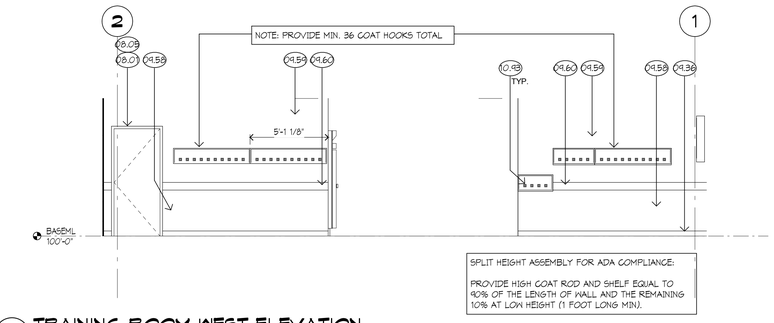


C4 WEST ELEVATION
1/8" = 1'-0"

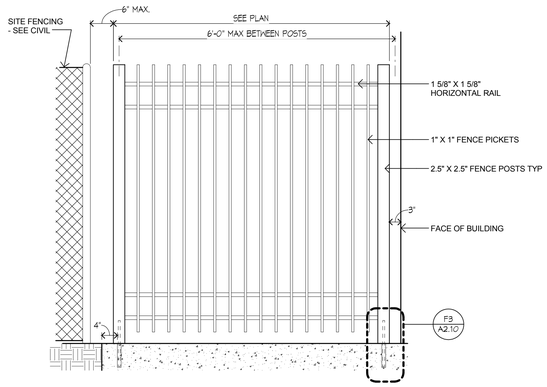
MATERIALS KEY	
KEY	MATERIAL
04.01	FACE BRICK NO. 1
04.99	BRICK EXPANSION JOINT
05.45	BOLLARD
07.16	SHEET METAL FLASHING AND TRIM
08.01	HOLLOW METAL FRAME
08.05	WOOD DOOR
08.11	SECTIONAL METAL OVERHEAD DOOR
08.21	PREFINISHED ALUMINUM TRANSLUSCENT SKYLIGHT FRAMING (ALT.#2)
08.30	PREFINISHED ALUMINUM WINDOW
08.36	PREFINISHED ALUMINUM SKYLIGHT (ALT.#2)
08.54	PREFINISHED METAL LOUVER
09.36	VINYL BASE
09.58	PAINT 1
09.59	PAINT 2
09.60	WOOD CHAIR RAIL (PAINT 3)
10.06	ALUMINUM DIMENSION LETTER SIGNAGE (N.I.C.)
10.20	FLAGPOLE
10.43	COAT HOOKS
12.45	VIDEO DISPLAY (NIC)
13.01	PRE-ENGINEERED WOOD STRUCTURE - COLUMN
13.03	STANDING SEAM SHEET METAL ROOF
13.04	GUTTER
13.05	DOWNSPOUT
13.06	EAVE FLASHING
13.07	METAL WALL PANELS
22.46	HOSE BIB (SEE MECH.)
32.92	ORNAMENTAL FENCING (ALT. #1)



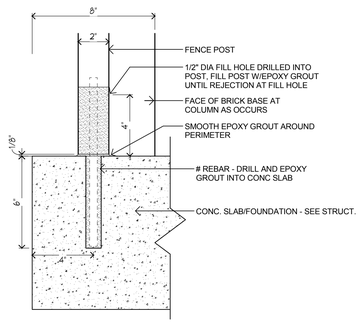
E1 TRAINING ROOM EAST ELEVATION, TYP.
1/4" = 1'-0"



E4 TRAINING ROOM WEST ELEVATION
1/4" = 1'-0"



F1 FENCE ELEVATION (ALT #1)
3/4" = 1'-0"



F3 POST DETAIL (ALT #1)
3" = 1'-0"

IL

A

Combined Area Fire Training Facility Re-Bid

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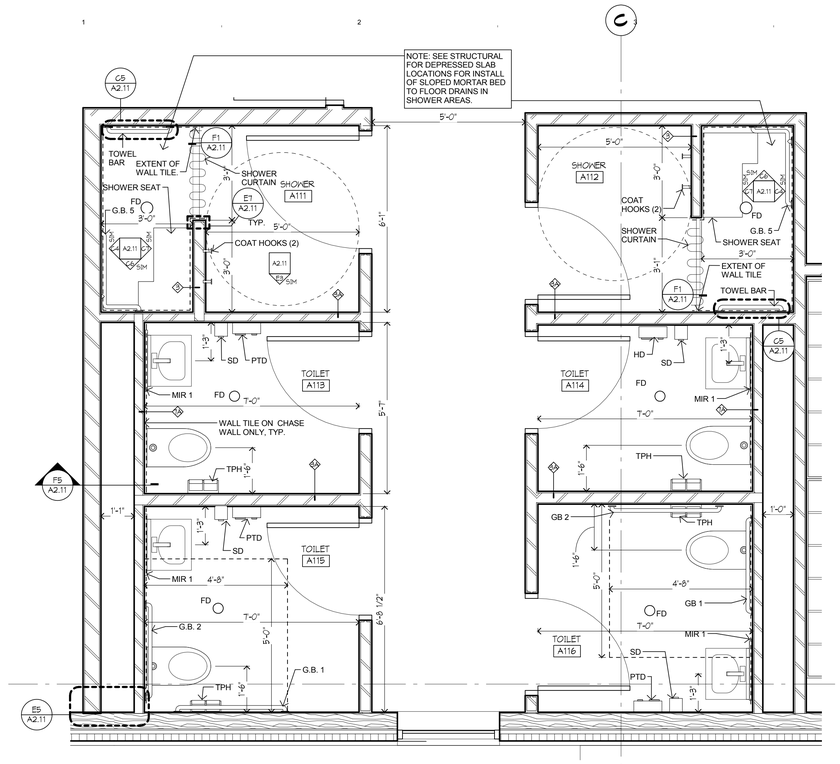
Check: **MJB**

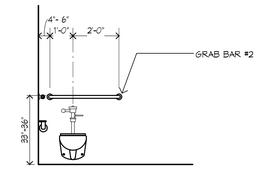
EXTERIOR ELEVATIONS

Scale: **As indicated**

A2.10

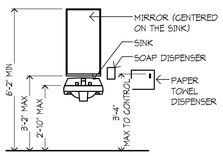


C1 ENLARGED TOILET PLAN
1/2" = 1'-0"

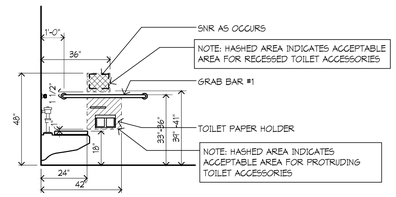


A4 ADULT HCAP WC
3/8" = 1'-0"

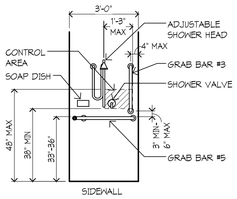
A5 ADULT WC
3/8" = 1'-0"



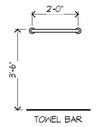
B4 LAV ELEV
3/8" = 1'-0"



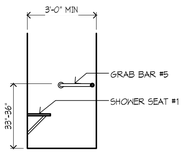
B5 ADULT HCAP WC
3/8" = 1'-0"



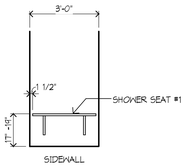
C4 TRANSFER SHOWER STALL
3/8" = 1'-0"



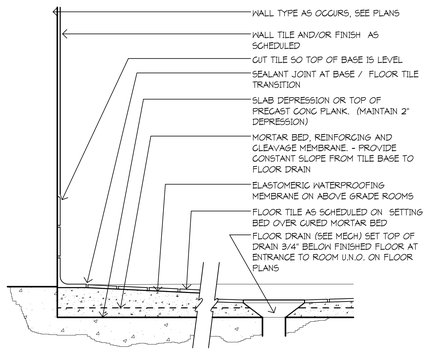
C5 TOWEL BAR
3/8" = 1'-0"



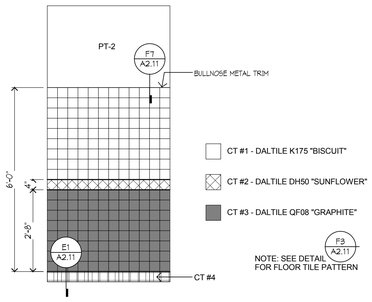
C6 TRANSFER SHOWER STALL
3/8" = 1'-0"



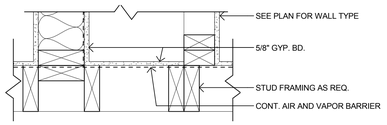
C7 TRANSFER SHOWER STALL
3/8" = 1'-0"



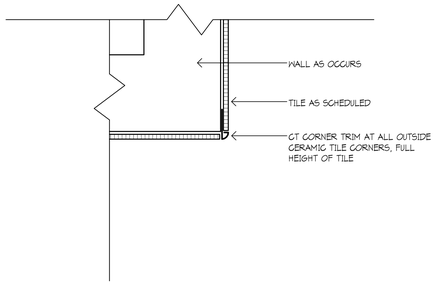
E1 TYP SHOWER ROOM SECTION
3" = 1'-0"



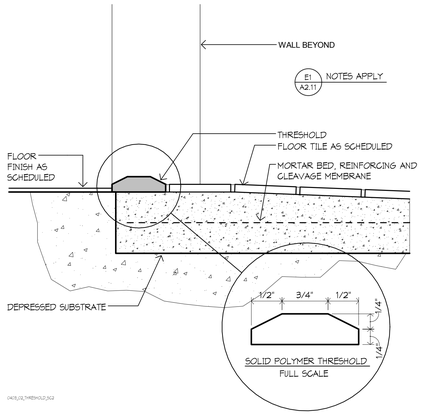
E3 WALL TILE PATTERN, TYP.
1/2" = 1'-0"



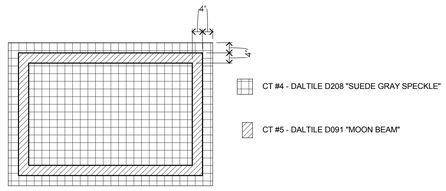
E5 TOLIET CHASE PLAN DETAIL
1 1/2" = 1'-0"



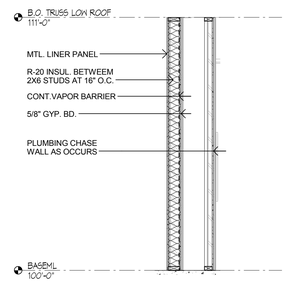
E7 PLAN AT CORNER TRIM
3" = 1'-0"



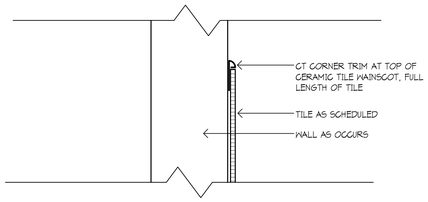
F1 TYP TOILET ROOM THRESHOLD
6" = 1'-0"



F3 FLOOR TILE PATTERN
1/2" = 1'-0"



F5 WALL SECTION AT TOILET CHASE
3/8" = 1'-0"



F7 SECTION AT CORNER TRIM
3" = 1'-0"

IL

A

Combined Area Fire Training Facility Re-Bid
851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

WOLD | RUCK PATE
110 North Brockway, Suite 220
Palatine, Illinois 60067
woldac.com | 847 241 6100

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **ARCHITECT** under the laws of the State of **ILLINOIS**

Matthew J. Bickel
License Number: **001.020883** Date: **11-30-18**

Revisions		
Description	Date	Num
Issued for Bid	**12-7-17**	**1**

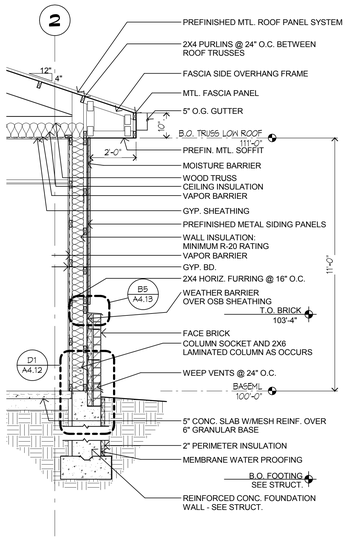
Comm: **173013**
Date: **December 7, 2017**
Drawn: **BDB**
Check: **MJB**
North

ENLARGED PLANS

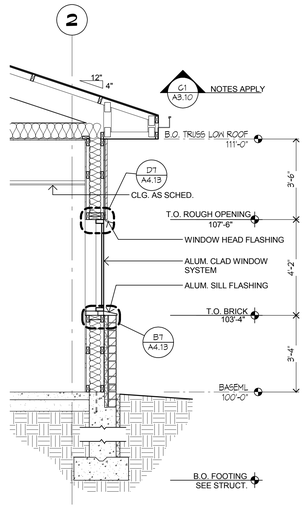
Scale: **As indicated**

A2.11

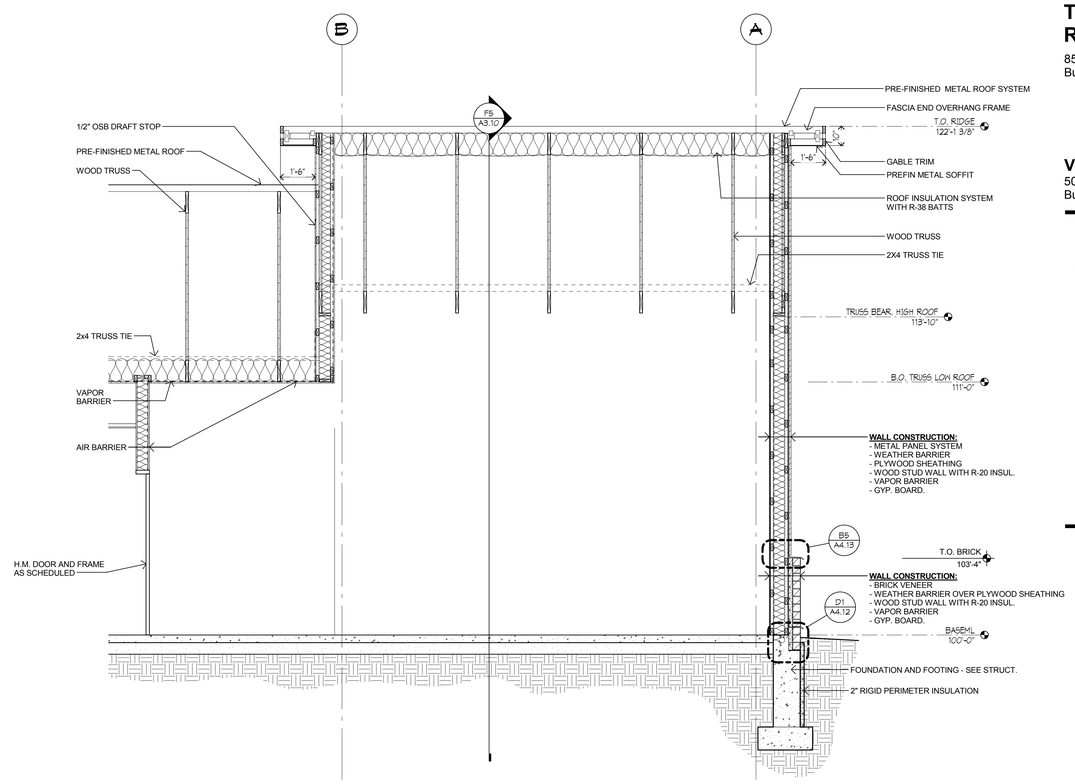
IL



C1 SECTION AT LOW ROOF, TYP.
3/8" = 1'-0"

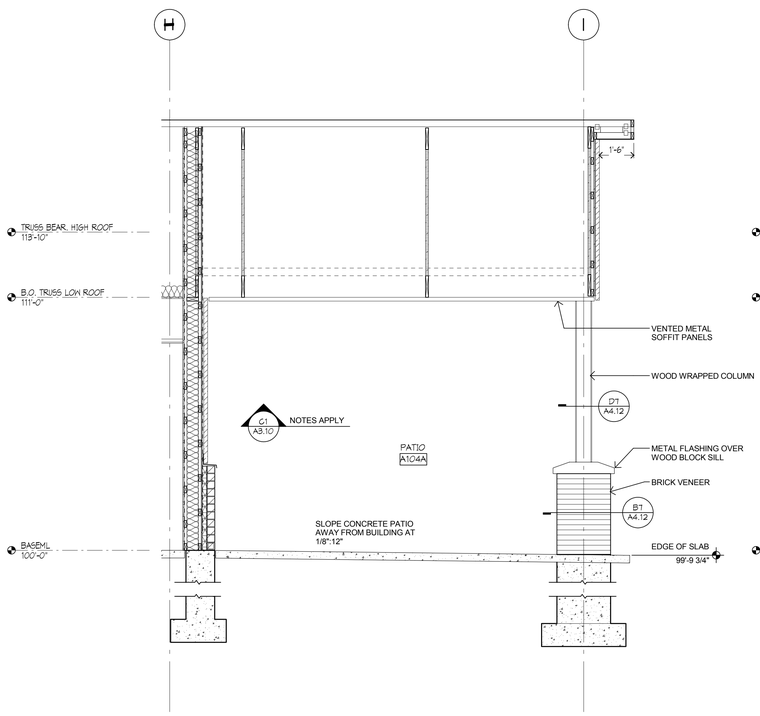


C2 SECTION AT WINDOW
3/8" = 1'-0"

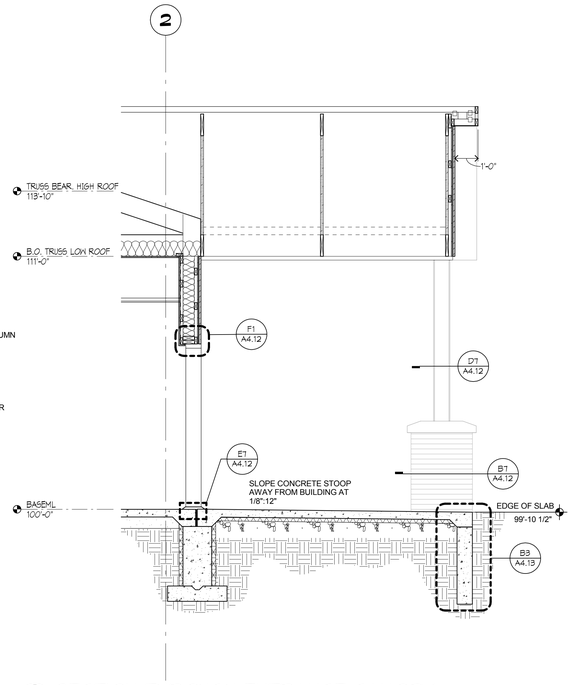


C5 SECTION THROUGH HIGH ROOF GABLE
3/8" = 1'-0"

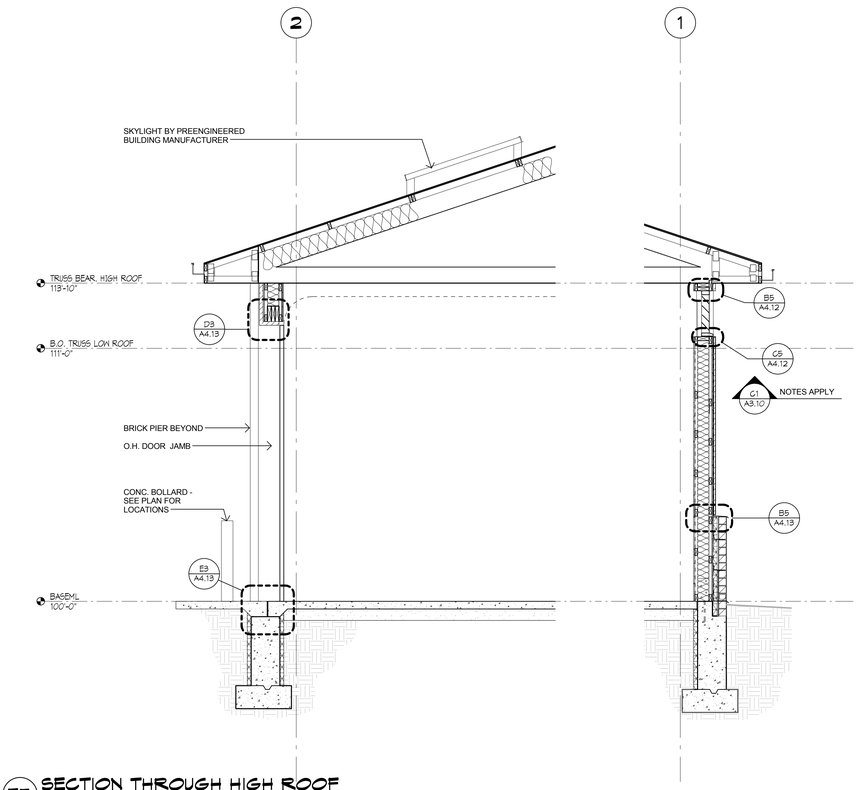
A



F1 SECTION THROUGH PATIO GABLE (ALT #1)
3/8" = 1'-0"



F3 SECTION THROUGH ENTRANCE CANOPY
3/8" = 1'-0"



F5 SECTION THROUGH HIGH ROOF
3/8" = 1'-0"

A

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851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
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Wold
RUCK PATE

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Drawn: **BB**
Check: **MJB**

WALL SECTIONS

Scale: **3/8" = 1'-0"**

A3.10

ROOM FINISH SCHEDULE												
ROOM NO	ROOM NAME	FLOOR	BASE	N WALL - TYP		E WALL		S WALL		W WALL		REMARKS
				MATL	FIN	MATL	FIN	MATL	FIN	MATL	FIN	
A101	VESTIBULE	P.CONC	VB	GYP BD	PT-2							
A102	CIRCULATION	P.CONC	VB	GYP BD	PT-2							
A103	KITCHENETTE	P.CONC	VB	--	--	--	--	GYP BD	PT-2	--	--	6
A104	TRAINING ROOM	P.CONC	VB	GYP BD	SEE ELEV							3
A104A	PATIO	CONC	VB	--	--							
A105	STORAGE	P.CONC	VB	GYP BD	PT-2							
A106	OFFICE	P.CONC	VB	GYP BD	PT-2							
A107	OFFICE	P.CONC	VB	GYP BD	PT-2							
A108	OFFICE	P.CONC	VB	GYP BD	PT-2							
A109	MECH/ELEC.	CONC	VB	GYP BD	PT-2							
A110	APPARATUS BAY	QUARTZ	QUARTZ	MTL PNL	--							1
A111	SHOWER	CT/P.CONC	CT-4/VB	GYP BD	C.TILE/PT-2	--	--	--	--	--	--	2,4
A112	SHOWER	CT/P.CONC	CT-4/VB	GYP BD	C.TILE/PT-2							2,4
A113	TOILET	P.CONC	VB	GYP BD	PT-2	--	--	--	--	--	--	5
A114	TOILET	P.CONC	VB	GYP BD	PT-2	--	--	--	--	--	--	5
A115	TOILET	P.CONC	VB	GYP BD	PT-2	--	--	--	--	--	--	5
A116	TOILET	P.CONC	VB	GYP BD	PT-2	--	--	--	--	--	--	5

ROOM FINISH SCHEDULE GENERAL NOTES

1. SEE DETAILS OF CONSTRUCTION FOR ABBREVIATIONS
2. IF ALL WALLS IN ROOM HAVE THE SAME FINISH, THE "N WALL-TYP" COLUMN WILL BE USED.
3. DISCREPANCIES BETWEEN THE ROOM FINISH SCHEDULE AND DRAWINGS SHALL BE REPORTED TO THE ARCHITECT FOR FINISH DETERMINATION.
4. ON WALLS WHIGH ARE COVERED WITH MILLWORK, A FINISH SHALL NOT BE APPLIED TO THE WALL BEHIND EXCEPT FOR LOCATIONS WHIGH MAY BE EXPOSED (I.E. SPACE BETWEEN MILLWORK AND TACK SURFACE.)
5. FOR CEILING MATERIAL WHEN MORE THAN ONE CEILING MATERIAL OCCURS THE CEILING FINISH IS INDICATED THUS: '/'
6. PAINT FINISHES INDICATED BY PT- # TO BE THE FOLLOWING:
   PT-1 - SW 7076 "CITYSCAPE" (ACCENT/WAINSCOT)
   PT-2 - SW 7570 "ESAKT WHITE" (FIELD)
   PT-3 - SW 6902 "DECISIVE YELLOW" (ACCENT/CHAIR RAIL/BOLLARDS)
   PT-4 - SW 6991 "BLACK MAGIC" (H.M. FRAMES)
7. VINYL BASE TO BE ROPPE "100 BLACK"
8. REFER TO SHEET A2.11 FOR TILE PATTERNS AND DETAILS FOR CERAMIC TILE COLORS.
9. PLASTIC LAMINATE COLORS:
   P.LAM 1 - FORMICA "156-58 "NATURAL MAPLE" (VERTICAL SURFACES)
   P.LAM 2 - FORMICA 919-58 "GRAPHITE GRAFIX" (COUNTERTOP)
10. WOOD DOOR SPECIES/COLOR: MARSHFILED - WHITE MAPLE "CLEAR 0-48"
11. DECORATIVE QUARTZ FLOORING COLOR: STRATA SHIELD Q205
12. P.CONC REFER TO CONCRETE SCHEDULE TO RECEIVE PAINT.

ROOM FINISH SCHEDULE REMARKS

1. WALLS TO BE FINISHED WITH METAL LINER PANEL BY PRE-ENG. WOOD BUILDING MANUFACTURER.
2. PROVIDE CERAMIC TILE TO A HEIGHT OF 6'-6" WITH EPOXY PAINT ABOVE. SEE DRAWING C1/A2.11 FOR LOCATIONS.
3. SEE ELEVATION FOR WOOD CHAIR RAIL AND PAINT ACCENTS.
4. PROVIDE FLOOR TILE AT SHOWER AREA ONLY. SEE SHEET A2.11 FOR AND TILE FLOOR PATTERN INFORMATION.
5. PAINT CEILING AND ALL EXPOSED STRUCTURE, PIPING, CONDUIT, MECHANICAL DUCTS AND VENTS.
6. PROVIDE VINYL BASE AT CASEWORK.

DOOR / OPENING SCHEDULE																
DOOR NO	DOOR / OPENING					LABEL	FRAME			GL	MOUNTING CONDITIONS			HDW GRP	REMARKS
	TYPE	QTY	WIDTH	HEIGHT	MATL		TYPE	DEPTH	MATL		HEAD	JAMB	SILL		
A101	FG2	1	3'-0"	7'-0"	AL	--	SF 2	--	AL	--	F1/A4.12	F1/A4.12	E7/A4.12	1	
A102	FG2	1	3'-0"	7'-0"	HM	--	FR 3A	--	HM	--	F5/A4.13	F5/A4.13	F5/A4.13	3	
A104	FG2	1	3'-0"	7'-0"	AL	--	SF 1	--	AL	--	F1/A4.12	F1/A4.12	E7/A4.12	2	
A105	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--	5	
A106	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--	4	
A107	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--	4	
A108	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--	4	
A109	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--	5	
A110A	N	1	3'-0"	7'-0"	HM	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--	3	
A110B	N	1	3'-0"	7'-0"	HM	--	FR 1	--	HM	--	F1/A4.12	F1/A4.12	E7/A4.12	7	
A110C	OH	1	14'-0"	12'-0"	ST	--	OH	--	--	--	D3/A4.13	C3/A4.13	E3/A4.13		
A111	F	1	3'-8"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--	6	
A112	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--	6	
A113	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--	6	
A114	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--	6	
A115	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--	6	
A116	F	1	3'-0"	7'-0"	WD	--	FR 1	--	HM	--	F5/A4.13	F5/A4.13	--	6	

DOOR SCHEDULE GENERAL NOTES

1. ALL DOORS ARE 1 3/4" THICK UNLESS OTHERWISE NOTED.
2. FOR FRAME DEPTH, ONLY EXCEPTIONS TO THE FOLLOWING TABLE ARE SCHEDULED:

   GYPSUM BOARD PARTITIONS: THROAT OF FRAME TO MATCH WALL THICKNESS.

   FRAME DEPTHS ARE SCHEDULED IN NOMINAL DIMENSIONS. SEE FRAME/ DOOR TYPES FOR CORRESPONDING ACTUAL DIMENSIONS.
3. FOR GLASS TYPES, ONLY EXCEPTIONS TO THE FOLLOWING TABLE ARE SCHEDULED:

   INTERIOR NON RATED:

   CLEAR (SAFETY WHEN REQUIRED BY TABLE IN GLAZING SPECIFICATION.)

   EXTERIOR NON-RATED:

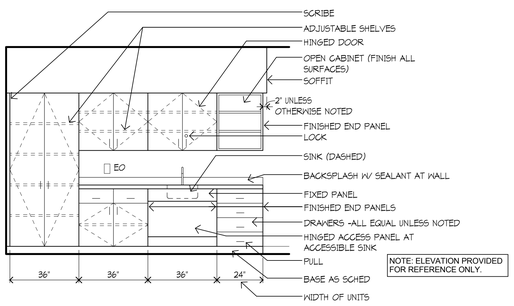
   CLEAR INSULATED (SAFETY INSULATED WHEN REQUIRED BY TABLE IN GLAZING SPECIFICATION.)
4. SEE SHEET A4.11 FOR FRAME TYPES.
5. SEE SHEET A4.11 FOR DOOR TYPES.

DOOR SCHEDULE REMARKS

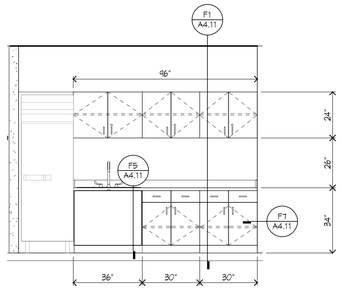
1. NONE

CASEWORK/MILLWORK GENERAL NOTES:

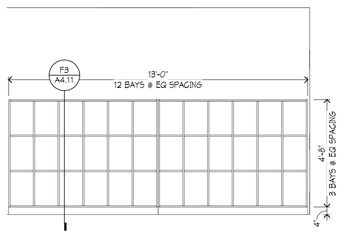
1. THIS IS AN INFORMATION SHEET AND IS INTENDED ONLY TO IDENTIFY THE COMPONENTS OF CABINETWORK ON SUBSEQUENT DRAWINGS.
2. WHERE A 90 DEGREE CORNER OCCURS, EXTEND BASE AND OR WALL CABINET (AND ADJUSTABLE SHELVES AS THEY OCCUR) INTO BLIND CORNER.
3. ELECTRICAL OUTLETS (EO) ARE SHOWN AS THEY RELATE TO MILLWORK. COORDINATE/ SEE ELECTRICAL
4. 1 3/4" MAXIMUM SCRIBE WIDTH PER SIDE. IF OPENING IS LARGER THAN 3 1/2", ADD ANOTHER 3" TO A CASEWORK UNIT.



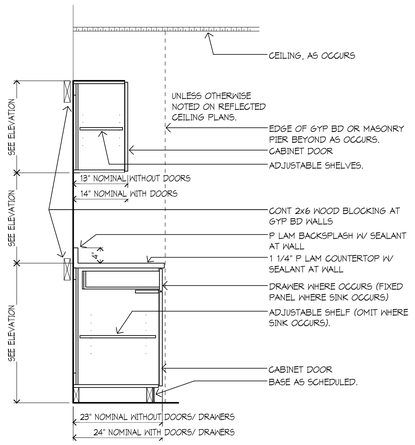
D1 MILLWORK GENERAL INFORMATION
3/8" = 1'-0"



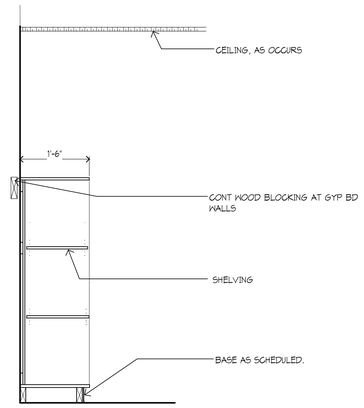
D3 KITCHEN ELEVATION
3/8" = 1'-0"



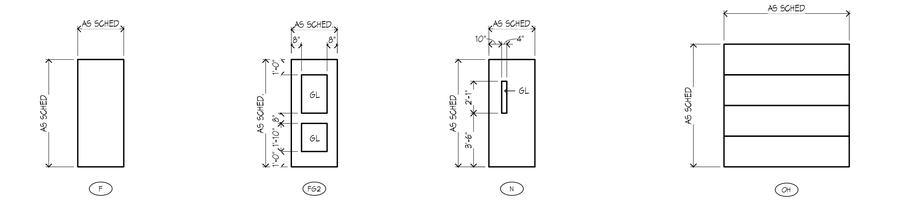
E3 BOOT LOCKER ELEVATION
3/8" = 1'-0"



F1 TYPICAL CASEWORK SECTION
3/4" = 1'-0"



F3 BOOT LOCKER STORAGE
3/4" = 1'-0"

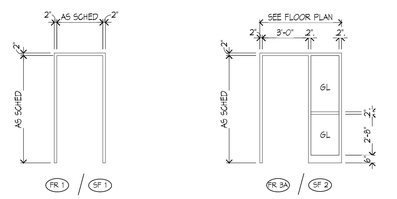


DOOR TYPE F
1/4" = 1'-0"

DOOR TYPE FG2
1/4" = 1'-0"

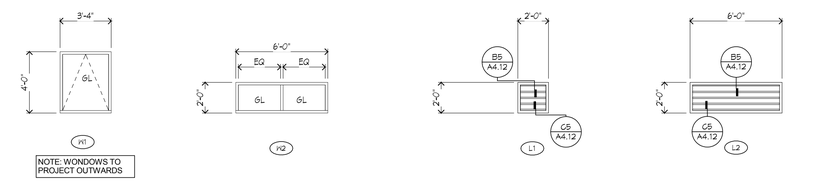
DOOR TYPE N
1/4" = 1'-0"

DOOR TYPE OH
1/4" = 1'-0"



FRAME TYPE 1
1/4" = 1'-0"

FRAME TYPE 3A
1/4" = 1'-0"

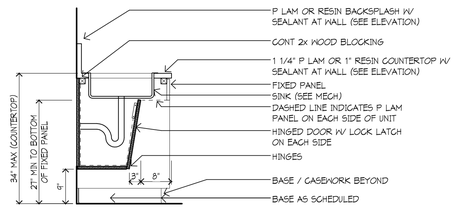


WINDOW TYPE W1
1/4" = 1'-0"

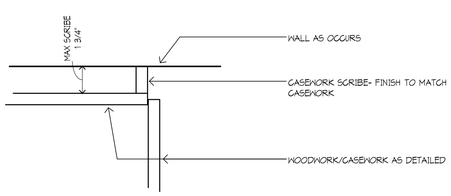
WINDOW TYPE W2
1/4" = 1'-0"

LOUVER TYPE L1
1/4" = 1'-0"

LOUVER TYPE L2
1/4" = 1'-0"



F5 SECTION AT ACCESSIBLE SINK
3/4" = 1'-0"



F7 PLAN AT CASEWORK
3" = 1'-0"

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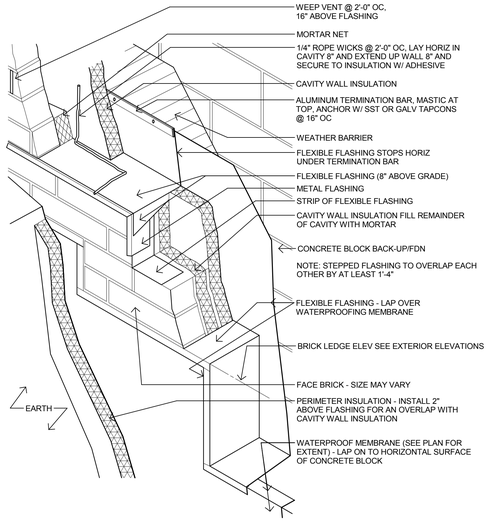
North

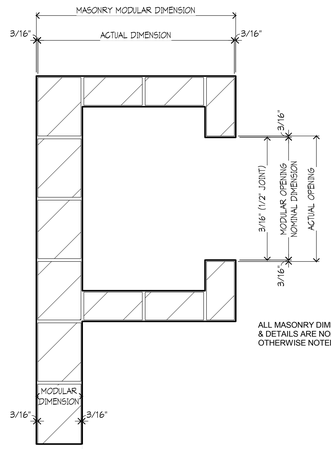
SCHEDULES AND DETAILS

Scale: **As indicated**

A4.11

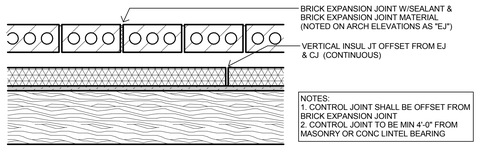


C1 FLASHING DETAIL
1" = 1'-0"



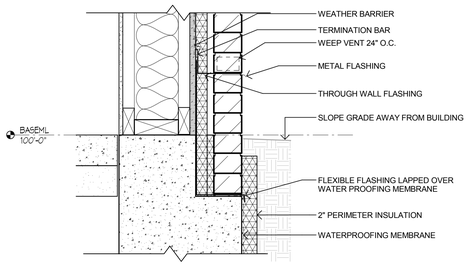
ALL MASONRY DIMENSIONS ON PLANS & DETAILS ARE NOMINAL UNLESS OTHERWISE NOTED.

C3 MASONRY DIMENSIONING
3/4" = 1'-0"

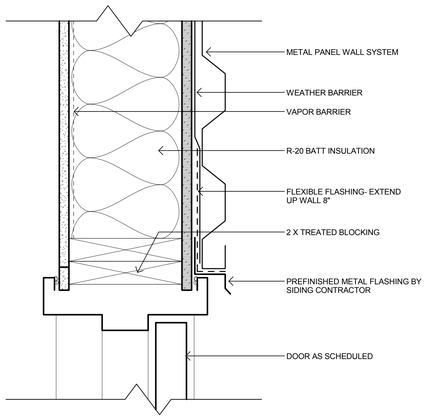


NOTES:
1. CONTROL JOINT SHALL BE OFFSET FROM BRICK EXPANSION JOINT
2. CONTROL JOINT TO BE MIN 4'-0" FROM MASONRY OR CONC LINTEL BEARING

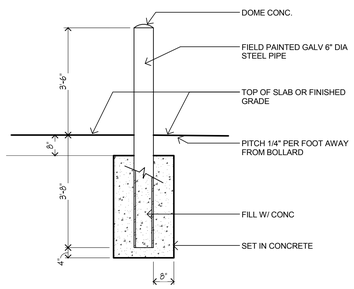
D3 TYPICAL EXT CONTROL/ EXP JOINT
1 1/2" = 1'-0"



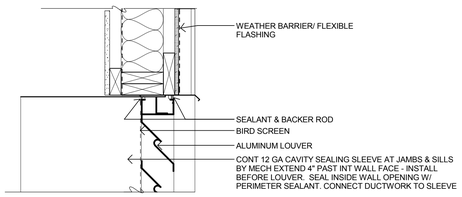
D1 BRICK LEDGE DETAIL
1 1/2" = 1'-0"



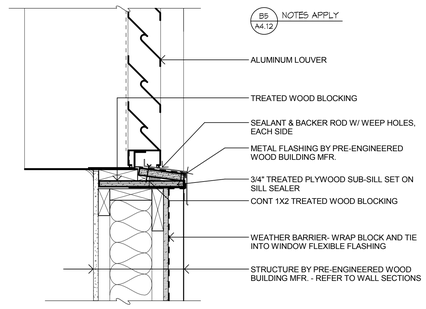
F1 EXT HM HEAD/ JAMB
3" = 1'-0"



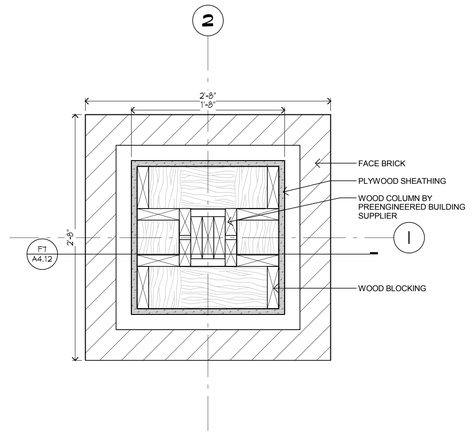
F2 BOLLARD DETAIL
1/2" = 1'-0"



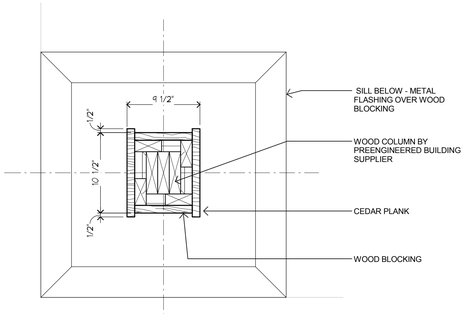
B5 LOUVER HEAD
1 1/2" = 1'-0"



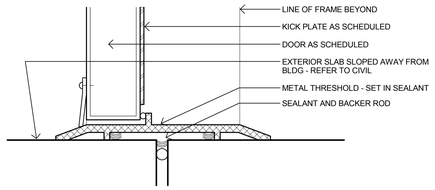
C5 LOUVER SILL
1 1/2" = 1'-0"



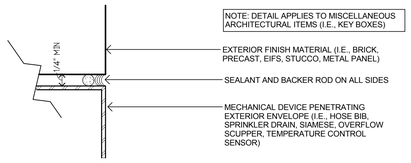
B7 COLUMN DETAIL AT BRICK, TYP.
1 1/2" = 1'-0"



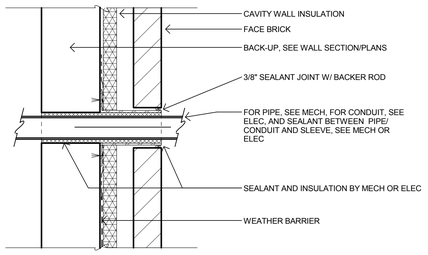
D7 COLUMN DETAIL AT WOOD COLUMN
1 1/2" = 1'-0"



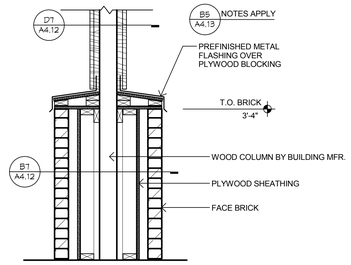
E7 EXTERIOR DOOR THRESHOLD
6" = 1'-0"



E5 SECTION AT TYP MECH DEVICE
6" = 1'-0"



F5 PIPE OR CONDUIT PENETRATION
1 1/2" = 1'-0"



F7 COLUMN SECTION DETAIL
3/4" = 1'-0"

Combined Area Fire Training Facility Re-Bid
851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

WOLD | RUCK PATE
110 North Brockway, Suite 220
Palatine, Illinois 60067
woldac.com | 847 241 6100

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **ARCHITECT** under the laws of the State of **ILLINOIS**

Matthew J. Bickel
License Number: **001.020883** Date: **11-30-18**

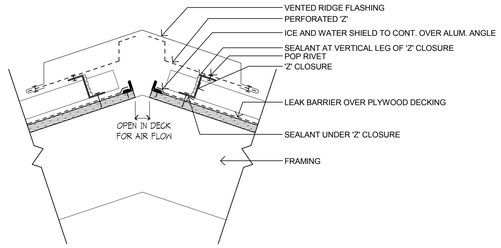
Revisions		
Description	Date	Num
Issued for Bid	**12-7-17**	**1**

Comm: **173013**
Date: **December 7, 2017**
Drawn: **BDB**
Check: **MJB**
North

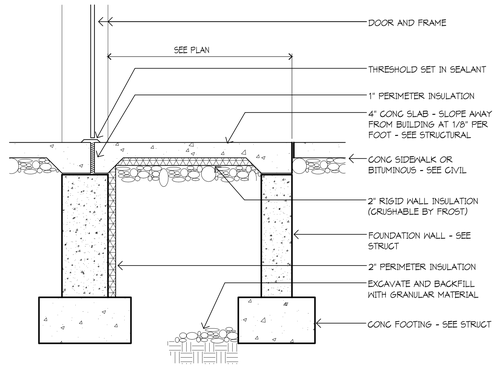
DETAILS

Scale: **As indicated**

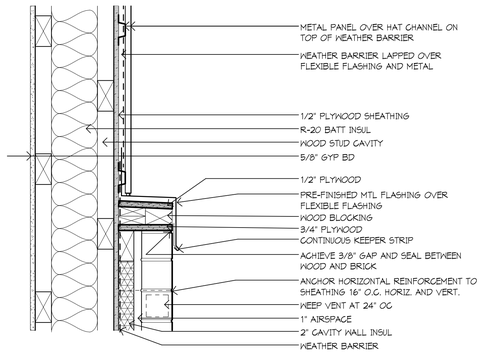
A4.12



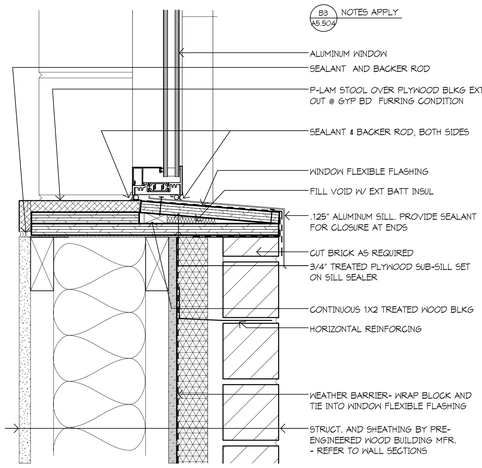
B1 RIDGE VENT
1 1/2" = 1'-0"



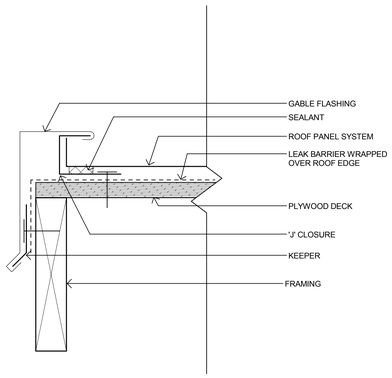
B3 SECTION AT STOOP - TYPICAL
3/4" = 1'-0"



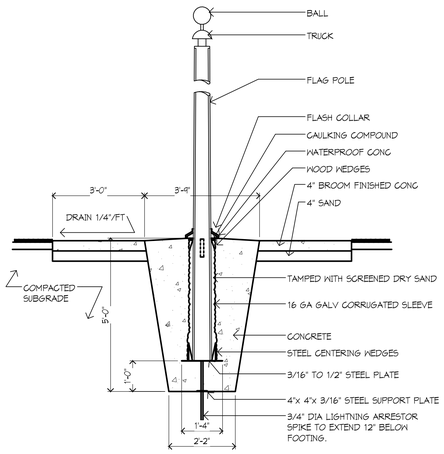
B5 SECTION AT SIDING/ BRICK
1 1/2" = 1'-0"



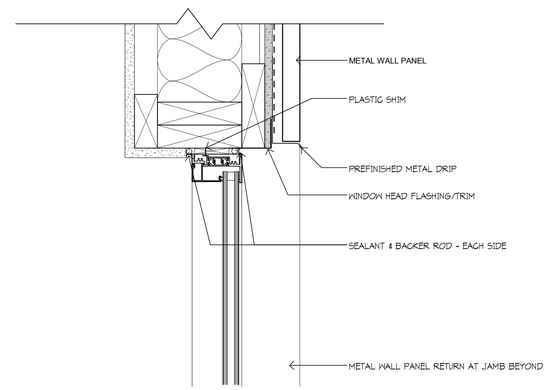
B7 SILL DETAIL
3" = 1'-0"



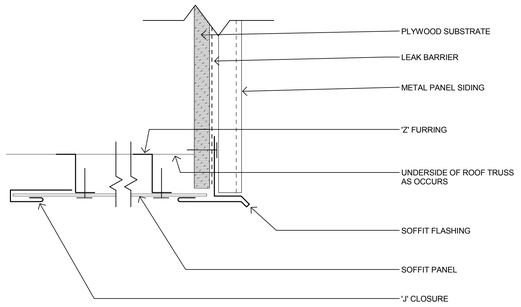
C1 GABLE FLASHING
3" = 1'-0"



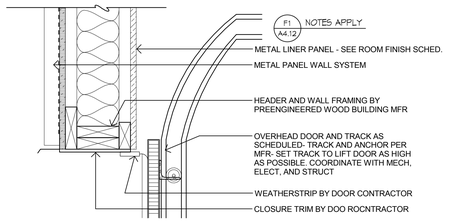
D5 FLAGPOLE DETAIL
1/2" = 1'-0"



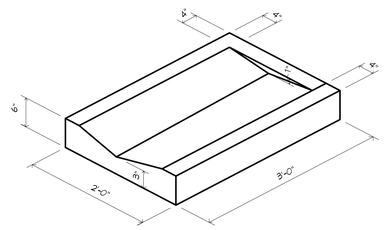
D7 WINDOW HEAD DETAIL
3" = 1'-0"



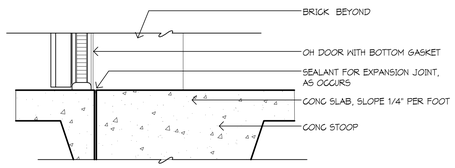
E1 FASCIA TO SOFFIT TRANSITION
3" = 1'-0"



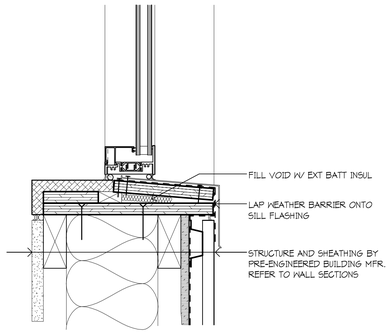
D3 EXT OH DOOR HEAD (JAMB SIM)
1 1/2" = 1'-0"



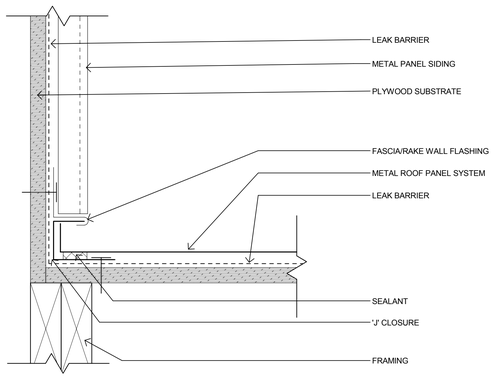
E5 CONCRETE SPLASHBLOCK
1" = 1'-0"



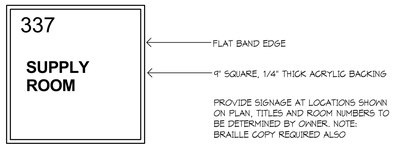
E3 EXT OH DOOR SILL
1 1/2" = 1'-0"



E7 WINDOW SILL AT METAL PANEL
3" = 1'-0"

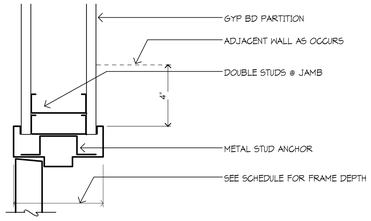


F1 RAKE DETAIL
3" = 1'-0"



PROVIDE SIGNAGE AT LOCATIONS SHOWN ON PLAN. TITLES AND ROOM NUMBERS TO BE DETERMINED BY OWNER. NOTE: BRAILLE COPY REQUIRED ALSO

F3 PANEL SIGNAGE
3" = 1'-0"



F5 JAMB (HEAD & SILL AT BORROWED LITE, SIMILAR)
3" = 1'-0"

IL

A

Combined Area Fire Training Facility Re-Bid
851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

Wold
RUCK PATE
WOLD | RUCK PATE
110 North Brockway, Suite 220
Palatine, Illinois 60067
woldac.com | 847 241 6100

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **ARCHITECT** under the laws of the State of **ILLINOIS**

Matthew J. Bickel
License Number: **001.020883** Date: **11-30-18**

Revisions		
Description	Date	Num
Issued for Bid	**12-7-17**	**1**

Comm: **173013**
Date: **December 7, 2017**
Drawn: **BDB**
Check: **MJB**
North

DETAILS

Scale: **As indicated**

A4.13

Wold Ruck Pate Project Number: 173013
Date: 12/7/2017
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Wold Ruck Pate Architecture and Engineering

STRUCTURAL GENERAL NOTES

BUILDING CODE IBC 2006

OCCUPANCY CATEGORY II

STRUCTURAL LOADING DATA

ROOF LOAD
DEAD LOAD 5 psf
COLLATERAL LOAD 10 psf
LIVE LOAD 30 psf
MECHANICAL LOAD: SEE MECHANICAL DRAWINGS FOR ROOF SUPPORTED EQUIPMENT LOCATION AND LOADS

FLOOR LIVE LOAD 100 psf

SNOW LOAD
GROUND SNOW LOAD Pg 25 psf
IMPORTANCE FACTOR Is 1.0
SNOW EXPOSURE FACTOR Ce 1.0
SNOW THERMAL FACTOR Ct 1.0
FLAT ROOF SNOW LOAD Pf 17.5 psf

WIND LOADS
MWFRS
BASIC WIND SPEED 90 mph
IMPORTANCE FACTOR Iw 1.0
OCCUPANCY CATEGORY II
WIND EXPOSURE B
INTERNAL PRESSURE COEFFICIENT +/- .18

SEISMIC LOADS
OCCUPANCY CATEGORY II
SEISMIC IMPORTANCE FACTOR 1.0
Ss 0.159
S1 0.066
SITE CLASS D
Sds 0.170
Sd1 0.090
SEISMIC DESIGN CATEGORY B

GENERAL

THE STRUCTURAL DRAWINGS ARE TO BE USED IN CONJUNCTION WITH THE ARCHITECTURAL, MECHANICAL AND ELECTRICAL DRAWINGS. REFERENCE MUST BE MADE TO ALL BID DOCUMENTS AS WELL AS THE PROJECT SPECIFICATIONS.
THE CONTRACTOR SHALL COORDINATE WITH THE MECHANICAL AND ARCHITECTURAL DRAWINGS AND WITH THE MECHANICAL CONTRACTOR, THE LOCATION OF ALL MECHANICAL EQUIPMENT.
THE CONTRACTOR SHALL NOTIFY THE ARCHITECT IF THE WEIGHT OF MECHANICAL UNITS ETC. ARE DIFFERENT FROM THE WEIGHTS POSTED ON THE DESIGN DRAWINGS.
DISCREPANCIES SHALL BE RESOLVED BEFORE PROCEEDING WITH CONSTRUCTION.
THE CONTRACTOR SHALL NOTIFY THE ARCHITECT/ENGINEER IMMEDIATELY OF ANY DISCREPANCIES TO AVOID THE POSSIBILITY OF UNNECESSARY FUTURE PROBLEMS AND POSSIBLE FIELD ORDERS. FAILURE TO DO SO WILL PUT THE FULL RESPONSIBILITY OF CORRECTION ON THE CONTRACTOR.
THE CONTRACTOR SHALL COORDINATE THE WORK OF ALL TRADES AND MAKE NECESSARY INVESTIGATIONS AND FIELD MEASUREMENTS.
DO NOT SCALE DRAWINGS.
THE STRUCTURAL ENGINEER HAS NO SUPERVISORY RESPONSIBILITY, HAS NO CONTROL OF OR RESPONSIBILITY FOR THE MEANS, METHODS, TECHNIQUES, PROCEDURES OR SEQUENCE OF CONSTRCUCTION. HAS NO RESPONSIBILITY FOR THE FAILURE OF ANY CONTRACTOR TO PERFORMTHE WORK IN ACCORDANCE WITH THE DESIGN DOCUMENTS AND NO RESPONSIBILITY TO DEVISE, IMPLEMENT OR ENFORCE ANY SAFETY PRECAUTIONS OR PROGRAMS FOR THE PROJECT.

EXCAVATION

CONTRACTOR SHALL LOCATE ALL EXISTING BELOW GRADE UTILITIES AND INERFERENCES PRIOR TO START OF WORK. NOTIFY THE ARCHITECT OF ANY INTERFERENCES.
STRIP TOPSOIL OVER THE ENTIRE BUILDING AREA.
FOUNDATIONS SHALL BEAR AT SUFFICIENT DEPTH TO PROVIDE ADEQUATE FROST COVERAGE PER LOCAL REQUIREMENTS. IN NO CASE SHALL DEPTHS BE LESS THAN THE MINIMUM DEPTHS SHOWN ON PLANS AND DETAILS.
MAINTAIN ALL EXCAVATIONS FREE OF WATER CONTINUOUSLY.
BACKFILL BEHIND EXTERIOR WALLS ON THE OUTSIDE OF THE BUILDING WITH COMPACTED GRANULAR FILL PLACED IN 10" LOOSE LIFTS COMPACTED TO 85% OF MAXIMUM DENSITY.
BACKFILL ON INSIDE OF BUILDING WITH COMPACTED GRANULAR FILL PLACED IN 10" LOOSE LIFTS COMPACTED TO 95% OF MAXIMUM DENSITY.
REFER TO REPORT BY RUBINO ENGINEERING DATED JUNE 30, 2017, FOR ADDITIONAL DETAILS AND GEOTECHNICAL REQUIREMENTS.

SHORING AND UNDERPINNING FOUNDATIONS

ALL SHORING OF EXISTING FOUNDATIONS REQUIRED BY THE CONTRACTOR DUE TO EXCAVATIONS NEAR EXISTING STRUCTURES AND UNDERPINNING OF EXISTING FOUNDATIONS AS INDICATED ON THE DESIGN DRAWINGS SHALL BE DESIGNED BY THE CONTRACTOR'S GEOTECHNICAL AND LICENSED STRUCTURAL ENGINEERS. ANY UNDERPINNING PROCEDURES INDICATED ON THE DESIGN DRAWINGS ARE CONCEPTUAL ONLY AND SHALL BE CONFIRMED BY THE CONTRACTOR'S GEOTECHNICAL AND STRUCTURAL ENGINEERS. SUBMIT SHORING AND UNDERPINNING PROCEDURES AND SEALED CALCULATIONS TO THE ARCHITECT FOR RECORD PURPOSES ONLY.

CONCRETE

GENERAL REQUIREMENTS
ALL WORK SHALL CONFORM TO ALL REQUIREMENTS OF ACI 301-02, SPECIFICATION FOR STRUCTURAL CONCRETE, EXCEPT AS MODIFIED BY THE REQUIREMENTS OF THE CONTRACT DOCUMENTS.

SUBMITTALS
CONCRETE MIXES WITH HISTORICAL TEST DATA.
MATERIAL CERTIFICATES: CEMENT, AGGREGATES, ADMIXTURES, REINFORCING STEEL
REINFORCING STEEL PLACEMENT DRAWINGS

PRODUCTS
REINFORCING BARS: ASTM A615 GRADE 60
REINFORCING BARS WELDABLE: ASTM A706 GRADE 60
PLAIN WIRE FABRIC: ASTM A185
PORTLAND CEMENT: ASTM C150 TYPE I OR II.
AGGREGATES: ASTM C33
WATER: POTABLE ASTM C94
ADMIXTURES
AIR ENTRAINING ASTM C260
CHEMICAL ADMIXTURES ASTM C 494
AIR CONTENT FOR CONCRETE EXPOSED TO WEATHER: 4 TO 7%.
SLUMP: 4"
CONCRETE STRENGTH: F'C 4,000 PSI AT 28 DAYS.
MIXING PER ASTM C94
CURING COMPOUNDS: ASTM C309 OR C1315

EXECUTION
CONCRETE COVER
CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH 3"
CONCRETE EXPOSED TO EARTH OR WEATHER 2"
CONCRETE NOT EXPOSED TO WEATHER 1-1/2"
ALL FOOTINGS, WALL FOOTINGS, GRADE BEAMS AND PILE/CASSON CAPS SHALL BE FORMED UNLESS NOTED.
LAP SPLICE LENGTHS PER ACI 318 CHAPTER 12 USING A CLASS B SPLICE. ALL WELDED WIRE FABRIC SHALL BE LAPPED ONE GRID MINIMUM
ALL SLAB-ON-GRADE CONSTRUCTION JOINTS SHALL BE KEYED; REINFORCING SHALL NOT PASS THROUGH. 24 HOURS MINIMUM BETWEEN ADJACENT POURS.
LOCATE JOINTS AS SHOWN ON PLANS; WHERE NOT SHOWN, CONTROL OR CONSTRUCTION JOINTS SHALL BE PLACED IN ACCORDANCE WITH ACI RECOMMENDATIONS I.E., A MAXIMUM PANEL SIZE (IN FEET) EQUAL TO APPROXIMATELY THREE TIMES THE THICKNESS OF THE SLAB (IN INCHES) IN BOTH DIRECTIONS.
HOOK ENDS OF BARS INTERRUPTED BY OPENINGS. HOOK TOP BARS AT ALL EDGES, AT ALL WALL AND SLAB OPENINGS, PROVIDE 2 #5 BARS X OPENING WIDTH PLUS 4 FEET (2 FEET EACH SIDE) EACH FACE, UNLESS SHOWN OTHERWISE.
PLACEMENT OF CONCRETE IN COLD WEATHER SHALL COMPLY WITH ACI306
PLACEMENT OF CONCRETE IN HOT WEATHER SHALL COMPLY WITH ACI305
TOLERANCES SHALL MEET ACI 117, ACI 301 AND ACI 318 AS A MINIMUM.

PRE-ENGINEERED BUILDING & COMPONENTS

THE PRE-ENGINEERED BUILDING SHALL BE DESIGNED FOR ALL REQUIRED LOADS DETERMINED BY ALL GOVERNING LOCAL, STATE AND NATIONAL CODES. IN NO INSTANCE SHALL THE DESIGN LOADS BE LESS THAN THOSE LISTED ABOVE UNDER STRUCTURAL LOADS. IN ADDITION TO THE LOADS LISTED ABOVE, THE FOLLOWING LOADS MUST BE INCLUDED:

ROOF COLLATERAL LOAD 10 PSF
SPRINKLER LOADS SEE MECHANICAL DRAWINGS
ROOF TOP UNITS SEE MECHANICAL DRAWINGS
HANGING LOADS SEE ARCHITECTURAL AND MECHANICAL DRAWINGS

LIMIT ROOF LIVE LOAD DEFLECTION TO L/240
LIMIT ROOF TOTAL DEFLECTION TO L/180
LIMIT LATERAL DEFLECTION OF WALLS FOR A 10 YEAR WIND TO L/240 TYPICAL AND L/600 AT BRICK VENEER LOCATIONS.
LIMIT STORY DRIFT OF FRAME FOR A 10 YEAR WIND TO H/240

BUILDING DESIGNER SHALL FOLLOW ACI 318 APPENDIX D SECTION D.8 FOR SPACING OF ANCHOR RODS ASSUMING SUPPLEMENTAL REINFORCEMENT IS NOT PROVIDED TO CONTROL SPLITTING. IN NO CASE SHALL ANCHOR RODS BE SPACED CLOSER THAN 6d (d = DIAMETER OF ANCHOR ROD).
MINIMUM EDGE DISTANCE FROM CONCRETE TO CENTER OF ANCHOR BOLTS SHALL BE 6d.
FOOTINGS AS SHOWN ARE FOR BIDDING PURPOSES ONLY, AND ARE BASED UPON ONE SPECIFIC BUILDING TYPE. ACTUAL FOOTINGS MAY DIFFER BASED UPON THE ACTUAL BUILDING MANUFACTURER SELECTED. THE CONTRACTOR SHALL SUBMIT FOUNDATION LOADS TO THE ARCHITECT/ENGINEER FOR VERIFICATION PRIOR TO EXCAVATION FOR AND PLACEMENT OF FOUNDATIONS. CONTRACTOR SHALL COORDINATE ANCHOR BOLT SIZES, SPACING, ETC. WITH REQUIREMENTS OF THE PRE-ENGINEERED BUILDING.
PRIOR TO FABRICATION, THE PRE-ENGINEERED BUILDING MANUFACTURER SHALL SUBMIT CALCULATIONS AND DRAWINGS PREPARED UNDER THE DIRECT SUPERVISION OF, AND SEALED BY AN ILLINOIS LICENSED STRUCTURAL ENGINEER FOR REVIEW.
SUBMITTALS
COLUMN LOADS (NON-FACTORED ALLOWABLE STRENGTH DESIGN) BROKEN DOWN INTO EACH LOAD CASE. THE ORIENTATION OF ALL LOADS MUST BE CLEARLY DEFINED ALONG WITH THE DESCRIPTION OF THE LOAD, i.e., DEAD, LIVE, SNOW, COLLATERAL, WIND, ETC.
ANCHOR ROD LAYOUT PLAN AND DETAILS.

SLEEVES, ANCHORAGES, OPENINGS, ETC.

IN GENERAL, STRUCTURAL DRAWINGS DO NOT SHOW EQUIPMENT PADS, DRAINS, HOLES, ANCHORAGES, INSERTS AND SLEEVES FOR ITEMS PASSING THROUGH OR ATTACHED TO CONCRETE OR FRAMING. REFER TO ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS AND PROJECT SPECIFICATIONS.
ADJUST EQUIPMENT PADS AND SUBFRAMING TO FIT EQUIPMENT FURNISHED.
PROVIDE SUBFRAMING FOR EQUIPMENT SUPPORTED ON OR SUSPENDED FROM THE STRUCTURE.

STRUCTURAL STABILITY AND CONSTRUCTION

INDIVIDUAL STRUCTURAL COMPONENTS ARE DESIGNED TO SUPPORT LOADS IN THEIR FINAL ERECTED POSITION AS PART OF THE TOTAL COMPLETED STRUCTURE.
PROVIDE TEMPORARY GUYING AND BRACING AS REQUIRED UNTIL ALL CONSTRUCTION AFFECTING LATERAL STABILITY IS COMPLETED.
CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR STABILITY OF STRUCTURE, ITS PARTS AND JOB SITE SAFETY BY USE OF GUYING, BRACING, SHORING, BARRICADES, SAFETY RAILINGS AND DEVICES DURING THE ENTIRE PERIOD OF CONSTRUCTION.

SHOP DRAWINGS AND TEST REPORTS

GENERAL CONTRACTOR SHALL CHECK ALL SHOP DRAWINGS BEFORE SUBMITTAL TO ARCHITECT/ENGINEER FOR REVIEW.
REVIEW BY ARCHITECT/ENGINEER WILL BE FOR CONFORMANCE TO GENERAL LAYOUT AND DESIGN INTENT ONLY. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ACCURACY OF DIMENSIONS, FABRICATION, FIT UP OF PARTS AND BILLS OF MATERIALS. CONTRACTOR SHALL COORDINATE WORK OF VARIOUS TRADES AND MAKE NECESSARY FIELD MEASUREMENTS.

THE CONTRACT SPECIFICATIONS PROVIDE A COMPLETE LISTING OF SUBMITTALS. THE FOLLOWING IS A SUMMARY OF THE REQUIRED SUBMITTALS:

CONCRETE
PRODUCT DATA SHEETS
PROPOSED CONCRETE MIX DESIGNS WITH ASSOCIATED HISTORICAL TEST DATA.
MATERIAL CERTIFICATIONS
REINFORCING STEEL PLACEMENT DRAWINGS PER ACI 315
FIELD QUALITY CONTROL TESTS: SLUMP, AIR CONTENT, COMPRESSIVE STRENGTH ETC.
PRE-ENGINEERED WOOD BUILDING
PRODUCT DATA SHEETS
MATERIAL CERTIFICATIONS
SHOP DRAWINGS
DESIGN CALCULATIONS SIGNED AND SEALED BY STRUCTURAL ENGINEER.
GALLERY WORK (HANDRAIL/GUARD RAIL/LADDERS ETC)
PRODUCT DATA SHEETS
MATERIAL CERTIFICATIONS
STRUCTURAL STEEL SHOP DRAWINGS
DESIGN CALCULATIONS SIGNED AND SEALED BY PROFESSIONAL ENGINEER.
UNDERPINNING SHORING PROCEDURES AND SEALED CALCULATIONS

DESIGN DELEGATION
CERTAIN COMPONENTS OF THE COMPLETED CONSTRUCTION ARE BEING DESIGN DELEGATED TO THE MANUFACTURER OF THE COMPONENT. THE FOLLOWING ARE DESIGNATED TO BE DESIGN DELEGATED ON THIS PROJECT
TEMPORARY SHORING AND BRACING
TEMPORARY EARTH RETENTION SYSTEMS
PRE-ENGINEERED WOOD BUILDING
GUARDRAIL, HANDRAIL, LADDERS, ETC.
OTHER WORK AS LISTED ON DRAWINGS, SPECIFICATIONS AND CUSTOMARY INDUSTRY STANDARDS.
WHERE DELEGATION OF DESIGN IS SPECIFIED, THE MANUFACTURER SHALL BE RESPONSIBLE FOR RETAINING THE SERVICES OF A LICENSED STRUCTURAL ENGINEER IN THE STATE HAVING JURISDICTION IS LOCATED. THE LICENSED STRUCTURAL ENGINEER SHALL DESIGN AND DETAIL COMPONENTS TO MEET GOVERNING BUILDING CODES, STANDARDS AND THE SPECIFIED PERFORMANCE CRITERIA. SIGNED AND SEALED CALCULATIONS SHALL BE SUBMITTED FOR RECORD. THE DESIGN DELEGATED STRUCTURAL ENGINEER SHALL BE SOLELY RESPONSIBLE FOR THE DESIGN OF THE COMPONENT.

STRUCTURAL TESTS AND INSPECTIONS (IBC 2006)

ALL TESTS AND INSPECTIONS SHALL BE PERFORMED BY AN INDEPENDENT TESTING AND INSPECTION AGENCY IN ACCORDANCE WITH CHAPTER 17 OF IBC 2006. THE SPECIAL INSPECTOR SHALL OBSERVE THE WORK ASSIGNED FOR CONFORMANCE TO THE APPROVED DESIGN DRAWINGS AND SPECIFICATIONS.

THE SPECIAL INSPECTOR SHALL FURNISH INSPECTION REPORTS TO THE BUILDING OFFICIAL AND THE ENGINEER OF RECORD OR ARCHITECT OF RECORD. ALL DISCREPANCIES SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE CONTRACTOR FOR CORRECTION. IF UNCORRECTED, THE SPECIAL INSPECTOR SHALL NOTIFY THE BUILDING OFFICIAL AND THE ENGINEER OR ARCHITECT OF RECORD.

THE SPECIAL INSPECTOR SHALL SUBMIT A FINAL REPORT STATING WHETHER THE WORK REQUIRING SPECIAL INSPECTION WAS IN CONFORMANCE WITH THE APPROVED PLANS AND SPECIFICATIONS AND THE APPLICABLE WORKMANSHIP PROVISIONS OF THIS CODE.

JOB SITE VISITS BY THE STRUCTURAL ENGINEER OF RECORD DOES NOT CONSTITUTE AN OFFICIAL SPECIAL INSPECTION.

THE FOLLOWING LIST OF MATERIALS AND WORK REQUIRE SPECIAL INSPECTIONS

		VERIFICATION AND INSPECTION	YES	
			CONTINUOUS	PERIODIC
1		**CONCRETE CONSTRUCTION (IBC 1705.4)**		
	A	Inspection of reinforcing steel		X
	B	Inspection of bolts installed in concrete	X	
	C	Verify use of required mix design		X
	D	Sampling fresh concrete and performing slump, air content and determining the temperature of fresh concrete at time of making specimens for strength tests.	X	
	E	Inspection of concrete placement	X	
	F	Inspection for maintenance of specified curing techniques		X
2		**WOOD CONSTRUCTION (IBC - 1704.6)**		
	A	VERIFY, SIZE, SPECIES AND GRADE OF LUMBER/SHEATHING COMPLIES WITH CONSTRUCTION DOCUMENTS		X
	B	VERIFY NAILING OF DIAPHRAM ROOF DECK AND SHEAR WALLS COMPLIES WITH CONSTRUCTION DOCMENTS		X
	C	VERIFY WOOD SHEAR WALL HOLD DOWNS CONFORM TO CONSTRUCTION DOCUMENTS	X	
3		**SOILS (IBC - 1705.70**		
	A	Verify site has been prepared in accordance with approved soils report.		X
	B	Fill placement - verify material, maximum lift thickness and compaction of fill are in accordance with the soils report.		X
	C	Verify in place dry density of fill complies with soils report.		X
	D	Confirm allowable soil bearing pressure complies with soils report.	X	

Combined Area Fire Training Facility Re-Bid
851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

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110 North Brockway, Suite 220
Palatine, Illinois 60067
woldac.com | 847 241 6100

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **ENGINEER** under the laws of the State of **Illinois**

License Number: **081-005394** Date **Issue Date**

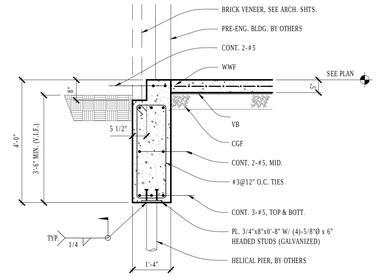
Revisions		
Description	Date	Num
Issued for Bid	12-7-17	1

Comm: **173013**
Date: **December 7, 2017**
Drawn: **PW**
Check: **KA**
North

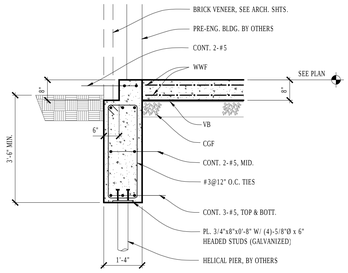
STRUCTURAL GENERAL NOTES

Scale: **As Indicated**

S0.10



9 S1.10 SECTION
SCALE: 1/2" = 1'-0"



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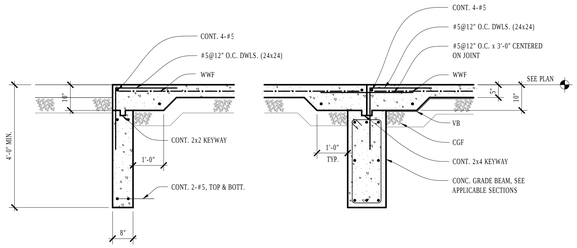
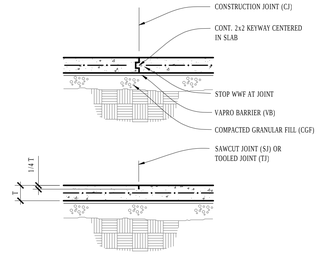
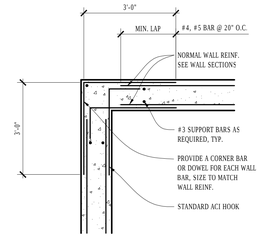


5 S1.10 STOOP SECTION
SCALE: NONE

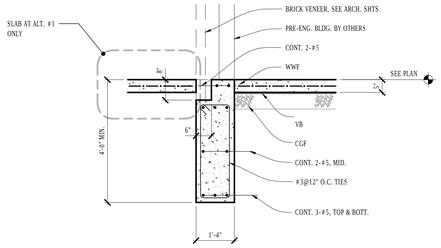


SEE PLAN FOR JOINT TYPES & LOCATIONS
400 SQ. FT. SLAB AREA WITHIN JOINTS MAX., U.N.

3 S1.10 TYP. SLAB JOINTS
SCALE: NONE



1 S1.10 TYP. BEAM CORNER
SCALE: NONE



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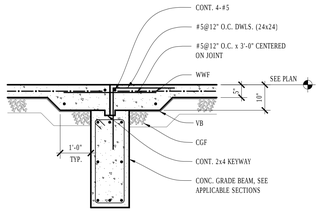

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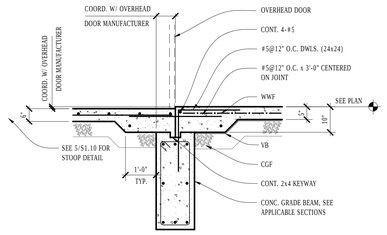

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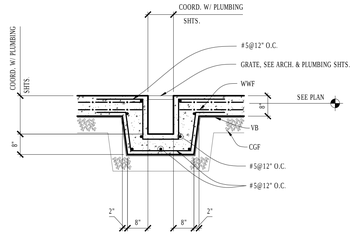
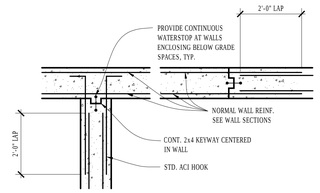
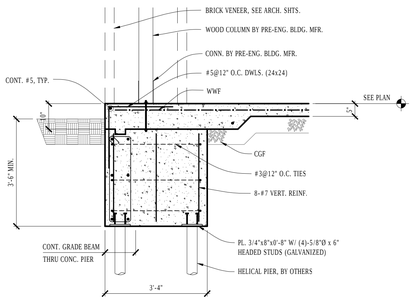


4 S1.10 TRENCH DRAIN
SCALE: NONE

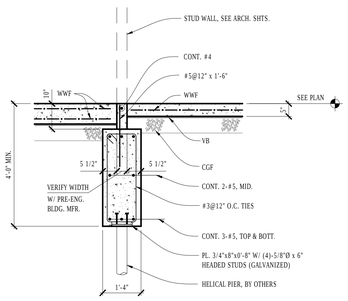


PROVIDE CONCRETE WALL JOINTS @ 40'-0" O.C., MAX.

2 S1.10 TYP. BEAM JOINTS
SCALE: NONE



14 S1.10 SECTION
SCALE: 1/2" = 1'-0"



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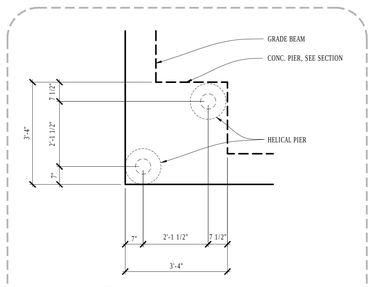
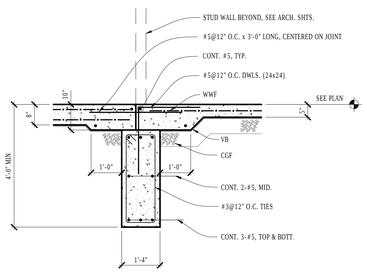


15 S1.10 DETAIL
SCALE: 1/2" = 1'-0"

ALTERNATE #1



12 S1.10 SECTION
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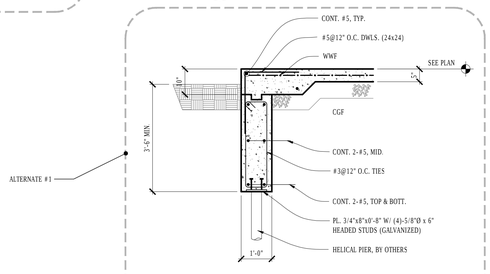
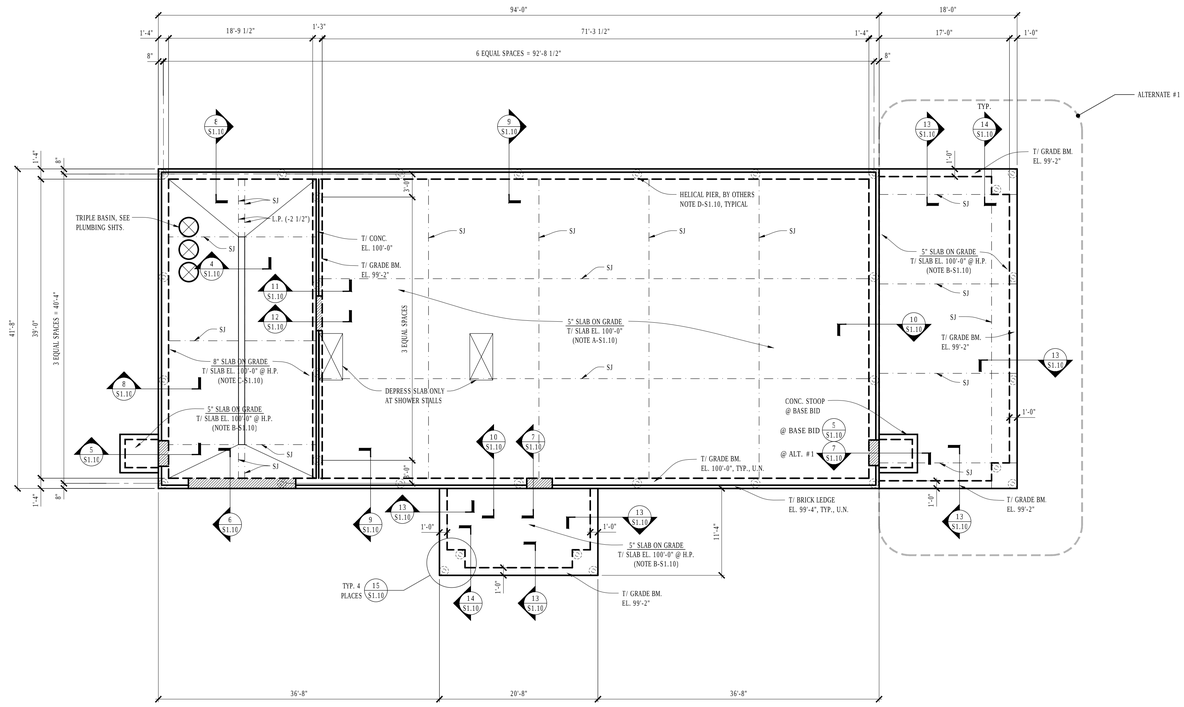


ALTERNATE #1

13 S1.10 SECTION
SCALE: 1/2" = 1'-0"



DRAWING S1.10 GENERAL NOTES:

: INDICATES TOP OF FOUNDATION WALL TO BE DEPRESSED, SEE APPLICABLE SECTION

DRAWING S1.10 KEYNOTES:

A-S1.10: PROVIDE 5" SLAB ON GRADE REINFORCED WITH 6x6-W2.1xW2.1 WELDED WIRE FABRIC. PLACE SLAB ON VAPOR BARRIER OVER 6" OF COMPACTED GRANULAR FILL. SLOPE SLAB TO FLOOR DRAINS. SEE ARCHITECTURAL AND PLUMBING SHEETS FOR DRAIN LOCATIONS AND SLOPE.

B-S1.10: PROVIDE 5" SLAB ON GRADE REINFORCED WITH 6x6-W2.1xW2.1 WELDED WIRE FABRIC. PLACE SLAB OVER 6" OF COMPACTED GRANULAR FILL. SLOPE SLAB TO DRAIN AWAY FROM BUILDING. SEE ARCHITECTURAL SHEETS FOR DRAINAGE SLOPE.

C-S1.10: PROVIDE 8" SLAB ON GRADE REINFORCED WITH 2 LAYERS OF 6x6-W2.9xW2.9 WELDED WIRE FABRIC. PLACE SLAB ON VAPOR BARRIER OVER 6" COMPACTED GRANULAR FILL. SLOPE SLAB TO FLOOR DRAINS. SEE ARCHITECTURAL AND PLUMBING SHEETS FOR DRAIN LOCATIONS AND SLOPE.

D-S1.10: HELICAL PIER BY FOUNDATION CONTRACTOR. EACH PILE SHALL HAVE AN ALLOWABLE VERTICAL DESIGN CAPACITY OF 40 k WITH A MINIMUM FACTOR OF SAFETY OF 2. PILES SHALL BE PLACE AT CENTERLINE OF FOUNDATION WALL, U.N.O.. ADDITIONAL PIERS SHALL BE ADDED AS REQUIRED TO ACHIEVE LOADS INDICATED.

N

FOUNDATION PLAN
SCALE: 1/8" = 1'-0"

Combined Area Fire Training Facility Re-Bid
851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

WOLD | RUCK PATE
110 North Brockway, Suite 220
Palatine, Illinois 60067
woldac.com | 847 241 6100

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **ENGINEER** under the laws of the State of **Illinois**

Engineers Name
License Number: **081-005394** Date **Issue Date**

Revisions

Description	Date	Num
Issued for Bid	12-7-17	1

Comm: **173013**
Date: **December 7, 2017**
Drawn: **PW**
Check: **KA**
North

FOUNDATION PLAN AND DETAILS

Scale: **As Indicated**

S1.10

IL

A

MN

SPRINKLER SYSTEM HANGER NOTES

1. SPRINKLER SYSTEMS SHALL BE INSTALLED WITH HANGARS AND BRACING ACCORDING TO NFPA 13 REQUIREMENTS FOR THE SEISMIC ZONE OF THE PROJECT'S LOCATION. FORM THE EDITION YEAR REFERENCED IN THE CODE THAT IS RECOGNIZED BY THE AUTHORITY HAVING JURISDICTION.
2. THE UNSUPPORTED LENGTH BETWEEN THE END SPRINKLER AND THE LAST HANGAR SHALL NOT EXCEED 36" FOR 1" DIAMETER (DIA.) PIPES, 48" FOR 1-1/4" DIA. PIPES AND 60" FOR 1-1/2" DIA. PIPES.
3. MAXIMUM DISTANCES BETWEEN HANGARS SHALL NOT EXCEED 12'-0" FOR 1" AND 1-1/4" DIA. PIPES AND 15'-0" FOR 1-1/2" THROUGH 8" DIA. PIPES.
4. SPRINKLER PIPES 1" TO 4" DIA. SHALL BE SUPPORTED BY 3/8" ALL THREAD RODS AND 3/8" HANGER ASSEMBLIES.
5. SPRINKLER PIPES 5" THOUGH 8" DIA. SHALL BE SUPPORTED BY 1/2" ALL THREAD RODS AND 1/2" HANGER ASSEMBLIES.
6. THERE SHALL NOT BE LESS THAN 1 HANGER PER PIPE SECTION.
7. WHEN THE MAXIMUM PRESSURE AT THE SPRINKLER EXCEEDS 100 PSI AND A BRANCH LINE ABOVE THE CEILING SUPPLIES SPRINKLERS IN A PENDENT POSITION BELOW THE CEILING, THE HANGER ASSEMBLY SUPPORTING THE PIPE SUPPLYING AN END SPRINKLER IN A PENDENT POSITION SHALL BE OF A TYPE THAT PREVENTS UPWARD MOVEMENT OF THE PIPE.
8. ALL ARM OVERS GREATER THAN 24" TO SPRINKLER DROP NIPPLES SHALL BE SUPPORTED BY A HANGER. WHEN THE MAXIMUM PRESSURE AT THE SPRINKLER EXCEEDS 100 PSI, THE HANGER ASSEMBLY SUPPORTING THE ARM OVER TO THE SPRINKLER IN A PENDENT POSITION SHALL BE OF A TYPE THAT PREVENTS UPWARD MOVEMENT OF THE PIPE.

FIRE PROTECTION HYDRAULIC DESIGN CRITERIA SCHEDULE.

NOTES:
1.CONSTRUCTION IS CONSIDERED TO BE NON-COMBUSTIBLE, UNOBSTRUCTED

ROOM FUNCTION	OCCUPANCY HAZARD CLASSIFICATION	FLOW DENSITY (GPM/SQ.FT.)	MINIMUM AREA OF APPLICATION	MAXIMUM COVERAGE PER SPRINKLER	SPRINKLER TYPE	SPRINKLER TEMPERATURE RATING
MECHANICAL ROOMS	ORDINARY HAZARD GRP-1	0.15	1500 SF	130 SF	UPRIGHT OR PENDANT	WET SYSTEM: 212°F
ELECTRICAL EQUIPMENT ROOMS	ORDINARY HAZARD GRP-1	0.15	1500 SF	130 SF	UPRIGHT OR PENDANT	WET SYSTEM: 212°F
ELECTRICAL AND TELEPHONE CLOSETS	ORDINARY HAZARD GRP-1	0.15	1500 SF	130 SF	CONCEALED	WET SYSTEM: 212°F
STORAGE ROOMS, JANITORS CLOSETS	ORDINARY HAZARD GRP-2	0.20	1500 SF	130 SF	UPRIGHT, PENDANT, OR CONCEALED	WET SYSTEM: 212°F
CORRIDORS, OFFICES, ELEVATOR LOBBIES, TOILETS CLOSETS, CONFERENCE, LOUNGES, SHOWERS, LOCKERS, DRESSING, AND WAITING.	LIGHT HAZZARD	0.10	1500 SF	225 SF	QUICK RESPONSE, CONCEALED	WET SYSTEM: 165°F
UNFINISHED SHELL, WORK AREAS	LIGHT HAZZARD	0.10	1500 SF	225 SF	UPRIGHT OR PENDANT	WET SYSTEM: 165°F
STAIRWAYS	LIGHT HAZZARD	0.10	1500 SF	225 SF	QUICK RESPONSE UPRIGHT OR PENDANT	WET SYSTEM: 165°F
EXAM, PROCEDURE, PATIENT CARE	LIGHT HAZZARD	0.10	1500 SF	225 SF	QUICK RESPONSE, CONCEALED	WET SYSTEM: 165°F

FIRE PROTECTION BACKFLOW PREVENTOR SCHEDULE

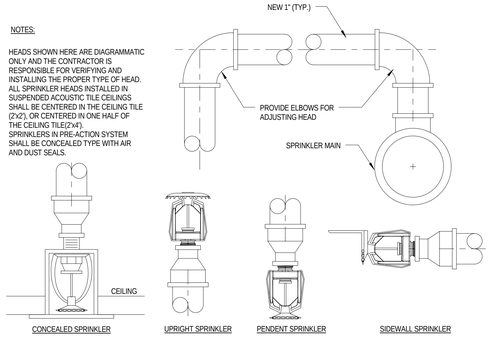
TAG	QTY	SIZE	MANUFACTURER	MODEL	DISCRIPTION	RATED CONDITIONS	
						FLOW	PRESSURE
FPBFP-1	1	4"	AMES	LFM300 OSY	DCDA DOUBLE CHECK DETECTOR ASSEMBLY WITH OUTSIDE STEM AND YOKE RESILIENT SEATED GATE VALVE	500 GPM	3.80 psi

DRY VALVE SCHEDULE

MARK	MANUFACTURER	MODEL	DRY CONNECTION	WET CONNECTION	DESCRIPTION
DV 1	VICTAULIC	768N	4"	4"	FIRELOCK ALARM CHECK VALVE. PROVIDE WITH VICTAULIC SERIES 7C7 AIR MAINTENANCE / COMPRESSOR ASSEMBLY TO BE MOUNTED ON RISER. 1/2 HP 115V-1Ø, 6.6 AMPS.

NOTES:

1. HEADS SHOWN HERE ARE DIAGRAMMATIC ONLY AND THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING AND INSTALLING THE PROPER TYPE OF HEAD.
2. ALL SPRINKLER HEADS INSTALLED IN SUSPENDED ACOUSTIC TILE CEILINGS SHALL BE CENTERED IN THE CEILING TILE (2'x2'), OR CENTERED IN ONE HALF OF THE CEILING TILE(2'x4').
3. SPRINKLERS IN PRE-ACTION SYSTEM SHALL BE CONCEALED TYPE WITH AIR AND DUST SEALS.



5 SPRINKLER HEAD TYPES
NOT TO SCALE

GENERAL FIRE PROTECTION NOTES

1. ALL WORK SHALL COMPLY WITH NFPA 13, LOCAL BUILDING CODES, AND ALL BUILDING STANDARDS.
2. NEW DRY-SPRINKLER SYSTEM PIPING SHALL BE GALVANIZED STEEL PIPE NO LESS THAN SCHEDULE 40.
3. SYSTEM SHALL BE TESTED AND FLUSHED IN ACCORDANCE WITH NFPA, THE FIRE INSURANCE CARRIER, AND THE LOCAL BUILDING DEPARTMENT.
4. FIRE PROTECTION CONTRACTOR SHALL OBTAIN THE RESULTS FOR A FLOW TEST PERFORMED WITHIN THE LAST 6 MONTHS OR SHALL PERFORM A NEW FLOW TEST.
5. EXTEND 1" STEEL PIPE FROM EXISTING MAINS TO NEW SPRINKLERS.
6. ALL NEW SYSTEMS SHALL BE TESTED HYDROSTATICALLY AT NOT LESS THAN 300 POUNDS PER SQUARE INCH FOR TWO HOURS OR AT 50 POUNDS PER SQUARE INCH IN EXCESS OF THE MAXIMUM STATIC PRESSURE WHEN THE MAXIMUM STATIC PRESSURE IS IN EXCESS OF 150 POUNDS. TESTS SHALL BE WITNESSES BY OWNER'S REPRESENTATIVE AND THE AUTHORITY HAVING JURISDICTION.
7. PROVIDE SYSTEM LOW POINT DRAINS AND AUXILIARY DRAINS AS NECESSARY.
8. THE OWNER SHALL PROVIDE A MINIMUM 40°F AMBIENT TEMPERATURE THROUGHOUT ALL AREAS OF THE BUILDING WHERE WET PIPE SPRINKLER SYSTEMS ARE PROVIDED. WET SPRINKLER PIPING SHALL NOT BE ROUTED THRU AREAS SUBJECT TO FREEZING.
9. DELIVER MATERIAL TO THE JOB SITE, UNLOAD AND STORE IT IN A LOCATION AS DETERMINED BY THE OWNER'S REPRESENTATIVE AS TO PREVENT DAMAGE TO MATERIAL.
10. THE SPRINKLER CONTRACTOR SHALL PROVIDE SPRINKLER PROTECTION UNDER ALL OBSTRUCTIONS, INCLUDING DUCTWORK, IN EXCESS OF 4'-0" WIDE IN EXPOSED STRUCTURE AREAS IN ACCORDANCE WITH NFPA #13 REQUIREMENTS.
11. SPRINKLER GUARDS SHALL BE PROVIDES FOR ALL SPRINKLERS 7'-0" OR LESS ABOVE FINISHED FLOOR AND IN AREAS SUBJECT TO MECHANICAL DAMAGE.
12. FIRE PROTECTION CONTRACTOR SHALL VERIFY SPRINKLER DESIGN CRITERIA WITH THE FIRE DEPARTMENT AND INSURANCE CARRIER PRIOR TO INSTALLATION OF SYSTEM(S).FIRE PROTECTION CONTRACTOR SHALL PREPARE HYDRAULIC CALCULATIONS AND SHOP DRAWINGS ("WORKING DRAWINGS") IN ACCORDANCE WITH NFPA 13 AND SUBMIT (4) FOUR COMPLETE SETS TO THE FIRE PREVENTION BUREAU, TO THE FIRE INSURANCE CARRIER FOR REVIEW AND/OR PRIOR TO FABRICATION OR INSTALLATION OF SYSTEM. THE SHOP DRAWINGS SHALL INCLUDE THE FOLLOWING INFORMATION AS APPLICABLE TO THE WORK SPACE: (A) FLOW TEST RESULTS AT SUPPLY CONNECTION. (B) FLOW AND PRESSURE REQUIRED AND AVAILABLE AT BASE OF RISERS. (C) TYPE OF PIPE, FITTINGS, TYPE OF JOINTS, DIMENSIONS AND LENGTHS OF PIPE. (D) AREA OF COVERAGE FOR EACH SPRINKLER. (E) NUMBER, TYPE, AND TEMPERATURE RATING FOR ALL SPRINKLER HEADS. (F) BUILDING OCCUPANCY INCLUDING BUILDING USE AND/OR COMMODITY STORED. (G) SECTION AND PLAN VIEWS OF RACK STORAGE, IF ANY. (H) STORAGE HEIGHTS OR RACK STORAGE. (I) DESCRIPTION OF SPECIAL SYSTEMS, INCLUDING VALVES AND TRIM. (J) LOCATION OF GAUGES, MAIN DRAINS, AUXILIARY DRAINS, AND TEST VALVES. (K) ARRANGEMENT OF FIRE DEPARTMENT CONNECTION INCLUDING DRAINAGE, THREADS, AND MOUNTING HEIGHT. (L) STATEMENT INDICATING THAT TESTS AND SLUSHING WILL BE COMPLETED. (M) HOSE RACK LAYOUT. (N) DETAIL AND LOCATION OF PIPE HANGARS. (O) INDICATE WHICH VALVES WILL HAVE TAMPER SWITCHES. (P) FLOW SWITCHES. (Q) PORTABLE FIRE EXTINGUISHER LAYOUT.
13. SUBMIT (4) FOUR SETS OF COMPLETE SHOP DRAWINGS TO THE OWNER (INCLUDING CATALOG CUTS AND HYDRAULIC CALCULATIONS) FOR REVIEW PRIOR TO FABRICATION AND/OR INSTALLATION OF THE WORK.
14. CONTRACTOR SHALL VISIT THE CONSTRUCTION SITE AND FAMILIARIZE HIMSELF WITH THE LOCAL CONDITIONS OF THE PROJECT AREA AND IDENTIFY CONDITIONS HE BELIEVES MAY IMPEDE THE EFFICIENT PERFORMANCE OF HIS CONTRACT REQUIREMENTS. SUBMISSION OF BID SHALL REPRESENT EVIDENCE THAT SUCH AN INSPECTION HAS BEEN MADE AND THAT CONDITIONS UNDER WHICH THE WORK IS TO BE INSTALLED, ARE SATISFACTORY TO THE CONTRACTOR. ADDITIONAL COMPENSATION FOR PREVIOUSLY EXISTING FIELD CONDITIONS, ARISING AFTER START OF WORK, THAT WERE NOT IDENTIFIED IN THE BID SUBMISSION, WILL BE DENIED.
15. THE MUNICIPAL WATER MAIN SHALL BE PROTECTED FROM BACKFLOW AND BACK SIPHONAGE CONDITIONS BY AN APPROVED BACKFLOW ASSEMBLY IN THE SERVICE ENTRANCE OR FIRE PUMP SUCTION PIPE, MEETING ALL THE REQUIREMENTS OF THE LOCAL WATER DEPARTMENT.
16. DESIGN WET SPRINKLER SYSTEMS HYDRAULICALLY FOR LIGHT AND ORDINARY HAZARD OCCUPANCIES, IN ACCORDANCE WITH BOTH THE REQUIRED AND ADVISORY PROVISIONS OF NFPA 13, AS MODIFIED BY THE LOCAL CODE AMENDMENTS, FROM THE EDITION YEAR REFERENCES IN THE BUILDING CODE THAT IS RECOGNIZED BY THE AUTHORITY HAVING JURISDICTION (AHJ).
17. THE DRAWINGS ARE DIAGRAMMATIC AND PROVIDED TO SUGGEST THE DESIRED ZONE DIVISIONS AND SYSTEM SEPARATIONS, THE ARRANGEMENT AND LOCATION OF MAINS, VALVES, EQUIPMENT, ALARMS, PANELS, DEVICES AND SYSTEM ATTACHMENTS, AND MAY NOT INDICATE ALL REQUIRED COMPONENTS NECESSARY FOR FINAL APPROVAL. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE EACH SYSTEM INSTALLATION TO INCLUDE ALL REQUIRED MATERIALS, ACCESSORIES AND EQUIPMENT INSIDE AND OUTSIDE OF THE BUILDING, NECESSARY TO PROVIDE EACH SYSTEM COMPLETE, TESTED AND IN WORKING ORDER, APPROVED BY THE AHJ AND READY FOR USE.
18. EACH FLOOR SHALL BE A SEPARATE SPRINKLER ZONE, ISOLATED FROM OTHER SYSTEMS BY A SUPERVISED CONTROL VALVE, ALARMED BY A WATER FLOW SWITCH AND ATTENDED BY AN INSPECTOR'S TEST AND DRAIN ASSEMBLY THAT IS PIPED TO A DRAIN RISER OR DISCHARGED OUTDOORS AT A LOCATION ACCEPTABLE TO THE AHJ.
19. WATER DISCHARGE FROM INDIVIDUAL SPRINKLERS IN THE HYDRAULICALLY MOST REMOTE AREAS SHALL BE BETWEEN 100% MINIMUM AND 125% MAXIMUM, OF THE CODE REQUIRED MINIMUM APPLICATION DENSITIES OR AS THE DRAWINGS SPECIFY, WHICHEVER IS GREATER, WITH A MAXIMUM PIPING VELOCITY THAT SHALL NOT EXCEED 20 FEET PER SECOND IN ANY PIPE SECTION. CALCULATIONS SHALL INCLUDE 250 GPM HOSE STREAM ALLOWANCE FIGURED AT THE BASE OF THE SPRINKLER RISER OR INCOMING WATER SERVICE ENTRANCE POINT.
20. DESIGN AND PROVIDE EACH SYSTEM GIVING FULL CONSIDERATION TO SPRINKLER SPRAY PATTERN OBSTRUCTIONS OF STRUCTURAL SUPPORT AND FRAMING, MEZZANINES, CONCEALED BLIND SPACES, AND ENCLOSED COMBUSTIBLE ROOF CONSTRUCTION.
21. DESIGN AND PROVIDE EACH SYSTEM GIVING FULL CONSIDERATION TO AVOIDING CONFLICTS WITH THE INSTALLATION WORK OF ALL OTHER TRADES, INCLUDING DUCTS, ELECTRICAL CONDUIT RUNS, ELECTRICAL AND HVAC EQUIPMENT AND PIPING. ARRANGE COMPONENTS AND EQUIPMENT AND ESTABLISH POSITIONS OF CONTROL VALVES, FLOW ALARMS, AND TESTDRAIN ASSEMBLIES TO MINIMIZE ACCESS PANELS AND PROVIDE ADEQUATE ACCESS SPACE FOR EQUIPMENT OPERATION, INSPECTION, TESTING, AND NORMAL MAINTENANCE. SPRINKLER PIPING MUST BE ROUTED TO ALLOW CLEAR ACCESS TO EQUIPMENT ABOVE.
22. FIRE STOP ALL PENETRATIONS OF FIRE RATED WALLS, PARTITIONS, AND FLOORS. PROVIDE A 2 PART MINIMUM, TESTED AND U.L. LISTED DETAIL, EQUAL TO THE RATING OF THE WALL OR FLOOR BEING PENETRATED.
23. PREPARE HYDRAULIC CALCULATIONS WITH A MINIMUM SAFETY FACTOR OF 10% OF THE STATIC PRESSURE (5 PSI MINIMUM), WITH DETAILED WORKING DRAWINGS, ACCORDING TO THE REQUIREMENTS OF NFPA 13 AND THE AHJ. COORDINATE INSTALLATION WITH ALL OTHER TRADES, ON SCALED PLANS SHOWING THE SERVICE ENTRANCE AND BACKFLOW PREVENTION ASSEMBLY, SPRINKLER POSITIONS, PIPING LAYOUTS, HANGAR LOCATIONS AND ATTACHMENT DETAILS, ELEVATIONS, AND SECTIONS OF THE SYSTEM'S PIPING LAYOUT, INDICATING ALL DATA ESSENTIAL FOR PROPER INSTALLATION. SHOW SCHEMATIC PIPING ARRANGEMENTS OF SPECIALTY VALVES, PIPE, FITTINGS, ALARM DEVICES, AND SWITCHES, INCLUDING ELECTRICAL AND WIRING DIAGRAMS.
24. SUBMIT PLANS AND HYDRAULIC CALCULATIONS FOR APPROVAL OF AHJ AND ENGINEER OF RECORD, ALONG WITH PRODUCT DATA SHEETS FOR ALL PIPE, FITTINGS, VALVES, EQUIPMENT AND SYSTEM ATTACHMENTS, PROPOSED FOR USE IN THE SYSTEM. EACH ITEM SHALL BARE A U.L. LISTING APPROPRIATE FOR THEIR INTENDED APPLICATION. INSTALLATION OF ANY WORK WITHOUT WRITTEN APPROVALS IS AT THE CONTRACTOR'S SOLE RISK AND ADDITIONAL COMPENSATION FOR ALL NECESSARY CHANGES SHALL BE DENIED.
25. PROVIDE PROTECTION TO FINISHED AREAS DURING THE INSTALLATION AND/OR DEMOLITION REQUIRED BY THIS PROJECT.

FIRE PROTECTION SYMBOLS

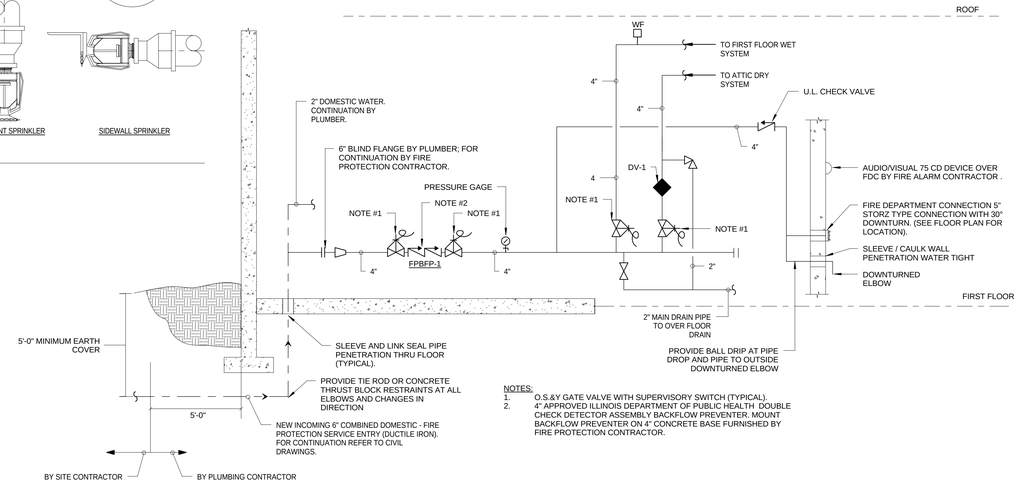
(NOTE: NOT ALL SYSMBOLS MAY BE REQUIRED OF THIS PROJECT.)

- ANGLE VALVE
- BALL VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- DV-XX — DRY VALVE ASSEMBLY VALVE TAG
- FIRE DEPARTMENT HOSE CONNECTION
- FLEX CONNECTION
- GATE VALVE - OS&Y
- HOSE END VALVE
- INCREASER/REDUCER
- NEW CONNECTION
- PIPE CAP
- PIPE CUT SYMBOL
- PRESSURE GUAGE
- PRESSURE REGULATING VALVE
- PUMP
- P-1 — PUMP TAG
- T&P — VALVE TYPE
- SAFETY RELIEF VALVE
- SHUT OFF VALVE
- STRIANER
- STRAINER WITH BLOW DOWN VALVE
- SUPERVISED INDICATING VAVLE
- UNION
- WF — WATER FLOW SWITCH
- NEW CONNECTION
- DEMOLITION LIMIT
- 0 — KEY NOTE TAG
- KEY NUMBER
- TYP — EQUIPMENT TYPE
- MRK — EQUIPMENT TAG
- EQUIPMENT NUMBER
- XX — RISER TYPE
- XXX — RISER TAG
- RISER NUMBER
- SYSTEM ABBREVIATION
- 1"-XXX — PIPE TAG
- PIPE SIZE
- PIPE RISE
- PIPE DROP

FIRE PROTECTION ABBREVIATIONS

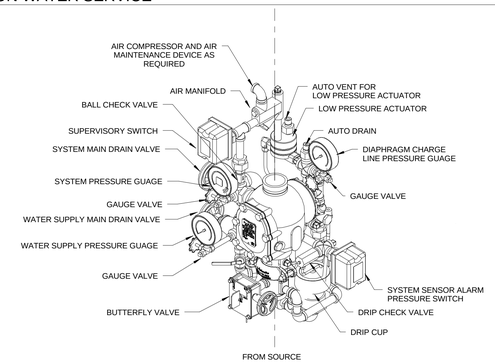
(NOTE: NOT ALL ABBREVIATIONS MAY BE REQUIRED OF THIS PROJECT.)

A	AMP
AD	ACCESS DOOR
ADA	AMERICANS WITH DISABILITIES ACT
AFF	ABOVE FINISH FLOOR
AHJ	AUTHORITY HAVING JUSTIDICTION
AI	ANALOG INPUT
APX	APROXIMATE
AO	ANALOG OUTPUT
ARCH	ARCHITECT
BAS	BUILDING AUTOMATION SYSTEM
BFP	BACK FLOW PREVENTER
BFV	BUTTERFLY VALVE
BHP	BREAK HORSE POWER
BI	BINARY INPUT
BMS	BUILDING MANAGEMENT SYSTEM
BO	BINARY OUTPUT
BTU	BRITISH THERMAL UNIT
BV	BALL VALVE
CA	COMPRESSED AIR
CD	CONDENSATE PIPING
CI	CAST IRON
CLG	CEILING
COV	CHAIN OPERATED VALVE
CPVC	CHLORINATED POLYVINYL CHLORIDE
CU IN	CUBIC INCH
CU FT	CUBIC FOOT
CW	COLD WATER
D	DRAIN
DCBP	DOUBLE CHECK VALVE
DCDA	DOUBLE CHECK VALVE DETECTOR ASSEMBLY
DDC	DIRECT DIGITAL CONTROL
DIA	DIAMETER
DN	DOWN
DS	DOWNSPOUT
DWG	DRAWING
EFF	EFFICIENCY
EL	ELEVATION
EX. (E)	EXITISTING
ETR	EXISTING TO REMAIN
EWT	ENTERING WATER TEMPERATURE
°F	DEGREE FAHRENHEIT
FD	FLOOR DRAIN
FLA	FULL LOAD AMPS
FP	FIRE PROTECTION / FIRE PUMP
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FPT	FEMALE PIPE THREAD
FS	FLOOR SINK
FT	FOOT / FEET
G	GAS (NATURAL)
GA	GAUGE
GAL	GALLON
GE	GROOVED END
GPM	GALLONS PER MINUTE
GPH	GALLON PER HOUR
HB	HOSE BIBB
HD	HUB DRAIN
HG	MERCURY
HP	HORSE POWER
HVAC	HEATING VENTILATING AND AIR CONDITIONING
I/O	INPUT OUTPUT
ID	INSIDE DIAMETER
IN	INCH, INCHES
IP	IRON PIPE
IPS	IRON PIPE SIZE
KW	KILOWATT
KO	KNOCK OUT
LBS	POIUNDS
LF	LINEAR FEET
LP	LIQUIFIED PETROLEUM
LRA	LOCKED ROTOR AMPS
MAX	MAXIMUM
MBH	THOUSAND BTU
MIN	MINIMUM
MOCP	MAXIMUM OVER-CURRENT PROTECTION
MOP	MAXIMUM OPERATING PRESSURE
MPT	MALE PIPE THREAD
N/A	NOT APPLICABLE
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NRS	NON-RISING STEM
NTS	NOT TO SCALE
OC	ON CENTER
ODP	OPEN DRIP PROOF
OS&Y	OUTSIDE STEM AND YOKE
OSD	OPEN SITE DRAIN
Ø	PHASE
P	PRESSURE / PUMP
PD	PRESSURE DROP
PE	POLYETHYLENE
P&ID	PIPING AND INSTRUMENTATION DRAWING
PPM	PARTS PER MILLION
PRV	PRESSURE REDUCING VALVE
PSI	POUND PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
R	RETURN
RLA	RUNNING LOAD AMPS
RM	ROOM
RPBP	REDUCED PRESSURE BACKFLOW PREVENTER
RPDA	REDUCED PRESSURE DETECTOR ASSEMBLY
RPM	REVOLUTIONS PER MINUTE
RPZ	REDUCED PRESSURE ZONE (VALVE)
SF	SERVICE FACTOR
SOV	SHUT OFF VALVE
SQ FT	SQUARE FEET
SV	SOLINOID VALVE
SW	SWITCH
T	TEMPRATURE
TS	TEMPRATURE SWITCH
TYP	TYPICAL
UL	UNDERWRITERS LABORATORY
V	VENT / VOLT
VB	VACUUM BREAKER
VEL	VELOCITY
VFD	VARIABLE FREQUERNCY DRIVE
W	WATTS
W/	WITH
W/O	WITHOUT
WH	WATER HEATER
WT	WEIGHT



NOTES:
1. O.S.&Y GATE VALVE WITH SUPERVISORY SWITCH (TYPICAL).
2. 4" APPROVED ILLINOIS DEPARTMENT OF PUBLIC HEALTH DOUBLE CHECK DETECTOR ASSEMBLY BACKFLOW PREVENTER. MOUNT BACKFLOW PREVENTER ON 4" CONCRETE BASE FURNISHED BY FIRE PROTECTION CONTRACTOR.

3 SCHEMATIC DIAGRAM OF BUILDING FIRE PROTECTION WATER SERVICE
NOT TO SCALE



4 DRY VAVLE ASSEMBLY DETAIL
NOT TO SCALE

M

Combined Area Fire Training Facility Re-Bid

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GAGE CONSULTING ENGINEERS, INC.
PROFESSIONAL DESIGN FIRM LICENSE NO. 184.001566, EXPIRES ON 04/30/2019

LICENSED PROFESSIONAL ENGINEER DAVID P. MCVEY 062-048431 STATE OF ILLINOIS
Exp: 11/30/19

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **PROFESSIONAL ENGINEER** under the laws of the State of **ILLINOIS**

License Number: **062-048431** Date **12-07-2017**

Revisions

Description	Date	Num
ISSUED FOR REBID	**12/07/2017**	**1**

Comm: **173013**
Date: **December 7, 2017**
Drawn: **GM**
Check: **EC**
North

FIRE PROTECTION GENERAL NOTES AND SYMBOLS

Scale: **As indicated**

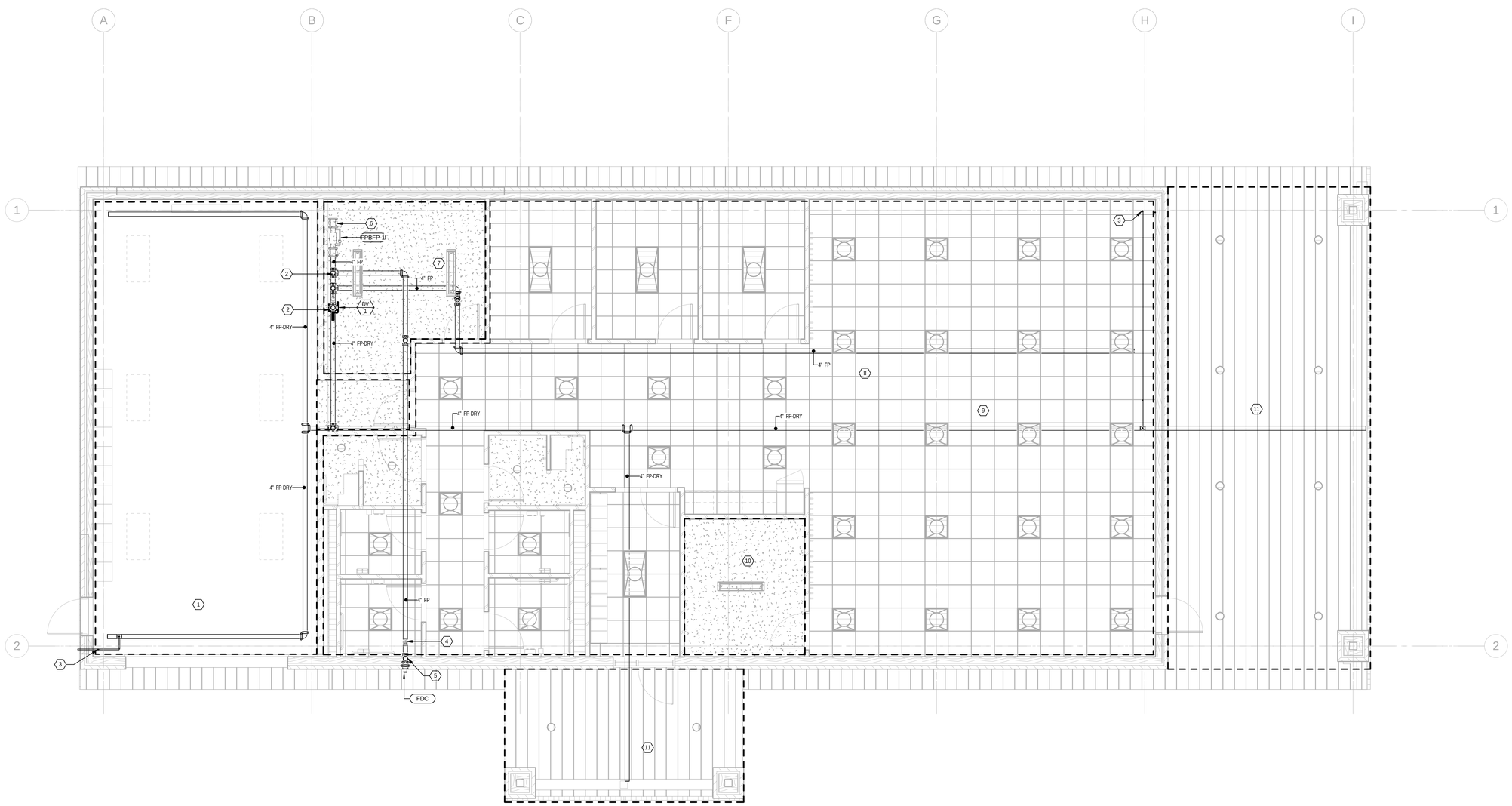
F001

FIRE PROTECTION PLAN PLAN NOTES

1. ALL INDOOR OCCUPIED SPACES SHALL BE COVERED BY THE WET SPRINKLER SYSTEM PER NFPA 13.
2. ALL WET SPRINKLER PIPING SHALL BE ROUTED COMPLETELY ON THE INTERNAL SIDE OF THE BUILDINGS THERMAL ENVELOPE.
3. THE ATTIC DRY SPRINKLER SYSTEM SHALL PROVIDE COVERAGE TO THE ATTIC AND OUTDOOR OVERHANGS AS NOTED.
4. SPECIAL APPLICATION LISTED ATTIC SPRINKLERS SHALL BE USED IN THE ATTIC PER U.L. RATING. ROOF CONSTRUCTION IS WOOD TRUSS AT 2'-0" O.C. WITH 4/12 SLOPE. PROVIDE UPRIGHT HANDS TO COVER OBSTRUCTED AREAS AS REQUIRED BY NEPA 13. SEE ARCHITECTURAL AND STRUCTURAL DOCUMENTS.
5. PROVIDE AUXILIARY DRAIN VALVES AT ALL LOCAL LOW POINTS IN PIPING OVER 5 GALLONS IN PIPE VOLUME AND OR WITHOUT A SPRINKLER HEAD. COORDINATE ACCESS VIA CEILING ACCESS PANEL WITH ARCHITECTURAL.
6. IN LOCATION WHERE BUILDING THERMAL INSULATION IS LOCATED ON FIRE RATED CEILING. ROUTE PIPING TIGHT TO TOP OF LOWER OF STRUCTURAL TRUSS MEMBER. INSTALL THERMAL INSULATOR OVER WET SPRINKLER PIPING. BUILDING THERMAL INSULATION SHALL NOT BE INSTALLED BENEATH WET SPRINKLER PIPING. COORDINATE WITH ARCHITECTURAL AND G.C.
7. ALL OVERHANGS OVER 48" WIDE SHALL BE COVERED BY DRY SYSTEM WHERE REQUIRED BY NFPA 13.

F100 KEY NOTES

KEY	NOTE
1	PROVIDE UPRIGHT HEAD COVERAGE FOR AREA OPEN TO STRUCTURE WITH PEAKED ROOF FROM DRY SYSTEM. ORDINARY HAZARD GROUP 1.
2	ROUTE SYSTEM DRAIN VALVE TO DISCHARGE OVER FLOOR DRAIN. SEE PLUMBING DRAWINGS.
3	INSPECTORS TEST VALVE FOR DRY SYSTEM BRANCH. ROUTE DRAIN TO OUTDOORS. PROVIDE VALVE IDENTIFICATION ON CEILING AS REQUIRED.
4	CHECK VALVE ON FIRE DEPARTMENT CONNECTION LINE.
5	4" WET FIRE PROTECTION LINE DOWN IN WALL TO FIRE DEPARTMENT CONNECTION. PROVIDE BALL DRIP AT PIPE ELBOW. DRAIN TO OUTDOORS.
6	CONNECT TO INCOMING COMBINED DOMESTIC / FIRE PROTECTION SERVICE BLIND FLANGE PROVIDED BY PLUMBING CONTRACTOR. SEE PLUMBING DRAWINGS.
7	PROVIDE UPRIGHT HEAD COVERAGE FROM WET SYSTEM IN AREA OPEN TO GYP. BOARD DECK TIGHT TO BOTTOM OF STRUCTURE. ORDINARY HAZZARD GROUP 1.
8	PROVIDE CONCEALED HEAD COVERAGE FOR AREA WITH CEILING. LIGHT HAZARD. PROVIDE UPRIGHT HEAD COVERAGE FROM WET SYSTEM IN PLENUM CEILING SPACE ABOVE AREA.
9	PROVIDE ATTIC SPRINKLER COVERAGE FROM DRY SYSTEM.
10	PROVIDE CONCEALED HEAD COVERAGE FROM WET SYSTEM IN AREA WITH DROP CEILING. ORDINARY HAZARD GROUP 2. PROVIDE UPRIGHT HEAD COVERAGE FROM WET SYSTEM IN PLENUM CEILING SPACE ABOVE AREA.
11	PROVIDE ATTIC COVERAGE OF CONCEALED SPACE ABOVE CANOPY CEILING FROM THE DRY SYSTEM. PROVIDE CONCEALED HEAD COVERAGE OF THE AREA BELOW THE CANOPY FROM THE DRY SYSTEM. All WORK ASSOCIATED WITH THE CANOPY AND PATIO SHALL BE BID AS PART OF ALTERNATE 1.



1 FIRE PROTECTION PLAN
1/4" = 1'-0"

Combined Area Fire Training Facility Re-Bid

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GAGE CONSULTING ENGINEERS, INC.
PROFESSIONAL DESIGN FIRM LICENSE NO.
184.001566, EXPIRES ON 04/30/2019

LICENSED PROFESSIONAL ENGINEER
DAVID P. MCVEY
062-048431
STATE OF ILLINOIS
Exp: 11/30/19

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed
PROFESSIONAL ENGINEER
under the laws of the State of **ILLINOIS**

License Number: **062-048431** Date **12-07-2017**

Revisions		
Description	Date	Num
ISSUED FOR REBID	**12/07/2017**	**1**

Comm: **173013**
Date: **December 7, 2017**
Drawn: **GM**
Check: **EC**
North

FIRE PROTECTION PLAN

Scale: **As indicated**

F100

MN

CONTROL SYSTEM GENERAL NOTES

1 GENERAL - THE CONTROLS CONTRACTOR SHALL BE THE CONTROLS ENGINEER FOR THIS PROJECT. RESPONSIBLE FOR DESIGN AND ENGINEERING OF ALL CONTROL SYSTEMS TO OPERATE AS DESCRIBED IN THE SEQUENCE OF OPERATION, TO CONFORM WITH THE GOVERNING BUILDING CODES AND OPERATE IN A MANNER CONSISTENT WITH KNOWN GOOD CONTROLS ENGINEERING PRACTICE. THE CONTROLS CONTRACTOR/ENGINEER SHALL IDENTIFY ANY POTENTIAL CONDITIONS THAT COULD BE CONSTRUED TO DEVIATE FROM GOOD CONTROLS ENGINEERING PRACTICE PRIOR TO BIDDING AND INCLUDE ALL ENGINEERING AND INSTALLATION WORK REQUIRED TO MAKE ALL HVAC SYSTEMS COMPLETE AND OPERATIONAL, IN CONFORMANCE WITH GOOD CONTROLS ENGINEERING PRACTICE. PRIOR TO SUBMITTING HIS BID. THE CONTROLS CONTRACTOR SHALL PROVIDE ALL CONTROL COMPONENTS, WIRING, INTERLOCKS, ELECTRICAL POWER, TUBING AND ALL OTHER DEVICES REQUIRED TO MAKE ALL HVAC EQUIPMENT INSTALLED UNDER THIS PROJECT COMPLETE AND FULLY OPERATIONAL PER THE SEQUENCE OF OPERATION AND AS REQUIRED FOR SAFE AND ACCURATE CONTROL. THE CONTROLS CONTRACTOR SHALL PROVIDE ALL CONTROL VALVES AND ACTUATORS TO THE HEATING/VENTILATION CONTRACTOR FOR INSTALLATION. THE CONTROLS CONTRACTOR SHALL DIRECT THE HEATING/VENTILATION CONTRACTOR AS TO THE PROPER LOCATION AND ORIENTATION OF ALL DEVICES TO ACHIEVE A PROPER AND CORRECT CONTROL SEQUENCE. THE CONTROLS CONTRACTOR SHALL INCLUDE ADEQUATE TIME IN HIS BID FOR COMPLETE COMMISSIONING OF THE MECHANICAL SYSTEMS, ON SITE IN COORDINATION WITH THE HEATING/VENTILATION CONTRACTOR AND OTHER TRADES AS REQUIRED TO MAKE ALL EQUIPMENT COMPLETE AND FULLY OPERATIONAL. IN THE EVENT THAT ANY PART OF THE HEATING/VENTILATION DRAWINGS, SPECIFICATIONS OR NOTES CONFLICT WITH ANY OTHER: THE MOST STRINGENT REQUIREMENT SHALL APPLY, PROVIDING THE GREATEST SAFETY AND/OR AT THE HIGHEST COST OF THE CONFLICTING OPTIONS.

2 ELECTRICAL - THE CONTROLS CONTRACTOR SHALL PROVIDE ALL ELECTRICAL POWER AND CONTROL WIRING, CONDUIT, JUNCTION BOXES, RACEWAY, TRANSFORMERS, RELAYS AND ALL OTHER ELECTRICAL APPURTENANCES REQUIRED FOR A COMPLETE AND FULLY OPERATIONAL CONTROL SYSTEM. THIS INCLUDES ALL POWER WIRING FROM SPARE CIRCUIT BREAKERS PROVIDED IN BUILDING EMERGENCY PANELS FOR POWERING OF CONTROLS AND CONTROL PANELS AND ALL OTHER CONTROL SYSTEM COMPONENTS. ALL ELECTRICAL WORK SHALL BE IN CONFORMANCE WITH THE LATEST NATIONAL ELECTRICAL CODE AND APPLICABLE STATE AND LOCAL AMENDMENTS. THE CONTROLS CONTRACTOR SHALL PROVIDE AND INSTALL ALL HARDWIRED INTERLOCKS BETWEEN STARTERS AS REQUIRED TO ACHIEVE THE SEQUENCE OF OPERATION AND PROPER SYSTEM CONTROLS. PROVIDE RELAYS AS REQUIRED FOR AUTOMATIC START/STOP OF ALL SINGLE PHASE EXHAUST FANS AND INTERLOCK OF AUTOMATIC DAMPERS.

3 CONTROL VALVES - ALL CONTROL VALVES SHALL SPRING RETURN TO A FAIL SAFE POSITION. ALL HEATING CONTROL VALVES SHALL FAIL OPEN BY SPRING RETURN TO HEATING AND ALL COOLING CONTROL VALVES SHALL FAIL CLOSED BY SPRING RETURN. ALL CONTROL VALVES USED FOR POSITIVE SHUT-OFF ISOLATION, SUCH AS HOT/CHILLED WATER ISOLATION OR CHANGEOVER IN A TWO-PIPE SYSTEM, SHALL BE QUARTER TURN TYPE BUTTERFLY OR BALL VALVES RATED FOR 300 PSI, BUBBLE TIGHT SHUT-OFF SERVICE. THE CONTROLS CONTRACTOR/ENGINEER SHALL SIZE ALL MODULATING TEMPERATURE CONTROL VALVES WITH A Cv AND PRESSURE DROP SUCH THAT THERE IS LINEAR CONTROL OF WATER FLOW THROUGHOUT THE ENTIRE STROKE OF THE VALVE. COORDINATE WITH THE MECHANICAL CONTRACTOR TO PROVIDE REDUCERS AS REQUIRED FOR MODULATING VALVES THAT ARE NOT LINE SIZE.

4 AUTOMATIC CONTROL DAMPERS - ALL CONTROL DAMPERS SHALL BE EXTRUDED ALUMINUM, LOW LEAKAGE AIR FOIL BLADE TYPE WITH ELASTOMER BLADE EDGE SEALS AND STAINLESS STEEL OR ELASTOMER BLADE END SEALS. ALL CONTROL DAMPERS SHALL SPRING RETURN TO A FAIL SAFE POSITION FOR FREEZE PREVENTION BY SPRING RETURN. FACE AND BYPASS DAMPER SHALL FAIL OPEN, OUTDOOR AIR DAMPERS SHALL FAIL CLOSED, EXHAUST AIR DAMPERS SHALL FAIL CLOSED, AND RETURN AIR DAMPER SHALL FAIL OPEN. THE CONTROLS CONTRACTOR SHALL WIRE AND CONTROL ALL DAMPERS PROVIDED BY OTHERS WITH UNITARY EQUIPMENT TO OPERATE AS SPECIFIED BY THE MANUFACTURER. WIRE POWER TO MOTORIZE BACKDRAFT DAMPERS AND INTERLOCK TO OPEN ON FAN START AND CLOSE ON FAN STOP.

5 THERMOSTAT - THE CONTROLS CONTRACTOR SHALL PROVIDE THERMOSTATS FOR ALL CONTROLLED EQUIPMENT TO OPERATE AS DESCRIBED IN THE SEQUENCE OF OPERATION AND/OR PER MANUFACTURER'S REQUIREMENTS AND KNOWN STANDARDS OF GOOD CONTROL PRACTICE. INCLUDE ALL THERMOSTATS AS REQUIRED FOR EQUIPMENT TO BE COMPLETE AND FULLY OPERATIONAL WHETHER SHOWN SPECIFICALLY ON THE PLANS OR NOT.
ALL TEMPERATURE SENSORS IN DUCTWORK, AIR HANDLING UNITS AND PLENUMS SHALL BE OF AVERAGING TYPE. PROPERLY SUPPORT AVERAGING ELEMENT (MINIMUM TWENTY FEET LENGTH) ACROSS A REPRESENTATIVE AREA TO ACHIEVE A TRUE AVERAGE READING. SUPPORT USING HEAVY CABLE AND/OR HALF INCH CONDUIT WITH NYLON WIRE TIES. THE CONTROLS CONTRACTOR/ENGINEER SHALL SELECT ALL PRESSURE AND TEMPERATURE SENSORS WITH AN APPROPRIATE SPAN AND RANGE FOR THE APPLICATION. FURNISH AND INSTALL STATIC PRESSURE SENSORS FOR VAV SYSTEMS TWO THIRDS DOWN MEDIUM PRESSURE DUCT RUN OR IN LOCATIONS SHOWN ON PLANS IF SPECIFICALLY INDICATED. FURNISH WITH STATIC PRESSURE SENSING TIP AND SECURE MOUNTING TO DUCT WITH REMOVABLE ACCESS COVER. BUILDING/SPACE STATIC PRESSURE SENSORS SHALL BE INSTALLED IN THE CEILING IN A MAIN BUILDING CORRIDOR OPEN TO THE MAIN ENTRANCE OF THE BUILDING. STATIC PRESSURE SENSING TIP SHALL HAVE COVER PLATE TO MATCH CEILING AND AN EMBOSSED LABEL STATING "PRESSURE CONTROL SENSOR - DO NOT PAINT". ALL OUTDOOR AIR SENSORS SHALL BE INSTALLED WITH SUN SHIELD AND IN A LOCATION WHERE THEY CANNOT BE WASHED BY EXHAUST AIR OR OTHER SOURCES OF FALSE READINGS. ALL TEMPERATURE AND PRESSURE SENSORS SHALL BE INSTALLED IN LOCATIONS SUCH THAT THEY DO NOT MAKE FALSE READINGS. CONTROLS CONTRACTOR/ENGINEER SHALL REVIEW THE PLANS AND IDENTIFY ANY SUCH POTENTIAL CAUSES FOR FALSE READINGS AND NOTIFY THE ENGINEER IN WRITING THAT THESE SHOULD BE RELOCATED PRIOR TO ROUGH IN AND CONTROLS INSTALLATION. THE CONTROLS CONTRACTOR SHALL RELOCATE ANY SENSORS INSTALLED IN IMPROPER LOCATIONS AND GIVING FALSE READINGS AT HIS OWN EXPENSE. CONDITIONS TO BE AWARE OF SHALL INCLUDE BUT ARE NOT LIMITED TO LOCATIONS OF THERMOSTATS BEHIND DOORS, OUTDOOR AIR SENSORS NEAR EXHAUST OPENINGS, STATIC PRESSURE SENSORS IN TURBULENT LOCATIONS, THERMOSTATS INSTALLED ADJACENT TO HEAT SOURCES SUCH AS COFFEE POTS, COMPUTERS, VENDING MACHINES AND OTHER APPLIANCES, ETC.

6 SAFETY DEVICES - THE CONTROLS CONTRACTOR SHALL WIRE ALL SUPPLY FANS OVER 2000 CFM TO THE LOCAL DUCT SMOKE DETECTOR TO SHUT DOWN THE SUPPLY FAN ON SMOKE ALARM. THE CONTROLS CONTRACTOR/ENGINEER SHALL FURNISH AND INSTALL MANUAL RESET SAFETY DEVICES FOR ANY AND ALL CONDITIONS THAT COULD DAMAGE THE EQUIPMENT AND/OR REPRESENT A THREAT TO HUMAN SAFETY. ALL WATER COILS SHALL BE PROTECTED BY AN AVERAGING ELEMENT FREEZE-STAT WITH A NON-ADJUSTABLE 40°F SET POINT, MANUAL RESET, AND HARDWIRED INTERLOCK TO SHUT DOWN THE ASSOCIATED FAN ANY TIME THE TEMPERATURE ACROSS ANY 12" LENGTH OF THE AVERAGING ELEMENT FALLS BELOW 40°F. FREEZE STATS SHALL BE INSTALLED DOWNSTREAM OF PRE-HEAT COIL, UPSTREAM OF AND CLOSE TO CHILLED WATER COIL. VARIABLE AIR VOLUME SYSTEMS SHALL HAVE A MANUAL RESET MAXIMUM DUCT STATIC PRESSURE SENSOR TO SHUT DOWN THE FAN ANY TIME DUCT STATIC PRESSURE RISES MORE THAN TWO INCHES WATER COLUMN ABOVE THE DESIGN OPERATING PRESSURE. BOILERS SHALL BE INTERLOCKED TO ONLY FIRE AFTER PROOF OF WATER FLOW AND THAT THE COMBUSTION AIR DAMPER IS FULL OPEN. WATER CHILLERS SHALL BE INTERLOCKED SUCH THAT THEY CAN NOT START UNTIL FLOW IS PROVED THROUGH CHILLED WATER BUNDLES. INSTALL A FLOAT SWITCH IN THE EVAPORATOR DRAIN PAN OF ALL UNIT VENTILATORS OR OTHER AIR HANDLING EQUIPMENT INSTALLED ABOVE CEILINGS IN OCCUPIED SPACES TO SHUT DOWN THE ASSOCIATED SYSTEM.

7 PUMP CONTROL - THE CONTROLS CONTRACTOR SHALL WIRE HOT WATER COIL CIRCULATING PUMPS TO START AND RUN CONTINUOUSLY ANY TIME THE OUTDOOR AIR TEMPERATURE IS BELOW 40°F. (ADJ.) CENTRAL HEATING AND/OR COOLING PUMPS SHALL HAVE A LOCAL CONTROL FOR PROOF OF FLOW AND AUTOMATIC STARTING OF THE STANDBY PUMP WHEN THE LEAD PUMP FAILS.

GENERAL NOTES

1 ALL WORK SHALL COMPLY WITH ALL LOCAL BUILDINGS. THE CONTRACTOR SHALL FURNISH AND INSTALL THE MECHANICAL SYSTEM COMPLETE WITH ALL EQUIPMENT, PIPING, VALVES, DUCTWORK, DUCTWORK ACCESSORIES, INSULATION, HANGERS, CONTROLS, AND ALL ACCESSORIES IN ACCORDANCE WITH THE BUILDING CODE, ALL AUTHORITIES HAVING JURISDICTION, AND THIS SPECIFICATION.

2 DRAWINGS ARE GENERALLY DIAGRAMMATIC. ROUTING OF PIPING, DUCTWORK, CONDUITS,OFFSET, FITTING NOR EVERY STRUCTURAL ELEMENT THAT MAY BE ENCOUNTERED DURING THE INSTALLATION OF THIS WORK. CONTRACTOR SHALL MAKE ANY REQUIRED CHANGES FROM THE GENERAL ROUTING SHOWN ON THESE DRAWINGS, SUCH AS OFFSETS, BENDS OR CHANGES IN ELEVATION DUE TO COORDINATION WITH THE WORK OF OTHER TRADES AND BUILDING CONSTRUCTION. ALL CHANGES SHALL BE MADE WITHOUT ADDITIONAL COST TO THE OWNER OR DELAY IN COMPLETION DATE OF THE PROJECT.

3 IT IS INTENDED THAT EQUIPMENT SHALL BE LOCATED SYMMETRICALLY WITH THE ARCHITECTURAL ELEMENTS OF THE BUILDING, NOT WITHSTANDING THE FACT THAT LOCATIONS INDICATED BY THESE DRAWINGS MAY BE DISTORTED FOR CLEARNESS OF PRESENTATION.

4 CONTRACTOR SHALL CHECK DRAWINGS OF OTHER TRADES TO VERIFY THAT SPACES IN WHICH THEIR WORK WILL BE INSTALLED ARE CLEAR OF OBSTRUCTIONS. WORK SHALL BE INSTALLED TO MAINTAIN MAXIMUM HEADROOM AND SPACE CONDITION AT ALL POINTS IN THE BUILDING. WHERE HEADROOM OR SPACE CONDITIONS APPEAR INADEQUATE, CONTRACTOR SHALL NOTIFY ARCHITECT/ENGINEER BEFORE PROCEEDING WITH THE INSTALLATION OF THEIR WORK.

5 CONTRACTOR SHALL FURNISH OTHER TRADES ADVANCE INFORMATION AND/OR SHOP DRAWINGS ON LOCATIONS AND SIZES OF PIPING, DUCTWORK, CONDUIT, RACEWAYS, EQUIPMENT, FRAMES, BOXES, SLEEVES AND OPENINGS, ETC. NEEDED FOR THEIR WORK TO PERMIT OTHER TRADES AFFECTED TO INSTALL THEIR WORK PROPERLY AND WITHOUT DELAY.

6 WHERE THERE IS EVIDENCE THAT WORK OF ONE TRADE WILL INTERFERE WITH WORK OF OTHER TRADES, ALL TRADES SHALL MEET ON JOB SITE TO WORK OUT SPACE CONDITIONS AND MAKE SATISFACTORY ADJUSTMENTS TO INSTALLATION OF THE NEW WORK. CONTRACTORS SHALL VERIFY EXACT LOCATIONS OF ALL DEVICES AND EQUIPMENT WITH FIELD CONDITIONS, SHOP DRAWINGS, AND WORK OF OTHER TRADES PRIOR TO ROUGH IN. CONTRACTOR SHALL BE RESPONSIBLE, AT HIS OWN EXPENSE, FOR THE REMOVAL AND REINSTALLATION OF ANY PART OF THEIR WORK IF SAME WAS INSTALLED WITHOUT CONSULTING WITH OTHER TRADES BEFORE INSTALLING THEIR WORK.

7 CONTRACTOR SHALL PROVIDE SLEEVES IN BEAMS, FLOORS, COLUMNS AND WALLS AS SHOWN ON THE DRAWINGS, AS REQUIRED BY JOB SITE CONDITIONS, AND/OR AS SPECIFIED, WHEN INSTALLING THEIR WORK. ALL BEAMS AND COLUMNS WHICH ARE REQUIRED TO BE SLEEVED SHALL BE CUT AND REINFORCED AS REQUIRED BY FIELD CONDITIONS AND LOCATIONS AND SIZES SHALL BE CHECKED AND APPROVED BY ARCHITECT BEFORE CONTRACTOR CUTS ANY STRUCTURAL BUILDING MEMBER.

8 THE SEQUENCE FOR THE INSTALLATION OF ALL WORK SHALL BE COORDINATED BETWEEN CONTRACTORS AND IN STRICT ACCORDANCE WITH ARCHITECT/ENGINEER AND OWNERS STIPULATION AS CALLED FOR IN THE SPECIFICATION AND/OR AS DIRECTED.

9 CONTRACTOR SHALL REFER TO THE ARCHITECTURAL AND STRUCTURAL CONTRACT DRAWINGS (BEFORE SUBMITTING HIS BID) TO FAMILIARIZE HIMSELF WITH THE EXTENT OF THE GENERAL CONTRACTOR WORK, CEILING HEIGHTS AND CLEARANCE FOR INSTALLING HIS WORK.

10 CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CORING, CUTTING, PATCHING, REPAIRING,REFINISHING AND REMOVAL/REPLACEMENT OF NEW OR EXISTING BUILDING CONSTRUCTION REQUIRED TO ACCOMMODATE THE INSTALLATION OR REMOVAL OF THEIR WORK. ALL PATCHING, REPAIRING AND REFINISHING WORK SHALL BE PERFORMED BY THOSE REGULARLY POSSIBLE. CARE SHALL BE TAKEN SO AS NOT TO DAMAGE ANY EXISTING BUILDING CONSTRUCTION OR ITEMS THAT ARE TO REMAIN. ANY EXISTING FINISHES THAT ARE DAMAGED DURING THE INSTALLATION OF NEW WORK OR REMOVAL OF EXISTING WORK SHALL BE REPAIRED, REPLACED AND PAID FOR BY THE INSTALLING CONTRACTOR, TO THE SATISFACTION OF THE ARCHITECT AND OWNER. REFER TO ARCHITECTURAL DRAWINGS FOR EXISTING BUILDING CONSTRUCTION THAT IS TO REMAIN AND, THEREFORE, SUBJECT TO PATCHING, REPAIRING, REFINISHING AND REMOVAL/REPLACEMENT.

11 CONTRACTOR SHALL BE RESPONSIBLE FOR HIS OWN CLEAN UP DURING CONSTRUCTION. IF CONTRACTOR FAILS TO PROVIDE SUCH CLEAN UP, THE ARCHITECT/ENGINEER WILL DIRECT ANOTHER CONTRACTOR TO PERFORM THE CLEAN UP AND THE NEGLIGENT CONTRACTOR SHALL PAY THE ASSOCIATED BACK CHARGES AS DEEMED APPROPRIATE BY THE ARCHITECT/ENGINEER.
1.CONTRACTOR SHALL BE RESPONSIBLE FOR HIS OWN CLEAN UP DURING CONSTRUCTION. IF CONTRACTOR FAILS TO PROVIDE SUCH CLEAN UP, THE ARCHITECT/ENGINEER WILL DIRECT ANOTHER CONTRACTOR TO PERFORM THE CLEAN UP AND THE NEGLIGENT CONTRACTOR SHALL PAY THE ASSOCIATED BACK CHARGES AS DEEMED APPROPRIATE BY THE ARCHITECT/ENGINEER.

12 CONTRACTOR SHALL INSTALL ALL AUXILIARY SUPPORTING STEEL AS REQUIRED FOR THE SUPPORTING OF THEIR PIPING, DUCTWORK, CONDUIT, TANKS, EQUIPMENT, ETC. ALL SUPPORTING STEEL FOR ITEMS ABOVE A SUSPENDED CEILING SHALL BE FROM BUILDING STRUCTURAL MEMBERS ONLY.

13 UNLESS INDICATED OTHERWISE, THE ARCHITECT/ENGINEER MAKES NO REPRESENTATION AS TO WHETHER OR NOT ANY HAZARDOUS OR CONTAMINATED MATERIALS (INCLUDING BUT NOT LIMITED TO ASBESTOS, PCB'S, CONTAMINATED SOILS, ETC.) ARE PRESENT WITHIN THE EXISTING BUILDING OR ON THE SITE. WORK SHOWN ON THE DRAWINGS AND/OR INDICATED IN THE SPECIFICATIONS SHALL NOT BE CONSTRUED TO CALL FOR CONTACT WITH ANY OF THESE MATERIALS. IF THESE MATERIALS ARE ENCOUNTERED OR SUSPECTED, THE CONTRACTOR SHALL NOT DISTURB THEM AND SHALL CONTACT THE ARCHITECT/ENGINEER IMMEDIATELY.

14 CONTRACTOR SHALL STORE ALL MATERIALS AND EQUIPMENT SHIPPED TO THE SITE IN A PROTECTED AREA. IF MATERIAL IS STORED OUTSIDE OF THE BUILDING, IT MUST BE STORED OFF THE GROUND A MINIMUM OF SIX INCHES (6") SET ON 6X6 PLANKS AND/OR WOOD PALLETS. ALL MATERIAL AND EQUIPMENT MUST BE COMPLETELY COVERED WITH WATERPROOF TARPS OR VISQUIN. ALL PIPING AND DUCTWORK WILL HAVE THE ENDS CLOSED TO KEEP OUT DIRT AND OTHER DEBRIS. NO EQUIPMENT WILL BE ALLOWED TO BE STORED ON THE SITE UNLESS IT IS SITTING ON WOOD PLANKS AND COMPLETELY PROTECTED WITH WEATHERPROOF COVERS.

15 THE DRAWINGS, SCHEDULES AND SPECIFICATIONS HAVE BEEN PREPARED USING ONE MANUFACTURER FOR EACH PIECE OF EQUIPMENT AS THE BASIS FOR DIMENSIONAL DESIGN. IF THE CONTRACTOR PURCHASES EQUIPMENT LISTED AS A SPECIFIED ACCEPTABLE MANUFACTURER BUT IS NOT THE SCHEDULED MANUFACTURER USED FOR THE BASE DESIGN, THE CONTRACTOR SHALL BE RESPONSIBLE FOR CHECKING ALL THE DIMENSIONS, CAPACITIES AND RATINGS OF THE EQUIPMENT TO VERIFY THAT IT WILL FIT IN THE SPACE SHOWN ON THE DRAWINGS. MINOR DEVIATIONS IN DIMENSIONS WILL BE PERMITTED, PROVIDED ALL THE RATINGS MEET THOSE SHOWN ON THE DRAWINGS AND EQUIPMENT WILL PHYSICALLY FIT INTO THE SPACE ALLOCATED WITH SUITABLE ACCESS AROUND EQUIPMENT FOR OPERATION AND MAINTENANCE ON THE EQUIPMENT.

16 WHEN EQUIPMENT IS SUBMITTED FOR REVIEW AND DOES NOT MEET THE PHYSICAL SIZE OR ARRANGEMENT OF THAT SCHEDULED AND SPECIFIED, CONTRACTOR SHALL PAY FOR ALL ALTERATIONS REQUIRED TO ACCOMMODATE SUCH EQUIPMENT AT NO ADDITIONAL COST TO OWNER. CONTRACTOR SHALL ALSO PAY ALL COSTS FOR ADDITIONAL WORK REQUIRED BY OTHER CONTRACTORS, OWNER, ARCHITECT OR ENGINEER TO MAKE CHANGES WHICH WOULD ALLOW THE EQUIPMENT TO FIT IN THE SPACE AND FUNCTION AS INTENDED.

17 CONTRACTOR SHALL FIELD VERIFY THE SIZE OF EXISTING OPENINGS, WINDOWS, DOORS, CORRIDORS, ROOMS, ETC. FOR ACCESS OF THE NEW EQUIPMENT INTO OR REMOVAL OF EXISTING EQUIPMENT FROM THE BUILDING. IF OPENINGS ARE TOO SMALL FOR ACCESS, CONTRACTOR SHALL, AT HIS OWN EXPENSE, PROVIDE NEW OR ENLARGED OPENINGS AND RESTORE SAME TO ORIGINAL SIZE AND CONDITION. CONTRACTOR MAY ELECT TO ORDER THE EQUIPMENT DISASSEMBLED AND/OR WITH SPLIT HOUSING FOR ENTRANCE INTO THE EXISTING SPACE OR BUILDING. CONTRACTOR SHALL REASSEMBLE EQUIPMENT AFTER IT IS IN THE SPACE AT HIS OWN EXPENSE.

18 WHERE DRAWINGS, SPECIFICATIONS OR NOTES CONFLICT ONE ANOTHER THE CONTRACTOR SHALL IMMEDIATELY ADVISE THE ARCHITECT OF SUCH CONFLICTS. FOR PURPOSES OF BIDDING AND PENDING WRITTEN RECEIPT OF ANY DIRECTION TO THE CONTRARY, THE CONTRACTOR SHALL INCLUDE IN HIS PROPOSAL THE MORE EXPENSIVE ALTERNATE DESCRIBED.

19 WHERE CEILING PLENUM RETURN SYSTEM IS USED, CONTRACTOR SHALL MAKE SURE THE INTEGRITY/CONTINUITY OF THE CEILING PLENUM. WHERE CEILING PLENUM IS ISOLATED BY WALL(S), CONTRACTOR SHALL PROVIDE APPROPRIATE TRANSFER WALL OPENING(S) AND SHEETMETAL SLEEVE(S) AS INDICATED ON DRAWINGS, AS REQUIRED BY JOB SITE CONDITIONS. SIZED FOR NO GREATER THAN 500 FPM AIR VELOCITY THROUGH THE OPENING(S). FIRE DAMPER IS REQUIRED WHEN THE TRANSFER DUCT PENETRATES FIRE RATED WALL.

20 WHEREVER EXTENSION, CONNECTIONS, OR CAPPINGS ARE MADE TO EXISTING DUCTWORK OR PIPING AND DAMAGED INSULATION RESULTS FROM SUCH CONNECTION, EXTENSION OR CAPPING, INSULATION SHALL BE REPAIRED AND/OR REPLACED IN A MANNER TO MATCH EXISTING BY THE CONTRACTOR INVOLVED.

SYMBOLS & ABBREVIATIONS

PIPE WITH FLOW DIRECTION
ELBOW, TURNED DOWN
ELBOW, TURNED UP
TEE, OUTLET DOWN
TEE, OUTLET UP
TEE
CONNECTION, BOTTOM
CONNECTION, TOP
PIPE BREAK
PIPE CAP
CLEAN OUT
PIPE SLEEVE
UNION
ANCHOR POINT
REDUCER - CONCENTRIC
REDUCER - ECCENTRIC
STRAINER
PUMP
PSD — PUMP SUCTION DIFFUSER
TDV — TRIPLE DUTY VALVE
SHUT OFF VALVE
BALANCING FITTING
BALL VALVE
BUTTERFLY VALVE
PLUG VALVE
GATE VALVE NRS
GATE VALVE OS&Y
GLOBE VALVE
M — 2-WAY CONTROL VALVE
M — 3-WAY CONTROL VALVE
TAP — CHECK VALVE TYPE
SAFTEY RELIEF VALVE
PRESSURE REGULATING VALVE
FLEXIBLE CONNECTION
DRAIN VALVE WITH HOSE END CONNECTION
AUTOMATIC AIR VENT
THERMOMETER WITHERMOWELL
PRESSURE GAGE
S — SWITCH
T — THERMOSTAT
H — HUMIDISTAT
H T P A — CONTROL POINT SENSORS
—HWS— HEATING HOT WATER SUPPLY
—HWR— HEATING HOT WATER RETURN
—CWS— CHILLED WATER SUPPLY
—CWR— CHILLED WATER RETURN
— CS — CONDENSER WATER SUPPLY
— CR — CONDENSER WATER RETURN
—HCWS— HOT/CHILLED WATER SUPPLY
—HCWR— HEATING HOT WATER RETURN
— LPS — LOW-PRESSURE STEAM
— MPS — MEDIUM-PRESSURE STEAM
— LPC — LOW-PRESSURE CONDENSATE
— D — CONDENSATE DRAIN
— RL — REFRIGERANT LIQUID
— RS — REFRIGERANT SUCTION
— GAS — NATURAL GAS
— CW — CITY WATER
WxD — DUCT W/ INSIDE DIMENSIONS, WIDTHxDEPTH
DIA — ROUND DUCT, DIAMETER
FLEXIBLE DUCT
DUCT TRANSITION
FLEXIBLE CONNECTION, WIDTHxDEPTH
SUPPLY DUCT, SECTION
EXHAUST OR RETURN DUCT, SECTION
VOLUME DAMPER (OR MANUAL DAMPER AS NOTED)
MOTORIZED DAMPER
SQUARE ELBOW WITH TURNING VANES * USED ONLY WHEN RADIUS ELBOW WILL NOT FIT AND VELOCITY IS LOWER THAN 1,500 FPM
R, W — RADIUS ELBOW R = W : NO SPLITER REQUIRED R = W/4 : MINIMUM 1 SPLITER REQUIRED
NEW CONNECTION
DEMOLITION LIMIT
AIR FLOW DIRECTION
U — UNDERCUT DOOR (MIN. 1/2")
EQ 1 — EQUIPMENT TAG, EQUIPMENT NAME, EQUIPMENT NUMBER
DIFFUSER TAG, DIFFUSER TYPE
A 200 / 8x8 — CFM, NECK SIZE
0 — KEY NOTE TAG

AD	ACCESS DOOR
AFF	ABOVE FINISHED FLOOR
BDD	ACKDRAFT DAMPER
BHP	BRAKE HORSE POWER
B.I.	BLACK IRON
C	COMMON PORT (CONTROL VALVE)
CC	COOLING COIL
CFM	CUBIC FEET PER MINUTE
DB	DRY BULB
DIA	DIAMETER
DN	DOWN
DS	DUCT SLEEVE WITH FIRE RATED SEALANT
DWG	DRAWING
EAT	ENTERING AIR TEMPERATURE
E.C.	ELECTRICAL CONTRACTOR
ELEC	ELECTRICAL
ESP	EXTERNAL STATIC PRESSURE DROP
EWT	ENTERING WATER TEMPERATURE
FA	FACE AREA
FD	FIRE DAMPER
FL.D	FLOOR DRAIN
FLA	FULL LOAD AMPS
FLR	FLOOR
FPM	FEET PER MINUTE
FS	FLOW SWITCH
FSD	COMBINATION FIRE AND SMOKE DAMPER
FT	FEET
G.C.	GENERAL CONTRACTOR
GPM	GALLONS PER MINUTE
HC	HEATING COIL
HP	HORSE POWER
HZ	HERTZ (FREQUENCY)
IN.	INCHES
LAT	LEAVING AIR TEMPERATURE
LF	LINEAR FOOT
LWT	LEAVING WATER TEMPERATURE
MCA	MINIMUM CIRCUIT AMPS
MD	MOTORIZED DAMPER
MOCP	MAXIMUM OVER CURRENT PROTECTION AMPS
NA	NOT APPLICABLE
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
OA	OUTSIDE AIR / OUTSIDE AIR DUCT
P.C.	PLUMBING CONTRACTOR
PH	PHASE
PLMB	PLUMBING
PS	PIPE SLEEVE
RA	RETURN AIR / RETURN AIR DUCT
RH	RELATIVE HUMIDITY
RPM	REVOLUTIONS PER MINUTE
SA	SUPPLY AIR / SUPPLY AIR DUCT
SHT	SHEET
SP	STATIC PRESSURE
SPEC	SPECIFICATION
TD	TRANSFER AIR DUCT
TSP	TOTAL STATIC PRESSURE DROP
U.N.O.	UNLESS NOTED OTHERWISE
V	VOLTS
VAV	VARIABLE AIR VOLUME / TERMINAL BOX
VD	VOLUME DAMPER
W	WATT
WB	WET BULB

Combined Area Fire Training Facility Re-Bid

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GAGE CONSULTING ENGINEERS, INC.
PROFESSIONAL DESIGN FIRM LICENSE NO. 184.001566, EXPIRES ON 04/30/2019

LICENSED PROFESSIONAL ENGINEER DAVID P. MCVEY 062-048431 STATE OF ILLINOIS
Exp: 11/30/19

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **PROFESSIONAL ENGINEER** under the laws of the State of **ILLINOIS**

License Number: **062-048431** Date **12-07-2017**

Revisions		
Description	Date	Num
ISSUED FOR REBID	**12/07/2017**	**1**

Comm: **173013**
Date: **December 7, 2017**
Drawn: **GM**
Check: **EC**
North

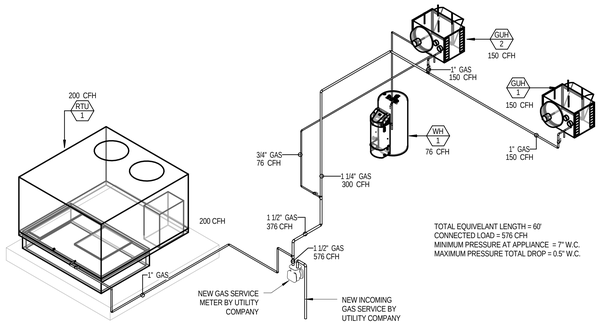
MECHANICAL GENERAL NOTES AND SYMBOLS

Scale: **1/8" = 1'-0"**

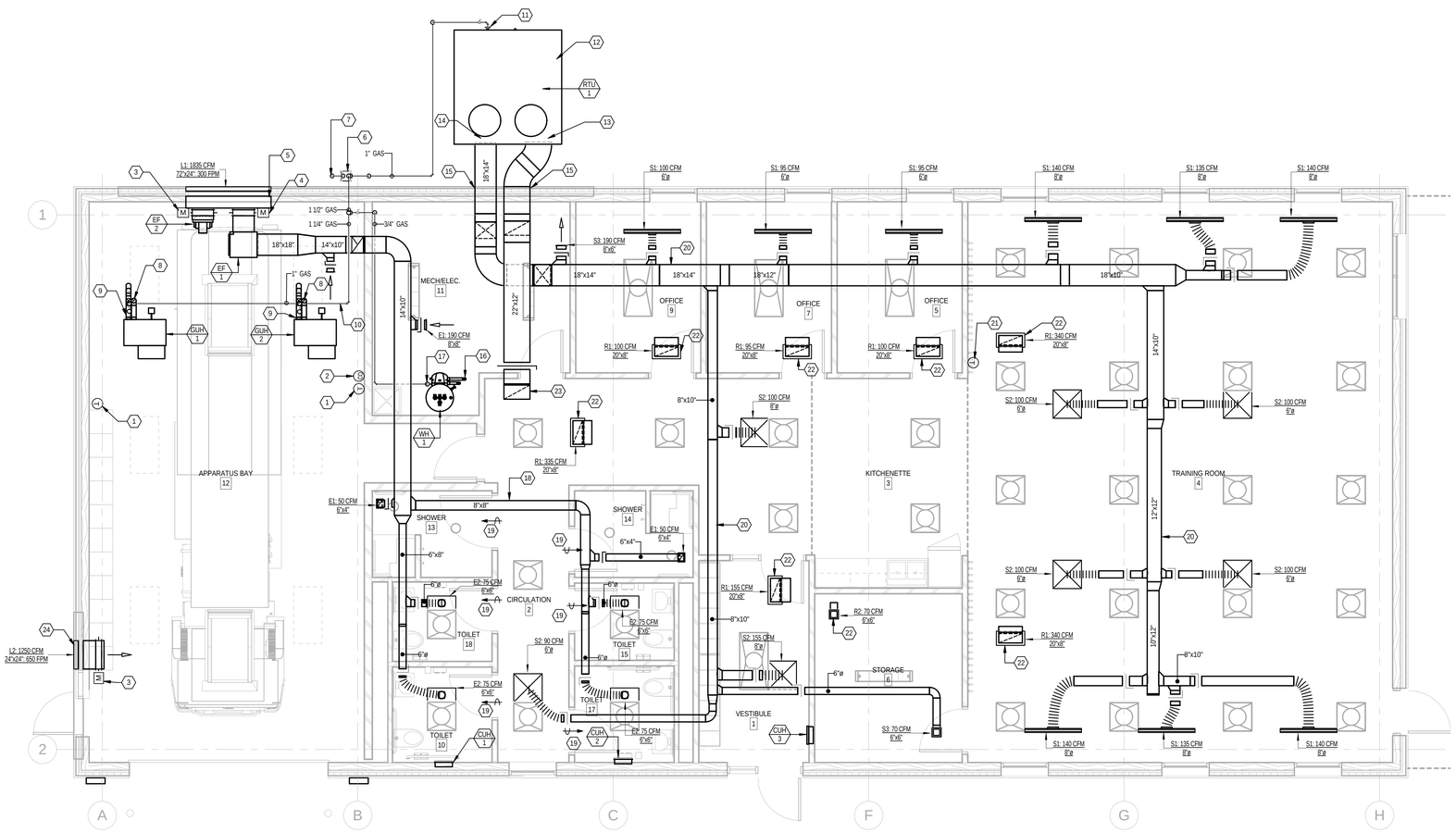
M001

M

MN



5 NATURAL GAS PIPING RISER DIAGRAM



1 MAIN LEVEL HVAC PLAN
1/4" = 1'-0"

MECHANICAL PIPING PLAN NOTES

1. CONTRACTOR SHALL FIELD VERIFY ALL FIELD CONDITIONS PRIOR TO BID.
2. PROVIDE AIR VENTS AT ALL LOCAL HIGH POINTS IN PIPING AND DRAIN VALVE AT ALL LOCAL LOW POINTS IN PIPING.
3. ALL BRANCH PIPING FROM GAS MAIN SHALL BE PROVIDED WITH ISOLATION VALVE. EACH NATURAL GAS FIRED APPLIANCE SHALL BE ABLE TO BE ISOLATED WITH OUT EFFECTING OTHER APPLIANCES.

MECHANICAL ROOF PLAN NOTES

1. ALL DUCTORK TO BE INSUALTED PER IECC 2015 AND ASHREA STANDARD 90.1-2013.
2. ALL DUCTWORK RUN OUTDOORS SHALL BE PROVIDED WITH WEATHER PROOF SHEATHING OVER DUCTWORK.
3. ALL VENITALTION INTAKES SHALL BE LOCATED MINIMUM 10' FROM ANY EXHAUST OPENINGS OR PLUMBING VENT TERMINATIONS.
4. ALL ROOF MOUNTED, NATURAL GAS, OR REFIGERANT PIPING SHALL BE ROUTED ON PIPING SUPPORTS.
5. ALL NATURAL GAS PIPING ROUTED ON THE EXTERIOR OF THE BUILDING SHALL BEPROVIDED WITH 2 COATES OF A WEATHER PROOF EPOXY COATING.

MECHANICAL VENTILATION PLAN NOTES

1. CONTRACTOR SHALL FIELD VERIFY ALL FIELD CONDITIONS PRIOR TO BID.
2. ALL RUNOUTS TO DIFFUSERS AND GRILLES SHALL BE NECK SIZE UNLESS OTHERWISE NOTED.
3. IN LOCATIONS WHERE VOLUME DAMPERS ARE LOCATED ABOVE HARD CEILING OR OTHERWISE INACCESSIBLE, PROVIDE CABLE DRIVEN DAMPER. TERMINATE CABLE END AT FACE OF DIFFUSER.
4. COORDINATE EXACT MOUNTING LOCATIONS FOR THERMOSTATS AND ALL OTHER WALL MOUNTED SENSOR AND CONTROL DEVICES WITH ARCHITECTURAL.
5. ALL DUCTS SIZES SHOWN ARE INTERIOR CLEAR DIMENSIONS. IF DUCT LINER IS USED , DUCTWORK MUST BE SIZED TO ACCOUNT FOR LINING MATERIAL.

M100 KEY NOTES

KEY	NOTE
1	WALL MOUNTED THEIRMOSTAT FOR GAS FIRED UNIT HEATER.
2	WALL MOUNTED CO DETECTOR. CO DETECTOR SHALL ACTIVATE GARAGE EXHAUST SYSTEM, EF-2.
3	MOTOR OPERATED DAMPER. INTERLOCK TO OPEN WITH ACTIVATION OF EF-2.
4	MOTOR OPERATED DAMPER. INTERLOCK TO OPEN WITH ACTIVATION OF EF-1.
5	INSULATED 72"X24" INSULATED EXHAUST PLENUM CONNECTED TO LOUVER L-1. BOTTOM OF PLENUM SHALL BE 11'- 6" A.F.F.
6	1-1/2" GAS THRU EXTERIOR WALL ABOVE GIRADE. COORDINATE EXACT LOCATION WITH ARCHITECTURAL.
7	NEW INCOMING GAS SERVICE WITH GAS METER. COORDINATE EXACT LOCATION WITH GAS UTILITY COMPANY. 576 MBH TOTAL CONNECTED LOAD. MINIMUM PRESSURE REQUIRED AT APPLIANCES IS 7" W.C.
8	4"Ø STAINLESS STEEL FLUE AND COMBUSTION AIR INTAKE UP THRU ROOM. TERMINATE FLUE WITH VENT CAP. TERMINATE COMBUSTION AIR INTAKE WITH GOOSENECK DOWN TOWARDS ROOF WITH 1/4" ALUMINUM MESH BIRD SCREEN.
9	1" NATURAL GAS CONNECTION TO GAS FIRED UNIT HEATER. PROVIDE DIRT LEG AND ISOALTION VALVE. INSTALL GAS PRESSURE REGULATOR PER MANUFACTURER'S RECOMMENDATIONS.
10	NATURAL GAS LINE TO BE ROUTED TIGHT TO STUCTURE ABOVE.
11	1" NATURAL GAS CONNECTION TO RTU-1. PROVIDE DIRT LEG AND ISOALTION VALVE. INSTALL GAS PRESSURE REGULATOR PER MANUFACTURER'S RECOMMENDATIONS.
12	RTU-1 SHALL BE MOUNTED ON 24" INSUALTED PLENUM CURB. PROVIDE CONCRETE PAD ON GRADE. UNIT LOCATION SHALL MAINTAIN FACTORY RECOMMENDED CLEARANCE DISTANCES.
13	22"X12" RETURN CONNECTION TO INSUALTED PLENUM CURB.
14	18"x14" SUPPLY DUCT CONNECTION TO INSULATED PLENUM CURB.
15	DUCTWORK PENITRATION THRU EXTERIOR WALL. COORDIANTE EXACT LOCATION ARCHITECTURAL.
16	2"Ø CPVC FLUE AND COMBUSTION AIR INTAKE FROM GAS FIRED WATER HEATER UP THRU ROOF. TERMINATE FLUE WITH VENT CAP. TERMINATE COMBUSTION AIR INTAKE WITH GOOSENECK DOWN TOWARDS ROOF WITH 1/4" ALUMINUM MESH BIRD SCREEN.
17	3/4" NATURAL GAS CONNECTION TO GAS FIRED WATER HEATER. PROVIDE DIRT LEG AND ISOALTION VALVE. INSTALL GAS PRESSURE REGULATOR PER MANUFACTURER'S RECOMMENDATIONS.
18	EXHAUST DUCTWORK SHALL BE ROUTED IN PLENUM CEILING SPACE.
19	3/4" UNDERCUT DOOR. COORDINATE WITH ARCHITECTURAL.
20	SUPPLY DUCTWORK SHALL BE ROUTED IN PLENUM CEILING SPACE.
21	WALL MONTED RTU CONTROLLER. COORDIANTE EXACT LOCATION WITH ARCHITECTURAL.
22	LINED PLENUM RETURN BOOT TO BE PROVIDED AT CEILING MOUNTED RETURN GRILLE.
23	22"x12" RETURN AIR OPENING TO PLENUM CEILING SPACE WITH 90° UPTURNED MITERED ELBOW. PROVIDE 1/4" ALUMINUM MESH BIRD SCREAN OVER OPENING.
24	INTAKE OUVER TO BE INSTALLED INLINE WITH CLEAR STORY WINDOWS. COORDINATE WITH ARCHITECTURAL.

Combined Area Fire Training Facility Re-Bid

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GAGE CONSULTING ENGINEERS, INC.
PROFESSIONAL DESIGN FIRM LICENSE NO.
184.001566, EXPIRES ON 04/30/2019

LICENSED PROFESSIONAL ENGINEER
DAVID P. MCVEY
062-048431
STATE OF ILLINOIS
Exp: 11/30/19

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **PROFESSIONAL ENGINEER** under the laws of the State of **ILLINOIS**

License Number: **062-048431** Date **12-07-2017**

Revisions		
Description	Date	Num
ISSUED FOR REBID	**12/07/2017**	**1**

Comm: **173013**
Date: **December 7, 2017**
Drawn: **GM**
Check: **EC**
North

MAIN LEVEL HVAC PLAN

Scale: **As indicated**

M100

M

GAS/DX ROOF TOP UNIT SCHEDULE

NOTES:
1.UNIT TO BE MOUNTED ON 24" INSULATED PLENUM CURB WITH FACTORY HORIZONTAL DUCT OPENINGS.
2.FACTORY PROGRAMMED SINGLE ZONE VARIABLE AIR VOLUME SEQUENCE OF OPERATION.
3.1" INJECTED FOAM WALL CONSTRUCTION, R-7.
4.PROVIDE WITH COMPARATIVE ENTHALPY ECONOMIZER, BAROMETRIC RELIEF, COMBINATION SPACE TEMPERATURE AND HUMIDITY SENSOR, STAND ALONE CONTROLS WITH ADJUSTABLE SET POINTS AND TENANT OVERRIDE , MERV 8 FILTERS, STAINLESS STEEL GAS HEAT EXCHANGER, DIRECT DRIVE ECM FAN MOTOR, ONE INVERTER SCROLL COMPRESSOR WITH ONE FIXED SPEED SCROLL COMPRESSOR, HOT GAS RE-HEAT, NON-FUSED DISCONNECT SWITCH, FIELD POWERED 115V GFI OUTLET, AND PHASE FAILURE MONITOR.

				SUMMER DESIGN		WINTER DESIGN	SUPPLY FAN						GAS HEATING						DX COOLING																			
																								COIL				COMPRESSOR(S)				ELECTRICAL						
MARK	SUPPLY AIR	RETURN AIR	OUTDOOR AIR	DB °F	WB °F	DB °F	QUANTITY	TYPE	T.S.P.	E.S.P.	BHP EACH	MOTOR HP EACH	INPUT	CAPACITY	STAGES	EAT	LAT	THERMAL EFF.	TOTAL CAPACITY	SENSIBLE CAPACITY	EAT DB	EAT WB	LAT DB	LAT WB	ROWS	FPI	REFRIGERANT	TYPE	QUANTITY	EER RATED	IEER RATED	VOLTAGE	Ø	MCA	MOCP	MANUFACTURER	MODEL	WEIGHT	NOTES
RTU 1	2125 CFM	1540 CFM	670 CFM	92 °F	74 °F	-2 °F	1	AIR FOIL - DIRECT DRIVE	2.30 in-wg	1.50 in-wg	1.25 hp	2.3 hp	200000 Btu/h	160000.0 Btu/h	MODULATING	46 °F	115 °F	80%	91111 Btu/h	65323 Btu/h	80.8 °F	66.8 °F	52.7 °F	52.7 °F	3	15	R-410A	SCROLL	2	11.7	19.3	208 V	3	33.9 A	45 A	DAIKIN APPLIED	DPS-007	2210 lbf	1,2,3,4

EXHAUST FAN SCHEDULE

NOTES:
1.PROVIDE NON-FUSED DISCONNECT SWITCH. COORDINATE WITH ELECTRICAL.
2.PROVIDED MOTORIZED BACKDRAFT DAMPER. ACTUATOR VOLTAGE SHALL BE LINE VOLTAGE.
3.FAN TO BE INTERLOCKED TO RUN WITH CO DETECTOR STATUS SIGNAL.
4.UNIT TO BE SUSPENDED FOR STRUCTURE ABOVE.
5.PROVIDE FAN SPEED CONTROLLER.

MARK	DESCRIPTION	AIR FLOW	STATIC PRESSURE	FAN RPM	SONES	FAN BHP	MOTOR RPM	MOTOR	VOLTAGE	Ø	MANUFACTURER	MODEL	WEIGHT	NOTES
EF 1	SQUARE INLINE - DIRECT DRIVE	635 CFM	0.75 in-wg	1105	7.5	0.16 hp	1800	0.25 hp	115 V	1	TWIN CITY FAN & BLOWER	DSI 135AN	132 lbf	1,2,4,5
EF 2	PROPELLER WALL FAN – DIRECT DRIVE	1200 CFM	0.40 in-wg	1748	13.9	0.18 hp	3600	0.25 hp	115 V	1	TWIN CITY FAN & BLOWER	WPD 14	42 lbf	1,2,3

ELECTRIC CABINET UNIT HEATER SCHEDULE

NOTES:
1.PROVIDE INTEGRAL THERMOSTAT.
2.PROVIDE UNIT MOUNTED DISCONNECT SWITCH
3.UNIT TO BE RECESSED IN WALL.

						ELECTRICAL						
MARK	ROOM NAME	ROOM NUMBER	DESCRIPTION	AIR FLOW	CAPACITY	VOLTAGE	Ø	AMPS	MANUFACTURER	MODEL	NOTES
CUH 1	TOILET	10	FAN FORCED ELECTRIC WALL HEATER	100 CFM	1500 W	120 V	1	13 A	MARLEY ENGINEERED PRODUCTS	LFK151F	1,2,3
CUH 2	TOILET	17	FAN FORCED ELECTRIC WALL HEATER	100 CFM	1500 W	120 V	1	13 A	MARLEY ENGINEERED PRODUCTS	LFK151F	1,2,3
CUH 3	VESTIBULE	1	FAN FORCED ELECTRIC WALL HEATER	100 CFM	3000 W	208 V	3	14 A	MARLEY ENGINEERED PRODUCTS	AWH4404-3000W	1,2,3

LOUVER SCHEDULE

NOTES:
1.PROVIDE ALUMINUM MESH BIRD SCREEN.
2.COLOR AND FINISH TO BE COORDINATED WITH ARCHITECTURAL.

MARK	DESCRIPTION	HEIGHT	WIDTH	AIRFLOW	FREE AREA	VELOCITY	SERVICE	MANUFACTURER	MODEL	NOTES
L1	EXTRUDED ALUMINUM NON-DRAINABLE STATIONARY LOUVER	24"	72"	1835 CFM	6.12 SF	300 FPM	GE	RUSKIN	ELF375X	1,2
L2	EXTRUDED ALUMINUM NON-DRAINABLE STATIONARY LOUVER	24"	24"	1250 CFM	1.92 SF	650 FPM	OA	RUSKIN	ELF375X	1,2

DIFFUSER, GRILLE, AND REGISTER SCHEDULE

NOTES:
1.SEE PLANS FOR NECK SIZE.
2.COORDINATE SURFACE MOUNTING REQUIREMENTS WITH ARCHITECTURAL.

TYPE	DESCRIPTION	FACE SIZE	MOUNTING	CONSTRUCTION MATERIAL	FINISH	SERVICE	MANUFACTURER	MODEL	NOTES
E1	GRILLE WITH 1/2" BLADE SPACING, 35°DEFLECTION	SEE PLANS	SURFACE	ALUMINUM	#26 WHITE	GENERAL EXHAUST AIR	TITUS	355FL	1,2
E2	CEILING GRILLE 1/2" BLADE SPACING, 35° DEFLECTION	24 x 12	LAY IN	STEEL	#26 WHITE	GENERAL EXHAUST AIR	TITUS	355RL	1
R1	CEILING GRILLE 1/2" BLADE SPACING, 35° DEFLECTION	24 x 12	LAY IN	STEEL	#26 WHITE	RETURN AIR	TITUS	355RS	1
R2	GRILLE WITH 1/2" BLADE SPACING, 35°DEFLECTION	SEE PLANS	SURFACE	STEEL	#26 WHITE	RETURN AIR	TITUS	355RL	1,2
S2	SQUARE PLAQUE DIFFUSER	24 x 24	LAY IN	STEEL	#26 WHITE	SUPPLY AIR	TITUS	OMNI	1
S3	GRILLE WITH ¾" BLADE SPACING, SINGLE DEFLECTION, INDEPENDENTLY ADJUSTABLE BLADES	SEE PLANS	SURFACE	STEEL	#26 WHITE	SUPPLY AIR	TITUS	301RL	1,2

SLOT DIFFUSER SCHEDULE

NOTES:
1.SEE PLANS FOR NECK SIZE.

TYPE	DESCRIPTION	MOUNTING	NUMER OF SLOTS	SLOT WIDTH	SLOT LENGTH	CONSTRUCTION MATERIAL	FINISH	SERVICE	MANUFACTURER	MODEL	NOTES
S1	HIGH CAPACITY ADJUSTABLE INSULATED PLENUM SLOT DIFFUSER	LAY-IN	2	3/4"	48"	STEEL	#26 WHITE	SUPPLY AIR	TITUS	TBDI-30	

GAS FIRED UNIT HEATER

NOTES:
1.UNIT TO BE MOUNTED FROM STRUCTURE ABOVE. PROVIDE ALL REQUIRED HARDWARE FOR INSTALLATION PER MANUFACTURES RECOMMENDATIONS.
2.PROVIDE 30° DEFLECTOR HOOD, SINGLE STAGE WALL MOUNTED AND THERMOSTAT WITH GUARD COVER.
3.PROVIDE TYPE B FLUE VENT WITH VENT CAP TERMINATION AND COMBUSTION AIR INTAKE WITH GOOSENECK TERMINATION WITH ¼" MESH BIRD SCREEN OR CONCENTRIC VENT KIT INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.

			GAS HEATING								ELECTRICAL			
MARK	MANUFACTURER	MODEL	INPUT	CAPACITY	THERMAL EFF	BURNER STAGES	EAT	LAT	CFM	FAN HP	VOLTAGE	Ø	FLA	NOTES:
GUH 1	MODINE	PTS150SS01	150000.0 Btu/h	123000.0 Btu/h	82%	1	50 °F	103 °F	2140 CFM	0 hp	115 V	1	5 A	1,2,3
GUH 2	MODINE	PTS150SS01	150000.0 Btu/h	123000.0 Btu/h	82%	1	50 °F	103 °F	2140 CFM	0 hp	115 V	1	5 A	1,2,3

IMC VENTILATION SCHEDULE

							CODE REQUIRED						DESIGN				
							OUTDOOR AIR			EXHAUST							
ROOM NUMBER	ROOM NAME	SPACE TYPE	AREA	VOLUME	OCCUPANTS	FIXTURES	CFM / S.F.	CFM / PERSON	REQUIRED O.A.	CFM PER FIXTURE	EX CFM PER SF	REQUIRED EXHAUST	SUPPLY	OUTDOOR AIR	RETURN	EXHAUST	NOTES
1	VESTIBULE	CORRIDOR	110 SF	991 CF	0	0	0.05 CFM/SF	0	6 CFM	0 CFM	0.00 CFM/SF	0 CFM	155 CFM	5 CFM	155 CFM	0 CFM	
2	CIRCULATION	CORRIDOR	309 SF	2785 CF	0	0	0.05 CFM/SF	0	15 CFM	0 CFM	0.00 CFM/SF	0 CFM	190 CFM	20 CFM	335 CFM	0 CFM	
3	KITCHENETTE	BREAKROOM	161 SF	1445 CF	0	0	0.00 CFM/SF	15	0 CFM	0 CFM	0.00 CFM/SF	0 CFM	0 CFM	0 CFM	0 CFM	0 CFM	
4	TRAINING ROOM	CLASSROOM	1183 SF	10648 CF	37	0	0.00 CFM/SF	15	555 CFM	0 CFM	0.00 CFM/SF	0 CFM	1230 CFM	555 CFM	680 CFM	0 CFM	
5	OFFICE	OFFICE	106 SF	953 CF	1	0	0.00 CFM/SF	20	20 CFM	0 CFM	0.00 CFM/SF	0 CFM	95 CFM	20 CFM	100 CFM	0 CFM	
6	STORAGE	STORAGE	123 SF	1355 CF	0	0	0.15 CFM/SF	0	18 CFM	0 CFM	0.00 CFM/SF	0 CFM	70 CFM	20 CFM	70 CFM	0 CFM	
7	OFFICE	OFFICE	106 SF	953 CF	1	0	0.00 CFM/SF	20	20 CFM	0 CFM	0.00 CFM/SF	0 CFM	95 CFM	20 CFM	95 CFM	0 CFM	
9	OFFICE	OFFICE	106 SF	953 CF	1	0	0.00 CFM/SF	20	20 CFM	0 CFM	0.00 CFM/SF	0 CFM	100 CFM	20 CFM	100 CFM	0 CFM	
10	TOILET	TOILET ROOM	47 SF	423 CF	0	1	0.00 CFM/SF	0	0 CFM	75 CFM	0.00 CFM/SF	75 CFM	0 CFM	0 CFM	0 CFM	75 CFM	
11	MECH/ELEC.	MECHANICAL	190 SF	2091 CF	0	0	0.05 CFM/SF	0	10 CFM	0 CFM	1.00 CFM/SF	190 CFM	190 CFM	10 CFM	0 CFM	190 CFM	
12	APPARATUS BAY	GARAGE	798 SF	10321 CF	0	0	1.50 CFM/SF	0	1197 CFM	0 CFM	1.50 CFM/SF	1197 CFM	1250 CFM	1250 CFM	0 CFM	1250 CFM	
13	SHOWER	SHOWER	50 SF	450 CF	0	1	0.00 CFM/SF	0	0 CFM	50 CFM	0.00 CFM/SF	50 CFM	0 CFM	0 CFM	0 CFM	50 CFM	
14	SHOWER	SHOWER	50 SF	447 CF	0	1	0.00 CFM/SF	0	0 CFM	50 CFM	0.00 CFM/SF	50 CFM	0 CFM	0 CFM	0 CFM	50 CFM	
15	TOILET	TOILET ROOM	38 SF	342 CF	0	1	0.00 CFM/SF	0	0 CFM	75 CFM	0.00 CFM/SF	75 CFM	0 CFM	0 CFM	0 CFM	75 CFM	
17	TOILET	TOILET ROOM	47 SF	427 CF	0	1	0.00 CFM/SF	0	0 CFM	75 CFM	0.00 CFM/SF	75 CFM	0 CFM	0 CFM	0 CFM	75 CFM	
18	TOILET	TOILET ROOM	39 SF	352 CF	0	1	0.00 CFM/SF	0	0 CFM	75 CFM	0.00 CFM/SF	75 CFM	0 CFM	0 CFM	0 CFM	75 CFM	
			3463 SF						1861 CFM			1788 CFM	3375 CFM	1920 CFM	1535 CFM	1840 CFM	

Combined Area Fire Training Facility Re-Bid
851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

WOLD | RUCK PATE
110 North Brockway, Suite 220
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GAGE
CONSULTING ENGINEERS INCORPORATED
1301 WEST 22ND STREET Suite 210
Oak Brook, IL 60523
630˙472˙0918 Fax 630˙472˙1006

GAGE CONSULTING ENGINEERS, INC.
PROFESSIONAL DESIGN FIRM LICENSE NO.
184.001566, EXPIRES ON 04/30/2019

LICENSED PROFESSIONAL ENGINEER
DAVID P. MCVEY
062-048431
STATE OF ILLINOIS
Exp: 11/30/19

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed
PROFESSIONAL ENGINEER
under the laws of the State of **ILLINOIS**

License Number: **062-048431** Date **12-07-2017**

Revisions		
Description	Date	Num
ISSUED FOR REBID	**12/07/2017**	**1**

Comm: **173013**
Date: **December 7, 2017**
Drawn: **GM**
Check: **EC**
North

MECHANICAL SCHEDULES

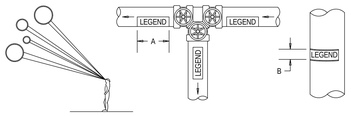
Scale:

M200

MN

M

MN



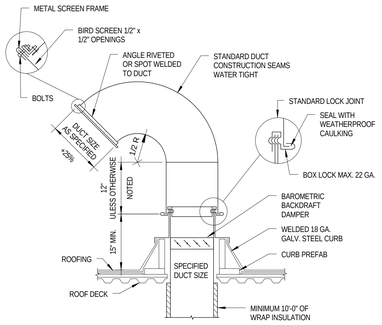
NOTE:
IDENTIFICATION MARKERS OR STRIPS TO BE PLACED ON ALL EXPOSED, COVERED AND UNCOVERED PIPES AT 50'-0" INTERVALS AND AT ALL VALVES AND BRANCHES AND ON BOTH SIDES OF WALLS WHERE PIPES PASS THROUGH SAME. ARROWS OF SAME COLOR AS IDENTIFICATION MARKERS SHALL ALSO BE PLACED ON PIPES POINTING AWAY FROM MARKER INDICATING DIRECTION OF FLOW.

SIZE OF LEGEND LETTERS

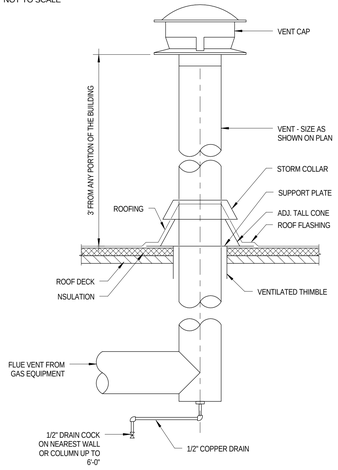
OUTSIDE DIAMETER OF PIPE OR COVERING	LENGTH OF COLOR FIELD A	SIZE OF LETTERS B
3/4" TO 1-1/4"	8"	1/2"
1-1/2" TO 2"	8"	3/4"
2"-1/2" TO 6"	12"	1-1/4"
8" TO 10"	24"	2-1/2"
OVER 10"	32"	3-1/2"

SERVICE	BACKGROUND OR COLOR BAND	IDENTIFICATION MARKER
CITY WATER	GREEN	WHITE ON GREEN
DOMESTIC COLD WATER	GREEN	WHITE ON GREEN
DOMESTIC HOT WATER	GREEN	WHITE ON GREEN
FIRE PROTECTION (SPRINKLER)	RED	WHITE ON RED
NATURAL GAS	YELLOW	BLACK ON YELLOW
SANITARY DRAIN	GREEN	WHITE ON GREEN

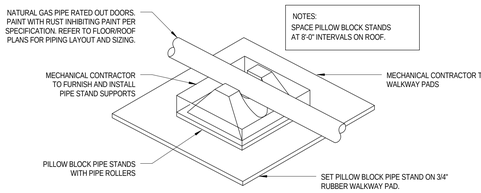
14 TYPICAL PIPE IDENTIFICATION MARKERS
NOT TO SCALE



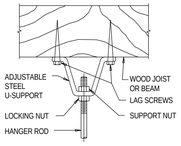
1 GOOSENECK AND COUNTER FLASHING DETAIL
NOT TO SCALE



16 GAS FLUE ROOF PENITRATION
NOT TO SCALE



10 PILLOW BLOCK GAS PIPE SUPPORT DETAIL
NOT TO SCALE



WOOD JOIST OR BEAM

SUPPORT HORIZONTAL STEEL AND COPPER PIPING AS FOLLOWS:

NOMINAL PIPE SIZE	DISTANCE BETWEEN SUPPORTS	HANGER ROD DIAMETERS
1/2"	6'	3/8"
3/4 TO 1-1/2"	6'	1/2"
2" TO 2-1/2"	10'	1/2"
3" AND 4"	10'	5/8"
6" TO 12"	14'	7/8"
14" TO 18"	20'	1"

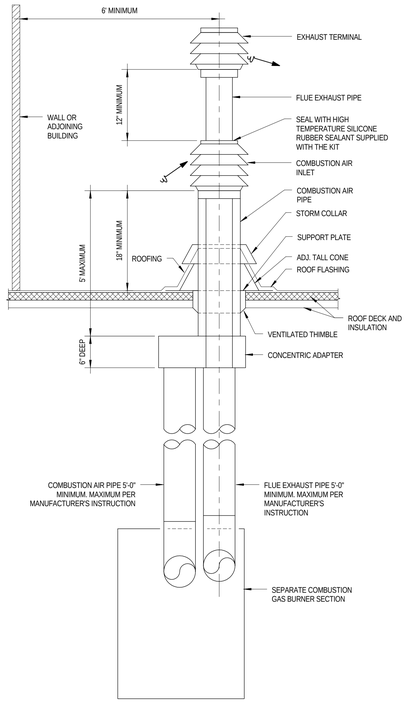
PLACE HANGER WITHIN 1 FOOT OF EACH HORIZ. ELBOW. SUPPORT HORIZ. SOIL WASTE AND STORM PIPE NEAR EACH HUB, WITH 5 FEET MAXIMUM SPACING BETWEEN HANGERS.

VERTICAL PIPING:
1. SUPPORT VERTICAL WATER PIPING AT EVERY FLOOR.
2. SUPPORT VERTICAL SOIL PIPE AT EACH FLOOR AT HUB.

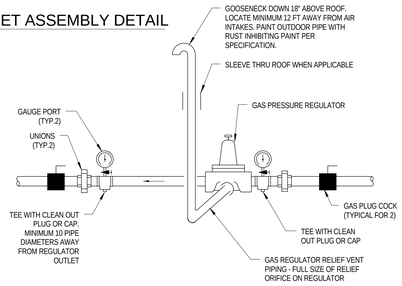
WHERE SEVERAL PIPES CAN BE INSTALLED IN PARALLEL AND AT SAME ELEVATION PROVIDE MULTIPLE OR TRAPEZE HANGERS.

WHERE PRACTICAL, SUPPORT RISER PIPING INDEPENDENTLY OF CONNECTED HORIZ. PIPING.

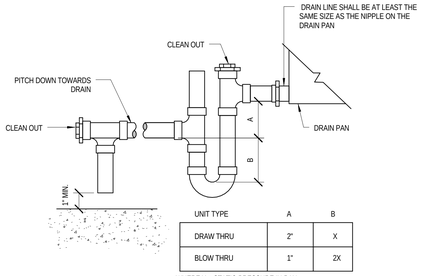
12 PIPE HANGER DETAILS
NOT TO SCALE



15 GAS VENT TERMINAL/COMBUSTION AIR INLET ASSEMBLY DETAIL
NOT TO SCALE



9 NATURAL GAS PRV STATION DETAIL
NOT TO SCALE

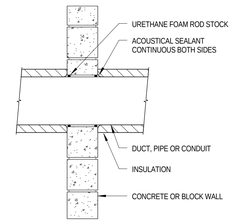


UNIT TYPE	A	B
DRAW THRU	2"	X
BLOW THRU	1"	2X

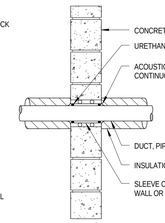
WHERE X = STATIC PRESSURE IN PAN

NOTES:
1. COIL MUST BE MOUNTED HIGH ENOUGH TO PERMIT TRAP TO BE INSTALLED.
2. PROVIDE SHIMS OR STRUCTURAL PLATFORMS REQUIRED TO ELEVATE FACTORY PACKAGED AIR HANDLING UNITS TO OBTAIN REQUIRED TRAP HEIGHT.

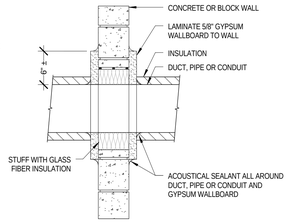
11 CONDENSATE DRAIN TRAP DETAIL
NOT TO SCALE



WITHOUT SLEEVE



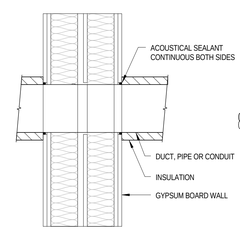
WITH SLEEVE



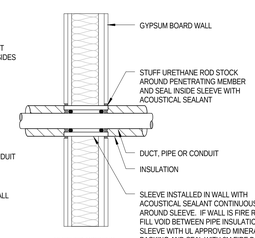
CONDITION WHERE HOLE IS CONSIDERABLY LARGER THAN DUCT, PIPE OR CONDUIT

NOTE: WHERE DUCTS, PIPES OR CONDUITS ARE EXTERNALLY INSULATED, DO NOT EXTEND INSULATION THRU WALL.

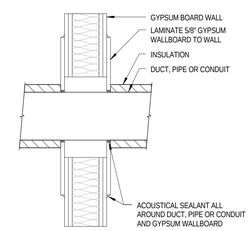
6 WALL PENITRATION DETAIL - BLOCK OR CONCRETE CONSTRUCTION
NOT TO SCALE



FRAMED OPENING



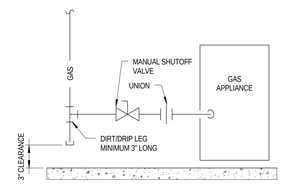
SLEEVED OPENING



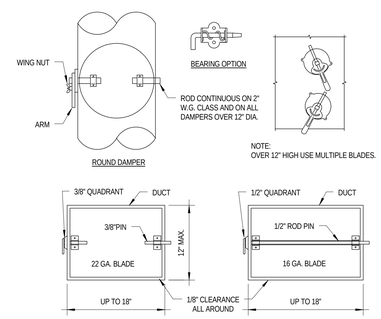
CONDITION WHERE HOLE IS CONSIDERABLY LARGER THAN DUCT, PIPE OR CONDUIT

NOTE: WHERE DUCTS, PIPES OR CONDUITS ARE EXTERNALLY INSULATED, DO NOT EXTEND INSULATION THRU WALL.

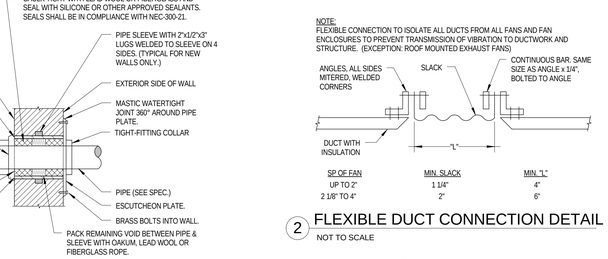
7 WALL PENITRATION DETAIL - STUD CONSTUCTION
NOT TO SCALE



8 NATURAL GAS CONNECTION DETAIL
NOT TO SCALE



5 VOLUME DAMPER DETAIL
NOT TO SCALE

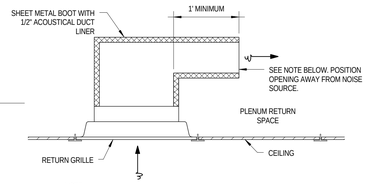


DETAIL NOTES:
1. CONTRACTOR SHALL ISOLATE ALL PIPES FROM CONSTRUCTION WHICH VIBRATE IN ORDER TO AVOID TRANSMISSION TO STRUCTURE.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR THE COORDINATION OF THEIR SLEEVES WITH OTHER TRADES AND/OR CONTRACTORS.
3. PIPE SLEEVES THRU SMOKE OR FIRE WALLS SHALL BE IN COMPLIANCE WITH NFPA-90A.

13 PIPE SLEAVE THRU EXTERIOR WALL DETAIL
NOT TO SCALE

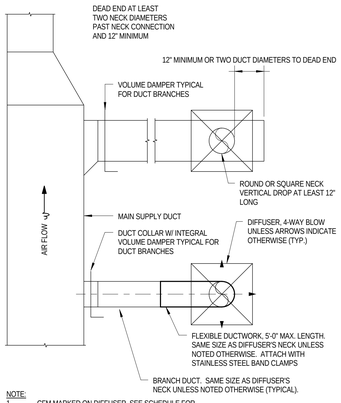
SP OF FAN	MIN. SLACK	MIN. "L"
UP TO 2"	1 1/4"	4"
2 1/8" TO 4"	2"	6"

2 FLEXIBLE DUCT CONNECTION DETAIL
NOT TO SCALE



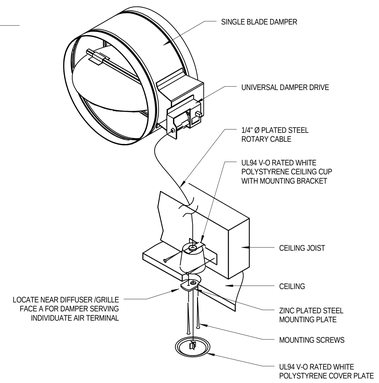
NOTE:
BOOT OUTLET SHALL BE MINUMUM 12" IN HEIGHT BY THE WITDH OF THE GRILLE. SEE PLANS FOR GRILLE DIMENSIONS

3 RETURN AIR GRILLE BOOT DETAIL
NOT TO SCALE



NOTE:
1. CFM MARKED ON DIFFUSER. SEE SCHEDULE FOR SIZING.
2. DETAIL APPLIES TO ALL SITUATIONS WHETHER SHOWN ON PLANS OR NOT

4 TYPICAL DIFFUSER BRANCH DETAIL
NOT TO SCALE



17 CONCEALED CABLE DRIVEN VOLUME DAMPER DETAIL
NOT TO SCALE

M

Combined Area Fire Training Facility Re-Bid

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

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GAGE CONSULTING ENGINEERS INCORPORATED
1301 WEST 22ND STREET Suite 210
Oak Brook, IL 60523
630·472·0918 Fax 630·472·1006

GAGE CONSULTING ENGINEERS, INC.
PROFESSIONAL DESIGN FIRM LICENSE NO. 184.001566, EXPIRES ON 04/30/2019

PROFESSIONAL ENGINEER DAVID P. MCVEY 062-048431 STATE OF ILLINOIS
Exp: 11/30/19

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **PROFESSIONAL ENGINEER** under the laws of the State of **ILLINOIS**

License Number: **062-048431** Date **12-07-2017**

Revisions		
Description	Date	Num
ISSUED FOR REBID	12/07/2017	1

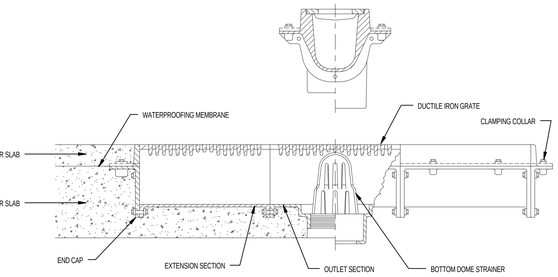
Comm: **173013**
Date: **December 7, 2017**
Drawn: **GM**
Check: **EC**
North

MECHANICAL DETAILS

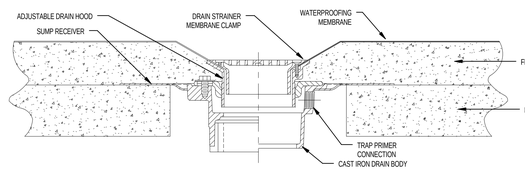
Scale: **As indicated**

M300

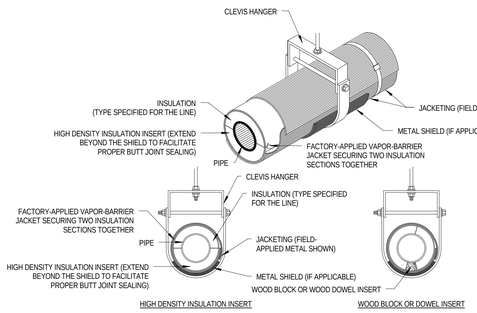
MN



6 EXTRA HEAVY DUTY MODULAR TRENCH DRAIN
NOT TO SCALE



4 SHOWER DRAIN
NOT TO SCALE



8 PIPING INSULATION WITH CLEVIS HANGAR
NOT TO SCALE

PLUMBING GENERAL NOTES

1 THE CONTRACTOR SHALL FURNISH AND INSTALL THE PLUMBING SYSTEMS COMPLETE WITH ALL EQUIPMENT, PIPING, VALVES, INSULATION, CONTROLS, HANGERS, TRIM, ACCESSORIES AND ASSOCIATED WORK, IN ACCORDANCE WITH THE 2014 ILLINOIS PLUMBING CODE, ALL AUTHORITIES HAVING JURISDICTION, AND THE PROJECT SPECIFICATIONS.THE WORK SHALL INCLUDE ALL LABOR, MATERIALS, EQUIPMENT, HOISTING AND RIGGING, SCAFFOLDING, LOADING AND UNLOADING, CLEAN-UP OF DEBRIS AND OTHER SERVICES, TO PROVIDE THE OWNER WITH FULLY OPERATIONAL SYSTEMS.

2 ALL WORK SHALL BE PROPERLY COORDINATED WITH THE WORK OF OTHER TRADES TO AVOID CONFLICTS. REFER TO THE ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR INFORMATION REGARDING CEILING ELEVATIONS, SPACE CLEARANCES, WALL AND PARTITION LOCATIONS ETC., USED TO PREPARE COORDINATED DRAWINGS.

3 ALL NECESSARY CUTTING AND PATCHING OF THE WORK OF GENERAL TRADES FOR THE INSTALLATION OF PLUMBING WORK SHALL BE PERFORMED BY THIS CONTRACTOR. RESTORE SURFACES TO MATCH EXISTING CONDITIONS.

4 ALL MATERIALS AND WORKMANSHIP SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR FROM DATE OF FINAL ACCEPTANCE OF THIS WORK. ENGAGE THE SERVICES OF VARIOUS MANUFACTURERS' SUPPLYING THE EQUIPMENT FOR THE PROPER START-UP ADJUSTMENT AND OPERATION OF THE EQUIPMENT, AND INSTRUCT THE OWNER'S PERSONNEL IN THE PROPER OPERATION AND MAINTENANCE OF THE PLUMBING SYSTEMS.

5 THIS CONTRACTOR SHALL SECURE ALL REQUIRED PERMITS AND APPROVALS AND TRANSMIT ORIGINALS TO THE OWNER FOR RECORD. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL FEES.

6 AN APPROVED REDUCED PRESSURE ZONE (RPZ) BACKFLOW PREVENTER DEVICE SHALL BE INSTALLED IN THE POTABLE WATER SUPPLY TO EACH LOCATION WHERE SANITIZING CHEMICALS OR DETERGENTS WILL BE ASPIRATED OR PUSHED BY WATER PRESSURE INTO CLEANSING/SANITIZING OPERATION. SPILL PROOF OR PRESSURE VACUUM BREAKERS ARE PROHIBITED.

7 DEAD ENDS SHALL BE AVOIDED IN DRAINAGE SYSTEM, EXCEPT WHERE NECESSARY TO EXTEND THE SYSTEM TO INSTALL A CLEANOUT IN AN ACCESSIBLE LOCATION. THE DEAD ENDS INTENDED FOR FUTURE CONNECTION OR CREATED BY REMOVAL OR ABANDONMENT OF PIPE, WHICH IS MORE THAN TWO (2'-0") FEET ABOVE A FLOOR OR MORE THAN TEN (10'-0") FEET HORIZONTALLY FROM THE NEAREST VENTED CONNECTION MUST HAVE A VENTED CONNECTION TO THE OUTSIDE ATMOSPHERE

8 WATER DISTRIBUTION PIPE THAT HAS BEEN TERMINATED OR IS AN UNUSED SEGMENT SHALL HAVE NO DEAD ENDS. NO UNUSED SEGMENT OF PIPE WITH A DEVELOPED LENGTH OF MORE THAN TWO (2'-0") FEET SHALL BE PERMITTED.

9 A STACK TEST IS REQUIRED ON ALL ROUGH AND UNDERGROUND PLUMBING.

10 ALL PVC PIPING LOCATED INSIDE THE RETURN AIR PLENUM CEILING TO BE INSULATED WITH 1/2" THICK FIRE BARRIER PLENUM WRAP INSULATION. THIS INCLUDES ALL PVC PIPING LOCATED INSIDE CHASES AND WALLS THAT ARE NOT COMPLETELY SEALED OFF FROM THE RETURN AIR CEILING PLENUM. REFER TO MECHANICAL DRAWINGS FOR THE EXTENT OF RETURN AIR PLENUM CEILINGS.

11 HOT AND HOT WATER RETURN PIPING TO BE INSULATED IN ACCORDANCE WITH THE SPECIFICATIONS AND IN COMPLIANCE WITH THE 2015 IECC CODE.

12 COLD WATER PIPING TO BE INSULATED IN ACCORDANCE WITH THE PROJECT SPECIFICATION AS TO AVOID CONDENSATION ON THE PIPE OR PIPE INSULATION.

13 INSTALL ALL WATER PIPING ON WARM SIDE OF BUILDING INSULATION. ALL DOMESTIC WATER AND SANITARY PIPING LOCATED IN AREAS SUBJECT TO FREEZING SHALL BE INSULATED AND PROVIDED WITH HEAT TRACE AS REQUIRED TO PREVENT PIPES FROM FREEZING. PLUMBING CONTRACTOR SHALL COORDINATE HEAT TRACE REQUIREMENTS WITH APPLICABLE TRADES.

14 PROVIDE SEISMIC RESTRAINTS FOR ALL PLUMBING EQUIPMENT PER ILLINOIS PLUMBING CODE, 2012 INTERNATIONAL BUILDING CODE, AND LOCAL REQUIREMENTS.

15 PROVIDE AND INSTALL GREASE, OIL, AND LINT INTERCEPTORS PER CURRENT LOCAL CODES.

16 PROVIDE CLEANOUTS PER LOCAL PLUMBING CODES. CONTRACTOR SHALL COORDINATE ACCESSIBLE LOCATIONS FOR ALL FLOOR AND WALL CLEANOUTS WITH ARCHITECTURAL.

17 REPORT WATER PRESSURE AT SITE TO ENGINEER. VERIFY LOCATION OF PRESSURE REDUCING VALVE WITH WATER DEPARTMENT IF REQUIRED.

18 EACH BATHROOM GROUP SHALL HAVE HOT AND COLD LINE ISOLATION VALVES ON THE WATER SUPPLY PIPING. ALL VALVES SHALL BE LOCATED IN ACCESSIBLE LOCATIONS.

19 PIPING SHOWN IS DIAGRAMMATIC IN NATURE AND INDICATE GENERAL LOCATION AND LAYOUT OF PIPING AND EQUIPMENT USED FOR CALCULATIONS AND SIZING. DRAWINGS ARE NOT INTENDED TO BE SCALED FOR EXACT DIMENSIONS. CONTRACTOR IS RESPONSIBLE FOR ALL COORDINATION WITH OTHER TRADES, INCLUDING PROVIDING ALL OFFSETS AS REQUIRED TO AVOID CONFLICTS. DEVIATIONS FROM GENERAL LAYOUT AS SHOWN SHALL REQUIRE APPROVAL FROM ARCHITECT AND ENGINEER PRIOR TO INSTALLATION.

20 BIDDERS, PRIOR TO SUBMITTING PROPOSALS, SHALL VISIT THE SITE AND FULLY EXAMINE THE AREAS INVOLVED WITH THIS WORK, TO FAMILIARIZE THEMSELVES WITH THE EXACT CONDITIONS AND DIFFICULTIES THAT MAY ATTEND THE EXECUTION OF THIS WORK. SUBMISSION OF A PROPOSAL WILL BE CONSTRUED AS EVIDENCE THAT SUCH AN EXAMINATION HAS BEEN MADE, AND LATER CLAIMS WILL NOT BE RECOGNIZED, FOR EXTRA LABOR, MATERIALS AND EQUIPMENT, REQUIRED BECAUSE OF ADDITIONAL DIFFICULTIES ENCOUNTERED, WHICH COULD HAVE BEEN FORESEEN HAD SUCH AN EXAMINATION BEEN MADE.

21 SUBMIT PDFS OF THE PLUMBING INSTALLATION SHOP DRAWINGS, CERTIFIED BY ALL TRADES THAT COORDINATION HAS BEEN ESTABLISHED. SUBMIT PLUMBING FIXTURE CUTS WITH TRIM, INSULATION, PIPE MATERIALS, FITTINGS, VALVES AND CERTIFIED EQUIPMENT CUTS WITH CONSTRUCTION WIRING DIAGRAMS. SUBMIT PDFS OF OPERATING AND SERVICE MANUALS WHICH SHALL INCLUDE COPIES OF ALL SHOP DRAWINGS, FIXTURE AND EQUIPMENT CUTS, SERVICE INSTRUCTIONS.

22 THE POTABLE WATER SYSTEM SHALL BE DISINFECTED BY FILLING WITH A SOLUTION CONTAINING 200 PPM OF AVAILABLE CHLORINE AND ALLOWING IT TO STAND 3 HOURS. THEN FLUSH THE SYSTEM WITH CLEAN, POTABLE WATER UNTIL CHLORINE LEVELS ARE WITHIN ACCEPTABLE LIMITS. ALL TESTING SHALL BE IN ACCORDANCE WITH LOCAL PLUMBING CODES.

23 DRAINAGE AND VENTING SYSTEMS SHALL BE TESTED BY WATER OR AIR TO PROVE WATERTIGHT. TESTING SHALL BE IN ACCORDANCE WITH LOCAL PLUMBING CODES.

24 ALL FIXTURE TRAPS SUBJECT TO LOSS OF A TRAP SEAL BY EVAPORATION MUST HAVE A TRAP PRIMER INSTALLED IN COMPLIANCE WITH ASSE 1018.

25 ANY HOSE BIBB FIXTURES MUST BE PROVIDED WITH BACKFLOW PREVENTION AND BE IN COMPLIANCE WITH LOCAL PLUMBING CODES.

26 ALL PLUMBING FIXTURES SHALL BE PROVIDED AS PER THE FIXTURE SCHEDULE OR APPROVED EQUAL AS LISTED IN PROJECT SPECIFICATIONS.

27 THE OUTLET TEMPERATURE OF THE RESTROOM LAVATORIES SHALL BE LIMITED TO 110°F. PROVIDE THERMOSTATIC MIXING VALVES AS REQUIRED.

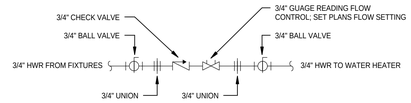
28 PROVIDE A POSITIVE SLOPE TO ALL FLOOR DRAINS. COORDINATE REQUIREMENTS WITH ARCHITECTURAL.

29 ALL PENETRATIONS THROUGH ANY FIRE-RESISTANT RATED ASSEMBLIES MUST BE PROTECTED IN ACCORDANCE WITH THE LOCAL BUILDING CODE.

30 HANGERS, ANCHORS & SUPPORTS SHALL BE IN ACCORDANCE WITH LOCAL PLUMBING CODES.

31 ALL IN-SLAB PIPING SHALL BE PROTECTED FROM BREAKAGE CAUSED BY STRESS OR STRAIN BY A PROTECTIVE SLEEVE OR WRAP-ON MATERIAL.

32 ANY HOSE BIBB FIXTURES MUST BE PROVIDED WITH BACKFLOW PREVENTION AND BE IN COMPLIANCE WITH LOCAL PLUMBING CODES.



12 HOT WATER RETURN BALANCING STATION
NOT TO SCALE

PLUMBING SYMBOLS

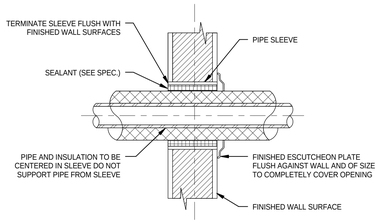
(NOTE: NOT ALL SYMBOLS MAY BE REQUIRED OF THIS PROJECT.)

- BALANCING VALVE
- BALL VALVE
- BUTTERFLY VALVE
- CHECK VALVE / BACKWATER VALVE
- CONTROL POINT — POINT TYPE
- MOTOR OPERATED / CONTROL VALVE
- FLEX CONNECTION
- GATE VALVE - OS&Y
- GATE VALVE - NRS
- GLOBE VALVE
- HOSE END DRAIN VALVE
- INCREASER/REDUCER
- MIXING VALVE
- NEW CONNECTION
- PIPE CAP
- PIPE CUT SYMBOL
- PRESSURE GUAGE
- PRESSURE REGULATING VALVE
- PUMP
- P-1 — PUMP TAG
- T&P — VALVE TYPE
- SAFETY RELIEF VALVE
- SHUT OFF VALVE
- STRIANER
- STRAINER WITH BLOW DOWN VALVE
- THERMOMETER
- THREE WAY MOTOR OPERATED / CONTROL VALVE
- UNION
- NEW CONNECTION
- DEMOLITION LIMIT
- KEY NOTE TAG
- 0 — KEY NUMBER; PLUMBING NOTE TAG
- EQP-X — FIXTURE DESIGNATION; EQUIPMENT TYPE
- TYP / MRK — EQUIPMENT NUMBER
- XX / PXXX — RISER NUMBER; PLUMBING RISER TAG; REFERANCE SHEET
- 1" XXX — PIPE TAG; SYSTEM ABBREVIATION; PIPE SIZE
- PIPE RISE
- PIPE DROP
- WALL HYDRANT / HOSE BIBB
- CLEANOUT
- DOMESTIC COLD WATER
- DOMESTIC HOT WATER
- DOMESTIC HOT WATER RETURN
- VENT
- SANITARY
- STORM

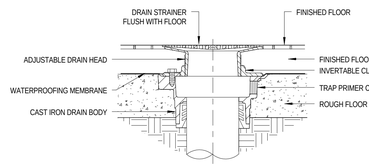
PLUMBING ABBREVIATIONS

(NOTE: NOT ALL ABBREVIATIONS MAY BE REQUIRED OF THIS PROJECT.)

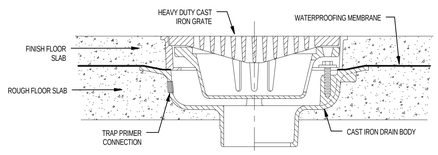
A	AMP
AD	ACCESS DOOR
ADA	AMERICANS WITH DISABILITIES ACT
AFF	ABOVE FINISH FLOOR
AHJ	AUTHORITY HAVING JUSTIDICTION
AI	ANALOG INPUT
APX	APROXIMATE
AO	ANALOG OUTPUT
ARCH	ARCHITECT
AW	ACID WASTE
B	BOILER
BAS	BUILDING AUTOMATION SYSTEM
BFP	BACK FLOW PREVENTER
BFV	BUTTERFLY VALVE
BFT	BUFFER TANK
BHP	BREAK HORSE POWER
BI	BINARY INPUT
BMS	BUILDING MANAGEMENT SYSTEM
BP	BOILER PUMP
BO	BINARY OUTPUT
BT	BATHING/BATH TUB
BTU	BRITISH THERMAL UNIT
BV	BALL VALVE
CA	COMPRESSED AIR
CD	CONDENSATE PIPING
CI	CAST IRON
CLG	CEILING
CO	CLEAN OUT
COP	COEFFICIENT OF PERFORMANCE
CO(TG)	CLEANOUT TO GRADE
COV	CHAIN OPERATED VALVE
CP	CONDENSATE PUMP
CPVC	CHLORINATED POLYVINYL CHLORIDE
CSS	CLINICAL SERVICE SINK
CU IN	CUBIC INCH
CU FT	CUBIC FOOT
CW	COLD WATER
D	DRAIN
DCBP	DOUBLE CHECK VALVE
DCV	DUAL CHECK VALVE
DCDA	DOUBLE CHECK VALVE DETECTOR ASSEMBLY
DDC	DIRECT DIGITAL CONTROL
DI	DE-IONIZED WATER
DIA	DIAMETER
DN	DOWN
DS	DISHSPOUT
DWG	DRAWING
DX	DIRECT EXPANSION
EFF	EFFICIENCY
EL	ELEVATION
EPP	ELEVATOR PIT PUMP
EX. (E)	EXITISTING
ET	EXPANSION TANK
ETR	EXISTING TO REMAIN
EWC	ELECTRIC WATER COOLER
EW	EYE WASH
EWT	ENTERING WATER TEMPERATURE
°F	DEGREE FAHRENHEIT
FCO	FLOOR CLEAN OUT
FD	FLOOR DRAIN
FLA	FULL LOAD AMPS
FP	FIRE PROTECTION
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FPT	FEMALE PIPE THREAD
FS	FLOOR SINK
FT	FOOT / FEET
F&T	FLOAT AND THEMOSTATIC
G	GAS (NATURAL)
GA	GAUGE
GAL	GALLON
GD	GARAGE DRAIN
GE	GROOVED END
GI	GREASE INTERCEPTOR
GPM	GALLONS PER MINUTE
GPH	GALLON PER HOUR
GW	GREASE WASTE
H	HUMIDIFIER
HB	HOSE BIBB
HD	HUB DRAIN
HG	MERCURY
HP	HORSE POWER
HW	HOT WATER
HWR	HOT WATER RETURN
HVAC	HEATING VENTILATING AND AIR CONDITIONING
HX	HEAT EXCHANGER
I/O	INPUT OUTPUT
ID	INSIDE DIAMETER
IM	ICE MAKER
IN	INCH, INCHES
IP	IRON PIPE
IPS	IRON PIPE SIZE
KW	KILOWATT
KO	KNOCK OUT
L	LAVATORY
LBS	POIUNDS
LF	LINEAR FEET
LI	LINT INTERCEPTOR
LP	LIQUIFIED PETROLEUM
LRA	LOCKED ROTOR AMPS
MAX	MAXIMUM
MB	MOP BASIN
MBH	THOUSAND BTU
MIN	MINIMUM
MOCP	MAXIMUM OVER-CURRENT PROTECTION
MOP	MAXIMUM OPERATING PRESSURE
MPT	MALE PIPE THREAD
N/A	NOT APPLICABLE
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NRS	NON-RISING STEM
NTS	NOT TO SCALE
OB	OUTLET BOX
OC	ON CENTER
ODP	OPEN DRIP PROOF
OI	OIL INTERCEPTOR
OS&Y	OUTSIDE STEM AND YOKE
OSD	OPEN SITE DRAIN
OST	OVERFLOW STORM
ORD	OVERFLOW ROOF DRAIN
Ø	PHASE
P	PRESSURE / PUMP
PD	PRESSURE DROP
PE	POLYETHYLENE
P&ID	PIPING AND INSTRUMENTATION DRAWING
PPM	PARTS PER MILLION
PRV	PRESSURE REDUCING VALVE
PSI	POUND PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
R	RETURN
RD	ROOF DRAIN
RLA	RUNNING LOAD AMPS
RM	ROOM
RP	RECIRCULATING PUMP
RPBP	REDUCED PRESSURE BACKFLOW PREVENTER
RPDA	REDUCED PRESSURE DETECTOR ASSEMBLY
RPM	REVOLUTIONS PER MINUTE
RPZ	REDUCED PRESSURE ZONE (VALVE)
S	SUPPLY
SAN	SANITARY
SB	SETTLING BASIN
SD	SHOWER DRAIN
SE	SEWAGE EJECTOR
SF	SERVICE FACTOR
SHV	SHOWER VALVE
SK	SINK
SP	SUMP PUMP
SOV	SHUT OFF VALVE
SQ FT	SQUARE FEET
ST	STORM
STM	STEAM
SV	SOLINOID VALVE
SW	SWITCH
T	TEMPRATURE
TMV	THERMOSTATIC MIXING VALVE
TS	TEMPRATURE SWITCH
TYP	TYPICAL
UL	UNDERWRITERS LABORATORY
UR	URINAL
V	VENT / VOLT
VB	VACUUM BREAKER
VEL	VELOCITY
VFD	VARIABLE FREQUERNCY DRIVE
VTR	VENT THRU ROOF.
W	WASTE / WATTS
W/	WITH
W/O	WITHOUT
WC	WATER CLOSET
WCO	WALL CLEAN OUT
WH	WATER HEATER
WT	WEIGHT



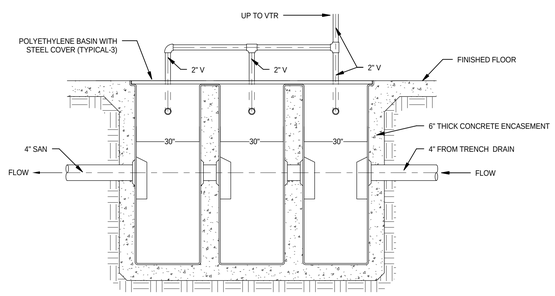
7 PIPE SLEEVE THRU INTERIOR WALL
NOT TO SCALE



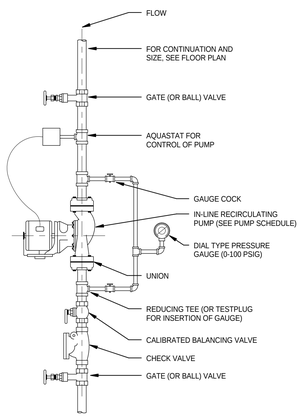
5 TYPICAL FLOOR DRAIN WITH ADJUSTABLE TOP
NOT TO SCALE



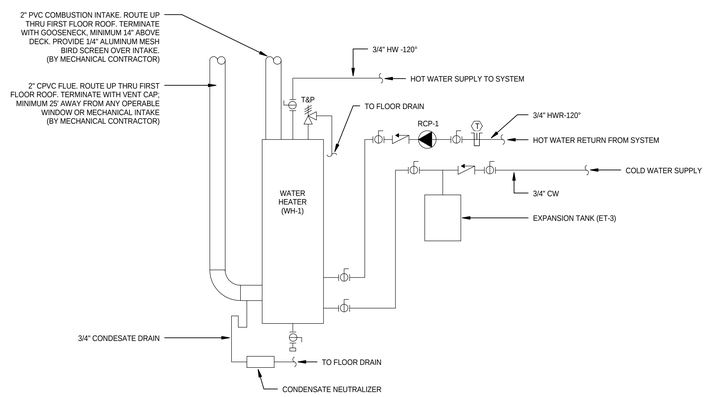
3 12" DIAMETER HEAVY-DUTY DRAIN
NOT TO SCALE



9 TRIPLE BASIN DETAIL
NOT TO SCALE



10 DOMESTIC WATER RECIRCULATING PUMP
NOT TO SCALE



11 WH-1 HIGH EFFICIENCY GAS WATER HEATER
NOT TO SCALE

M

Combined Area Fire Training Facility Re-Bid

851 Krause Drive
Buffalo Grove, IL 60089

Village of Buffalo Grove
50 Raupp Blvd.
Buffalo Grove, IL 60089

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GAGE CONSULTING ENGINEERS, INC.
PROFESSIONAL DESIGN FIRM LICENSE NO. 184.001566, EXPIRES ON 04/30/2019

LICENSED PROFESSIONAL ENGINEER DAVID P. MCVEY 062-048431 STATE OF ILLINOIS
Exp: 11/30/19

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed **PROFESSIONAL ENGINEER** under the laws of the State of **ILLINOIS**

License Number: **062-048431** Date **12-07-2017**

Revisions		
Description	Date	Num
ISSUED FOR REBID	**12/07/2017**	**1**

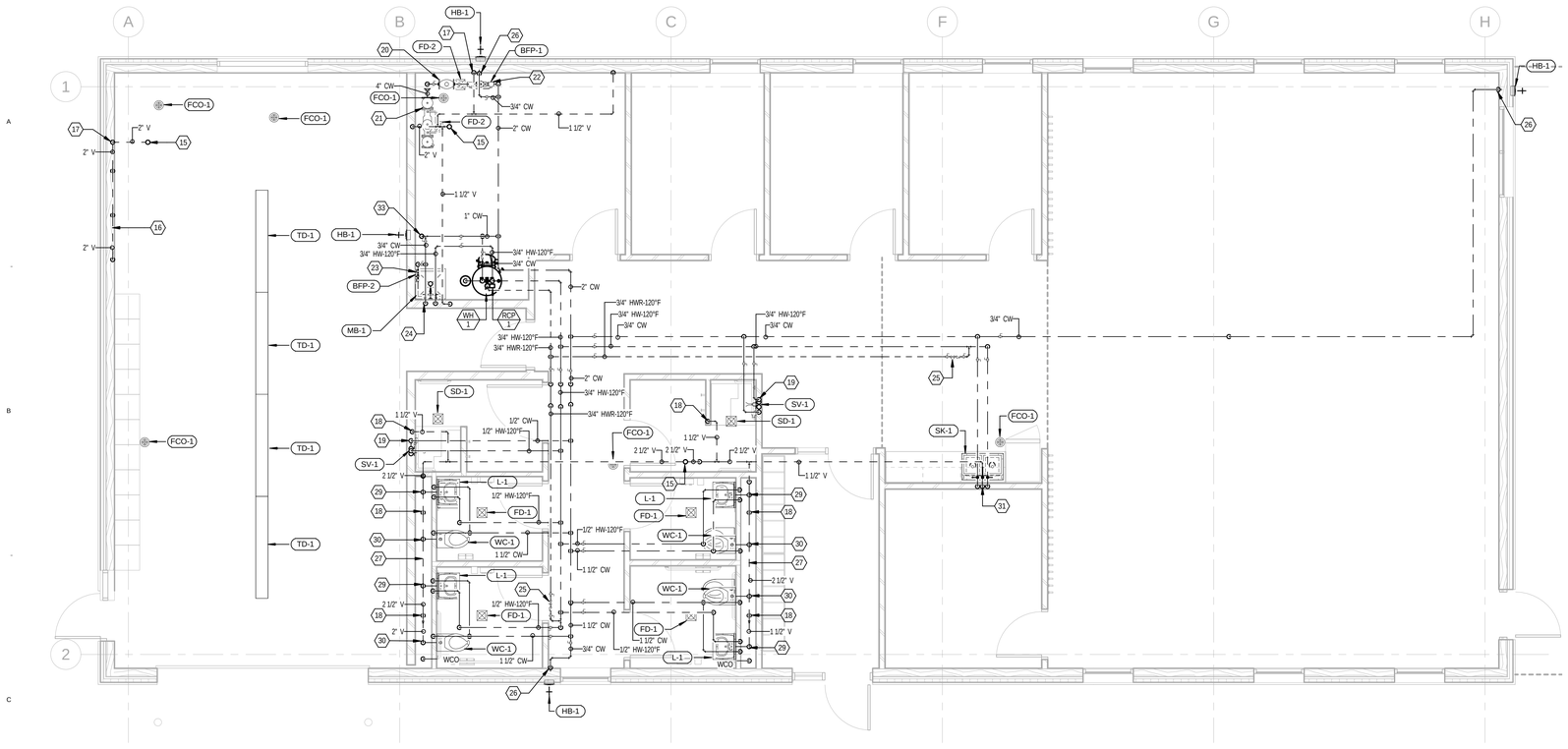
Comm: **173013**
Date: **December 7, 2017**
Drawn: **GM**
Check: **EC**
North

PLUMBING GENERAL NOTES, SYMBOLS, AND DETAILS

Scale: **As indicated**

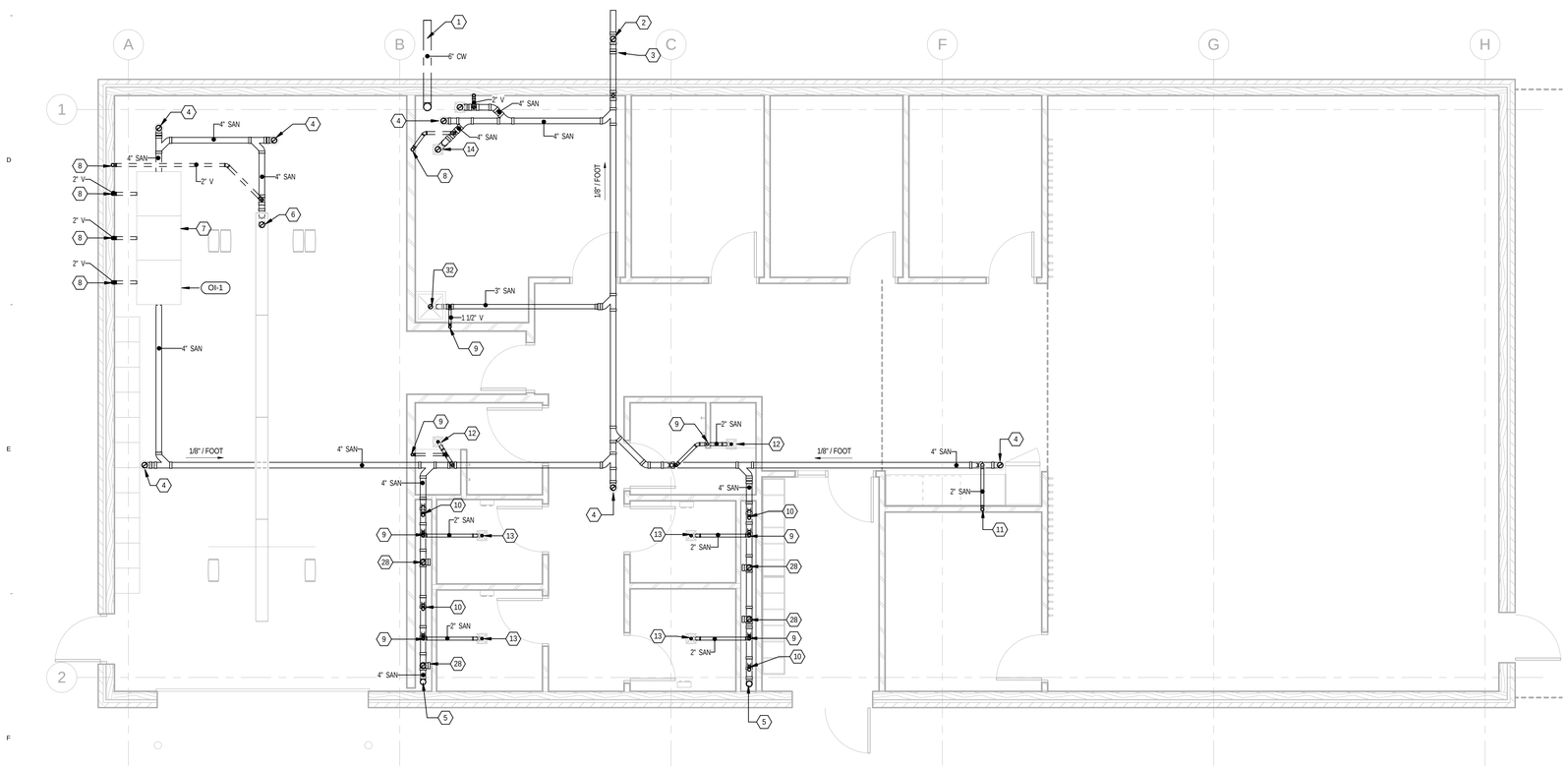
P001

MN



1 PLUMBING PLAN
1/4" = 1'-0"

M



2 UNDERGROUND PLUMBING PLAN
1/4" = 1'-0"

PLUMBING PLAN NOTES

1. ALL DOMESTIC WATER PIPING SHALL BE INSTALLED COMPLETELY ON THE INTERIOR SIDE OF THE BUILDING THERMAL INSULATION. COORDINATE WITH ARCHITECTURAL ON INSULATION LOCATION.
2. ALL PVC PIPING LOCATED IN A AREAS DESIGNATED AS A MECHANICAL PLENUM SHALL BE PROVIDED WITH FIRE WRAP TO A MAINTAIN 25/50 FLAME SPREAD AND SMOKE DEVELOPED RATING.
3. ALL DOMESTIC WATER PIPING SHALL BE INSULATED WITH MINIMUM 1" PIPE INSULATION WITH VAPOR BARRIER JACKET.
4. ALL HOT WATER SUPPLY AND RETURN PIPING SHALL BE INSTATED TO IECC 2015 REQUIREMENTS OR BETTER.
5. ALL HORIZONTAL STORM AND STORM OVERFLOW PIPING SHALL BE PROVIDED WITH MINIMUM 1" PIPE INSULATION WITH VAPOR BARRIER JACKET.
6. ALL EXPOSED INSULATED PIPING BELOW 8' A.F.F. SHALL BE PROVIDED WITH WHITE PVC PROTECTIVE JACKET.
7. ALL ISOLATION AND CONTROL VALVES SHALL BE LOCATED IN AN ACCESSIBLE LOCATION. COORDINATE ACCESS PANEL LOCATIONS WITH ARCHITECTURAL.
8. ROUTE ALL DOMESTIC WATER PIPING SERVING ROOMS ADJACENT TO THE CORRIDOR BELOW THE TRUSS GIRDER. SEE STRUCTURAL AND ARCHITECTURAL DETAILS.
9. ALL DOMESTIC WATER CONNECTING WITH OWNER PROVIDED EQUIPMENT SHALL BE PROVIDED WITH QUARTER TURN BALL VALVE(S) AND WATER HAMMER ARRESTER(S).
10. ALL ISOLATION VALVES SHALL BE PROVIDED WITH INDENTIFICATION OF ROOM OR SPECIFIC FIXTURE OR EQUIPMENT SERVED.
11. MOUNTING HEIGHT OF ALL FIXTURES SHALL BE COORDINATED WITH ARCHITECTURAL PRIOR TO ROUGH IN.

UNDERGROUND PLUMBING PLAN NOTES

1. ALL UNDERGROUND STORM PIPING SHALL BE INSTALLED AT A MINIMUM 1% GRADE DOWN. COORDINATE REQUIRED PIPE INVERT ELEVATION LEAVING THE BUILDING WITH CIVIL ENGINEERING DOCUMENTS.
2. ALL UNDERGROUND SANITARY PIPING LARGER THAN 2" NPS SHALL BE INSTALLED AT A MINIMUM 1% GRADE DOWN. ALL UNDERGROUND SANITARY PIPING 3" NPS AND SMALLER SHALL BE INSTALLED AT A MINIMUM 2% GRADE DOWN. COORDINATE REQUIRED INVERT ELEVATION LEAVING THE BUILDING WITH CIVIL ENGINEERING DOCUMENTS.
3. ALL UNDERGROUND DOMESTIC WATER PIPING OUTSIDE OF THE BUILDING FOOTPRINT SHALL BE INSTALLED AT A MINIMUM 5' BELOW GRADE. COORDINATE EXACT LOCATION WITH CIVIL ENGINEERING DOCUMENTS.
4. ALL UNDERGROUND GREASE WASTE PIPING SHALL BE EXTRA HEAVY WEIGHT CAST IRON, MINIMUM 4" NPS.
5. UNDERGROUND PIPE PENETRATIONS OF STRUCTURAL FOUNDATION WALL SHALL BE PROVIDED WITH PIPE SLEEVES. COORDINATE ALL LOCATIONS WITH STRUCTURAL ENGINEER.
6. ALL FLOOR CLEANOUTS SHALL BE INSTALLED WITH MINIMUM 18" SERVICE CLEARANCE.

P100 KEY NOTES

KEY	NOTE
1	6" INCOMING COMBINED DOMESTIC WATER AND FIRE PROTECTION SERVICE. SEE CIVIL DRAWINGS FOR CONTINUATION AND INVERT REQUIREMENTS.
2	4" BUILDING DRAIN. SEE CIVIL DRAWINGS FOR CONTINUATION AND INVERT REQUIREMENTS.
3	4" UP TO COTG.
4	4" UP TO FCO.
5	4" UP TO WCO.
6	4" UP TO TRENCH DRAIN BOTTOM OUTLET.
7	EXACT LOCATION OF OIL INTERCEPTOR SHALL BE COORDINATED WITH ARCHITECTURAL. INLET AND OUTLET INVERT ELEVATIONS SHALL BE COORDINATED BY CONTRACTOR PRIOR TO PURCHASE OF INTERCEPTOR.
8	2" VENT UP.
9	1-1/2" VENT UP.
10	2" UP TO LAVATORY.
11	2" UP TO SINK.
12	2" UP TO SHOWER DRAIN.
13	2" UP TO FLOOR DRAIN
14	4" UP TO FLOOR DRAIN.
15	4" VTR.
16	MANIFOLD OIL INTERCEPTOR VENTS TOGETHER IN WALL; MINIMUM 6" A.F.F.
17	2" VENT DOWN IN WALL TO UNDERGROUND.
18	1-1/2" VENT DOWN IN WALL TO UNDERGROUND.
19	1/2" DOMESTIC HOT AND COLD WATER DOWN TO SHOWER VALVE.
20	2" DOMESTIC WATER SERVICE. COORDINATE METER REQUIREMENT WITH MUNICIPALITY.
21	4" FIRE PROTECTION SERVICE AND BACKFLOW PREVENTER. SEE FIRE PROTECTION DRAWINGS.
22	ROUTE RPZ DRAIN TO FLOOR DRAIN, DISCHARGE WITH AIR GAP.
23	RPZ FOR CONNECTION TO CHEMICAL SANITIZING STATION. ROUTE RPZ DRAIN TO MOP BASIN, DISCHARGE WITH AIR GAP.
24	3/4" DOMESTIC HOT AND COLD DOWN TO MOP BASIN FAUCET.
25	HOT WATER RETURN BALANCING STATION, SET TO 0.5 GPM. SEE DETAIL ON P001.
26	3/4" DOMESTIC COLD WATER DOWN IN WALL TO HOSE BIBB.
27	MANIFOLD TOILET ROOM FIXTURE VENTS IN PLUMBING CHASE, MINIMUM 6" ABOVE FLOOD RIM OF LAVATORY.
28	4" SANITARY UP TO WALL MOUNTED WATER CLOSET.
29	1/2" DOMESTIC HOT AND COLD, 1-1/2" VENT DOWN TO LAVATORY. 2" WASTE DOWN TO UNDERGROUND.
30	1-1/2" DOMESTIC COLD, 2" VENT DOWN TO WALL MOUNTED WATER CLOSET. 4" SANITARY DOWN TO UNDERGROUND.
31	1/2" DOMESTIC HOT AND COLD, 1-1/2" VENT DOWN TO SINK. 2" WASTE DOWN TO UNDERGROUND.
32	3" SANITARY UP TO MOP BASIN.
33	3/4" DOMESTIC COLD WATER DOWN TO HOSE BIBB.

Combined Area Fire Training Facility Re-Bid

851 Krause Drive
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Village of Buffalo Grove

50 Raupp Blvd.
Buffalo Grove, IL 60089

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GAGE CONSULTING ENGINEERS, INC.
PROFESSIONAL DESIGN FIRM LICENSE NO. 184.001566, EXPIRES ON 04/30/2019

LICENSED PROFESSIONAL ENGINEER
DAVID P. MCVEY
062-048431
STATE OF ILLINOIS
Exp: 11/30/19

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed
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under the laws of the State of **ILLINOIS**

License Number: **062-048431** Date **12-07-2017**

Revisions

Description	Date	Num
ISSUED FOR REBID	**12/07/2017**	**1**

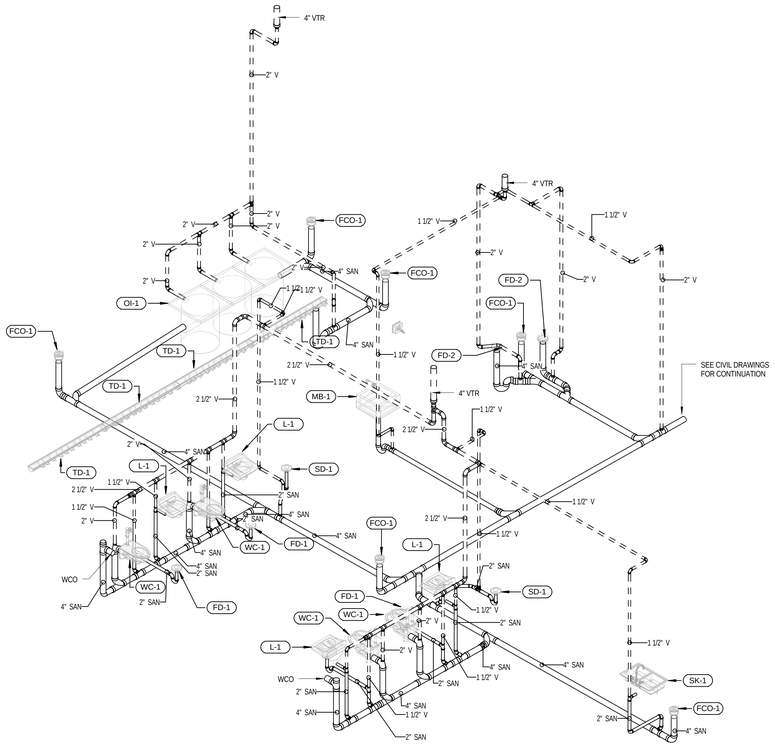
Comm: **173013**
Date: **December 7, 2017**
Drawn: **GM**
Check: **EC**
North

MAIN LEVEL PLUMBING PLANS

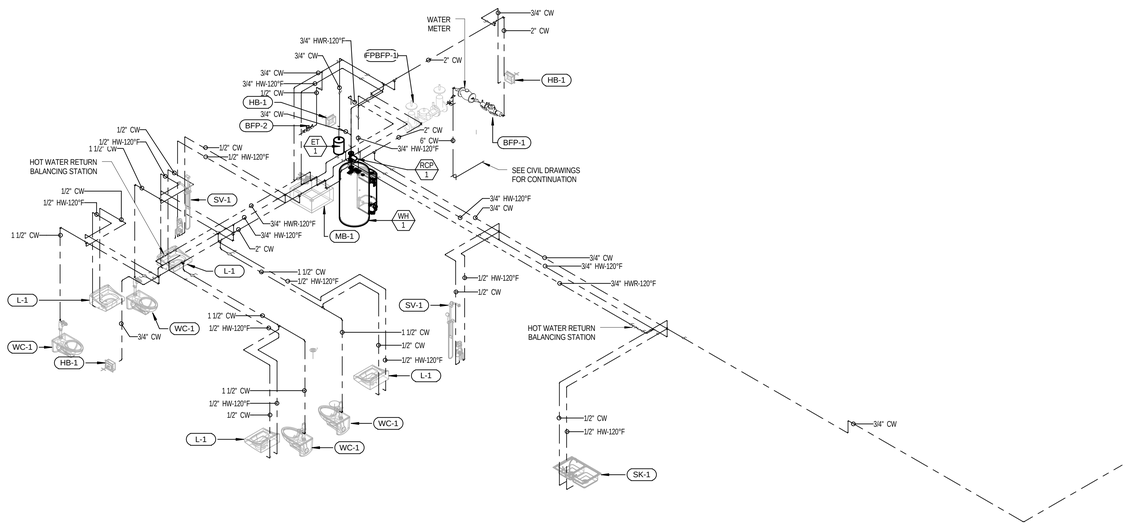
Scale: **As indicated**

P100

MN



1 SANITARY / VENT RISER DIAGRAM



2 DOMESTIC WATER RISER DIAGRAM

M

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North

PLUMBING RISER DIAGRAMS

Scale:

P200

FLOOR DRAIN SCHEDULE

TAG	QTY.	MANUFACTURER	MODEL	STRAINER	STRAINER DIM.	DRAIN BODY	WASTE	SERVICE	DESCRIPTION
FD-1	4	ZURN	Z415S	SQUARE - POLISHED NICKEL BRONZE	6" X 6"	CAST IRON	2"	FINISHED AREAS	DURA-COATED BODY, ADJUSTABLE COLLAR WITH SEEPAGE SLOTS. PROVIDE WITH HEEL PROOF STRAINER, VANDAL PROOF SECURED TOP, DEEP SEAL P-TRAP AND ZURN MODEL Z1022-XL TRAP PRIMER.
FD-2	2	ZURN	Z541	CAST IRON	12"Ø	CAST IRON	4"	MECHANICAL	DURA-COATED BODY AND GRATE. SEEPAGE PAN AND COMBINATION MEMBRANE FLASHING CLAMP AND FRAME, POLYPROPYLENE SEDIMENT BUCKET. PROVIDE WITH, VANDAL PROOF SECURED TOP, DEEP SEAL P-TRAP AND ZURN MODEL Z1022-XL TRAP PRIMER

SHOWER DRAIN SCHEDULE

TAG	QTY.	MANUFACTURER	MODEL	STRAINER	STRAINER DIM.	DRAIN BODY	WASTE	DESCRIPTION
SD-1	2	ZURN	Z415S	SQUARE - NICKEL BRONZE	6" X 6"	CAST IRON	2"	DURA-COATED BODY, ADJUSTABLE COLLAR WITH SEEPAGE SLOTS. LIGHT DUTY SQUARE LEVELING STRAINER, VANDAL PROOF SECURED TOP. PROVIDE DEEP SEAL P-TRAP.

CLEANOUT SCHEDULE

TAG	QTY.	MANUFACTURER	MODEL	TOP	BODY	PIPE SIZE	SERVICE	DESCRIPTION
FCO-1	6	ZURN	Z1400	ROUND - POLISHED NICKEL BRONZE	CAST IRON	4"	ALL AREAS	DURA-COATED BODY WITH GAS AND WATER TIGHT ABS TAPERED THREAD PLUG AND ROUND EXTRA SECURED TOP ADJUSTABLE TO FINISHED FLOOR. PROVIDE WITH VANDAL-PROOF SCREWS.

FLUSH VALVE WATER CLOSET SCHEDULE

			TOILET		FLUSH VALVE						
TAG	QTY.	SERVICE	MANUFACTURER	MODEL	MANUFACTUERER	MODEL	GPF	SANITARY	CW	DESCRIPTION
WC-1	4	PUBLIC TOILET	AMERICAN STANDARD	2257.001	SLOAN	ECOS 115-1.28 HW	1.3 gal	4"	1"	WALL MOUNTED ELONGATED FLUSHOMETER TOILET, VITREOUS CHINA, WHITE FINISH, 16-1/2" BOWL HEIGHT. PROVIDE CARRIER AND BEMIS MODEL 3155SSCT ANTI-MICROBIAL OPEN FRONT SEAT LESS COVER. HARD WIRED SENSOR ACTIVATED FLUSH VALVE. PROVIDE WALL CARRIER AND ESCUTCHEON PLATE. ADA COMPLIANT FIXTURE.

MOP BASIN SCHEDULE

		BASIN		FAUCET					
TAG	QTY.	MANUFACTURER	MODEL	MANUFACTURER	MODEL	WASTE	CW	HW	DESCRIPTION
MB-1	1	FIAT	TSB-100	CHICAGO FAUCET	814-VBCP	3"	1/2"	1/2"	12" TERRAZZO MOP BASIN WITH STAINLESS STEEL CAPS ON ALL CURBS. PROVIDE WITH STAINLESS STEEL STRAINER. FAUCET SHALL BE WALL MOUNTED WITH INTEGRAL PAIL HOOK AND VACUUM BREAKER.

LAVATORY SCHEDULE

		BASIN		FAUCET					
TAG	QTY.	MANUFACTURER	MODEL	MANUFACTURER	MODEL	WASTE	CW	HW	DESCRIPTION
L-1	4	AMERICAN STANDARD	0356.421	SLOAN	EAF200-ISM	1 1/2"	1/2"	1/2"	ADA COMPLIANT FIXTURE - WALL HUNG VITREOUS CHINA, SINGLE FAUCET HOLE, D-SHAPED BOWL WITH FRONT OVERFLOW. HARD WIRED POLISHED CHROME IR SENSOR FAUCET. 0.5 GPM FLOW RATE. PROVIDE POINT OF USE THERMOSTATIC MIXING VALVE, LOOSE KEY STOPS, STAINLESS STEEL GRID STRAINER, TAILPIECE, P-TRAP, AND CARRIER. INSULATE EXPOSED DOMESTIC WATER AND WASTE LINES PER ADA REQUIREMENTS.

HOSE BIBB SCHEDULE

TAG	QTY.	MANUFACTURER	MODEL	CW	DESCRIPTION
HB-1	4	WOODFORD MANUFACTURING COMPANY	B65C-6	1/2"	ANTI-SIPHON FREEZELESS WALL HYDRANT – ¾" MALE HOSE THREAD VACUUM BREAKER. CHROME PLATED CONCEALED RECTANGULAR WALL BOX, AND LOOSE KEY OPERATION. COORDINATE WALL THICKNESS WITH ARCHITECTURAL.

BACKFLOW PREVENTOR SCHEDULE

						RATED CONDITIONS	
TAG	QTY	SIZE	MANUFACTURER	MODEL	DISCRIPTION	FLOW	PRESSURE
BFP-1	1	2"	WATTS	LF009-M2-QT	REDUCED PRESSURE ZONE BACKFLOW PREVENTER ASSEMBLY	80 GPM	13.00 psi
BFP-2	1	1/2"	WATTS	LF009-QT	REDUCED PRESSURE ZONE BACKFLOW PREVENTER ASSEMBLY	5 GPM	17.00 psi

SINK SCHEDULE

		BASIN		FAUCET					
TAG	QTY.	MANUFACTURER	MODEL	MANUFACTURER	MODEL	WASTE	CW	HW	DESCRIPTION
SK-1	1	ELKAY	LRAD332265PD	CHICAGO FAUCET	201-AGN8AE29-317AB	1 1/2"	1/2"	1/2"	TOP MOUNT DOUBLE BOWL SINK WITH TWO PERFECT DRAIN STRAINER ASSEMBLIES, 6.5" BOWL DEPTH, 18 GAUGE STAINLESS STEEL WITH LUSTERTONE FINISH. WITH REAR CENTER DRAIN PLACEMENT. 8" RIDGED/SWING GOOSENECK SPOUT, 4" VANDAL PROOF WRIST BLADE HANDLE, CHROME FINISH, QUARTER TURN COMPRESSION CARTRIDGES, AND 2.2 GPM LAMINAR FLOW NON AERATING OUTLET. PROVIDE P- TRAP FOR EACH BOWL, LOOSE KEY STOPS, AND ESCUTCHEON PLATES.

SHOWER VALVE SCHEDULE

TAG	QTY.	MANUFACTURER	MODEL	CW	HW	DESCRIPTION
SV-1	2	DELTA	T13H152	1/2"	1/2"	SHOWER VALVE – POLISHED CHROME PLATED FINISH. PRESSURE BALANCED 1.2 GPM CARTRIDGE WITH FIELD ADJUSTABLE LIMIT, INTEGRAL CHECKS ON HOT AND COLD SUPPLIES. METAL LEVER HANDLE. HAND SHOWER WITH TWO CHECK VALVES AND NON-POSITIVE SHUT OFF, 24" STAINLESS STEEL SLIDE BAR. PROVIDE DELTA MODEL R10000-UNWS ROUGH-IN. ADA COMPLIANT FIXTURE.

OIL INTERCEPTOR SCHEDULE

TAG	QTY.	MANUFACTURER	MODEL	BODY	WASTE	BASIN DEPTH	HOLDING CAPACITY	DESCRIPTION
OI-1	1	ZURN	Z885	POLYETHYLENE	4"	3' - 0"	216 gal	TRIPPLE BASIN OIL SEPARATOR. 1/4" THICK BODY, MEDIUM DUTY 1/4" THICK STEEL DIAMOND PLATE COVERS.

GAS WATER HEATER SCHEDULE

NOTES:
1.COPPER NICKEL HEAT EXCHANGER, STAINLESS STEEL 316L TANK.
2.UNIT TO BE MOUNTED ON 4" CONCRETE HOUSEKEEPING PAD.
3.PROVIDE ACID NOTARIZATION KIT. ROUTE DRAIN TO OVER FLOOR DRAIN.
4.PROVIDE T&P RELIEF VALVE ROUTE TO FLOOR DRAIN.
5.PROVIDE EXPANSION TANK (ET-1). MINIMUM 4.4 GALLON ACCEPTANCE.
6.PROVIDE NON-FUSED DISCONNECT SWITCH. COORDINATE WITH ELECTRICAL.

						GPH RECOVERY	SUPPLY	ELECTRICAL			
MARK	MANUFACTURER	MODEL	STORAGE	INPUT	THERMAL EFF.	@ 100°F RISE	TEMPERATURE	VOLTAGE	Ø	WEIGHT	NOTES
WH 1	HTP	PH76-50	45 gal	76000 Btu/h	97%	97 gal	140 °F	120 V	1	155 lb	1,2,3,4,5,6

RECIRCULATION PUMP SCHEDULE

NOTES:
1.PROVIDE NON-FUSED DISCONNECT SWITCH. COORDINATE WITH ELECTRICAL.
2.PROVIDE AQUASTAT FOR ON/OF CONTROL.

								ELECTRICAL			
MARK	MANUFACTURER	MODEL	DESCRIPTION	FLOW	HEAD	INLET SIZE	DISCHARGE SIZE	MOTOR HP	VOLTAGE	Ø	NOTES
RCP 1	TACO	009-SF5	CARTRIDGE CIRCULATOR. DIRECT DRIVE, REPLACEABLE CARTRIDGE, SELF LUBRICATING, STAINLESS STEEL CONSTRUCTION FOR DOMESTIC WATER SERVICE, NON-METALLIC IMPELLER.	8 GPM	12.00 psi	3/4"	3/4"	0.13 hp	115 V	1	1,2

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Drawn: **GM**
Check: **EC**
North

PLUMBING SCHEDULES

Scale:

P300

LUMINAIRES

LT-1 / A1a — LUMINAIRE CONNECTED TO NORMAL POWER SOURCE

LUMINAIRE CONNECTED TO ESSENTIAL ELECTRICAL SYSTEM CRITICAL BRANCH

LUMINAIRE CONNECTED TO ESSENTIAL ELECTRICAL SYSTEM LIFE SAFETY BRANCH

EXIT SIGN

EMERGENCY LIGHT

ADJACENT LETTERS INDICATED ON SYMBOLS ABOVE INDICATE THE FOLLOWING:

LT-1: LUMINAIRE TYPE PER LUMINAIRE SCHEDULE
A: POWER SOURCE PANEL
1: CIRCUIT NUMBER
a: SWITCH CONTROL
R1: RELAY DESIGNATION FOR LIGHTING FIXTURES CONTROLED VIA A RELAY LIGHTING CONTROL PANEL

LIGHTING CONTROLS

OS — OVERRIDE SWITCH, +44" A.F.F. IN WALL

MS — MOTION SENSOR

PCT — PHOTOCELL / COMBINATION PHOTOCELL AND MOTION SENSOR

PP — POWER / RELAY PACK

SINGLE POLE WALL SWITCH, +44" A.F.F IN WALL

ADJACENT LETTERS INDICATED WITHIN SYMBOLS ABOVE INDICATE THE FOLLOWING LIGHTING CONTROL REQUIREMENTS:

V: VACANCY MODE, MANUAL ON / AUTO OFF CONTROLS
O: OCCUPANCY MODE, AUTO ON / AUTO OFF CONTROLS

NOTE:
1. REFER TO LIGHTING CONTROL DEVICE SCHEDULE FOR SPECIFIC DEVICE DESCRIPTION.

WIRING DEVICES

DUPLEX RECEPTACLE - 20A, 125V, 2P, 3W (NEMA5-20R) -18" A.F.F. IN WALL OR AS NOTED

QUADRAPLEX RECEPTACLE - 20A, 125V, 2P, 3W (NEMA5-20R) -18" A.F.F. IN WALL OR AS NOTED

DUPLEX RECEPTACLE - 20A, 125V, 2P, 3W (NEMA 5-20R) -6" IN WALL ABOVE COUNTER TOP OR AS NOTED

QUADRAPLEX RECEPTACLE-20A, 125V, 2P, 3W (NEMA 5-20R) -6" IN WALL ABOVE COUNTER TOP OR AS NOTED

J — JUNCTION BOX IN WALL

J — JUNCTION BOX IN CEILING

A1 / GF — ADJACENT LETTERS INDICATED ON PLANS FOR THE SYMBOLS ABOVE INDICATE THE FOLLOWING:

A: INDICATES POWER SOURCE PANEL
1: INDICATES CIRCUIT NUMBER
GF: INDICATES GROUND FAULT CIRCUIT INTERRUPTER
TR: INDICATES TAMPER-RESISTANT
WP: INDICATES WEATHER PROOF IN-USE RECEPTACLE

LOW VOLTAGE SYSTEM DEVICES

TELEPHONE/DATA OUTLET -18" A.F.F. IN WALL OR AS NOTED

TELEPHONE/DATA OUTLET -6" IN WALL ABOVE COUNTER TOP OR AS NOTED

TV — TELEVISION OUTLET IN WALL

ACCESS CONTROL SYSTEM DEVICES

CR — CARD READER - JUNCTION BOX AT 42"

DC — DOOR CONTACT IN DOOR FRAME

DS — DOOR STRIKE IN DOOR FRAME

RE — REQUEST-TO-EXIT SENSOR

ED — ELECTRIC DOOR POWER CONNECTION IN DOOR FRAME

ELECTRICAL EQUIPMENT

PANELBOARD

NON-FUSED DISCONNECT SWITCH

VFD — VARIABLE FREQUENCY DRIVE

AHU 1 — MECHANICAL EQUIPMENT TAG

39.1 — KITCHEN EQUIPMENT TAG

CONDUIT, RACEWAYS AND WIRING

EXPOSED CONDUIT OR SURFACE RACEWAY 'R' INDICATES RACEWAY

CONDUIT CONCEALED IN WALL OR CEILING CONSTRUCTION

CONDUIT CONCEALED IN FLOOR CONSTRUCTION OR UNDERGROUND

FIRE ALARM SYSTEM DEVICES

FACP — FIRE ALARM CONTROL PANEL

FAA — FIRE ALARM ANNUNCIATOR

S — MANUAL PULL STATION 44" ABOVE FLOOR

AV — AUDIBLE DEVICE WITH VISUAL ALARM LIGHT 80" ABOVE FLOOR OR 6" BELOW CEILING, WHICHEVER IS LOWER

V — VISUAL ALARM LIGHT 80" ABOVE FLOOR OR 6" BELOW CEILING, WHICHEVER IS LOWER

SD — SMOKE DETECTOR

WF — SPRINKLER FLOW SWITCH

Z M — ZONE ADDRESSABLE MODULE FOR FIRE ALARM MONITOR

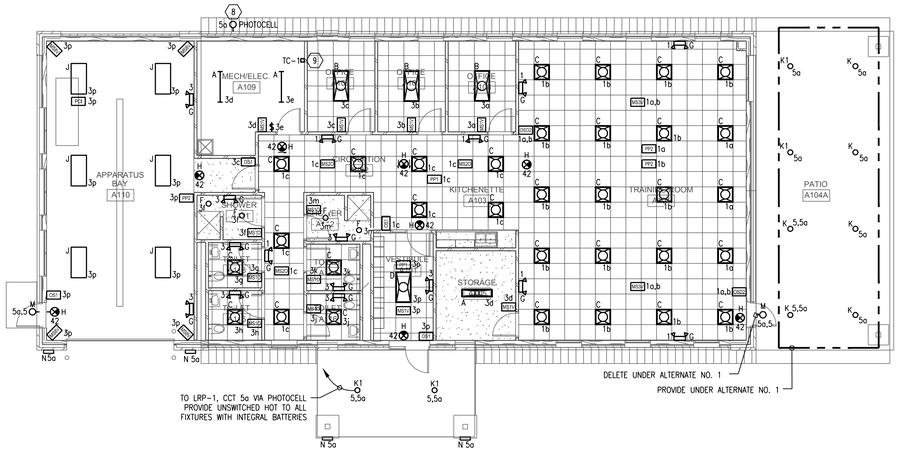
VSS — TAMPER PROOF SPRINKLER VALVE SWITCH

GENERAL NOTES (FOR ALL DRAWINGS):

1. SEE ARCHITECTURAL DRAWINGS AND ELEVATIONS FOR EXACT MOUNTING HEIGHTS AND LOCATIONS OF ALL ELECTRICAL DEVICES, PRIOR TO ROUGH-IN.
2. ALL CIRCUITS SHALL BE RUN WITH DEDICATED NEUTRALS. SHARED NEUTRALS ARE NOT ALLOWED. THE NEUTRAL IS CONSIDERED A CURRENT CARRYING CONDUCTOR AND THE MAXIMUM NUMBER OF CURRENT CARRYING CONDUCTORS ALLOWED IN A RACEWAY IS EIGHT (8).
3. ALL 120V HOMERUNS OVER 75 FEET SHALL BE RUN WITH A MINIMUM OF #10 WIRE AND ALL 120V HOMERUNS OVER 100 FEET SHALL BE RUN WITH A MINIMUM OF #8 WIRE.
4. LABEL ALL RECEPTACLES WITH THE PANEL AND CIRCUIT NAME SERVING THEM.
5. BACK BOXES SHALL NOT BE MOUNTED BACK TO BACK IN ACOUSTICAL PARTITIONS OR PARTITIONS CONTAINING SOUND BATTING.

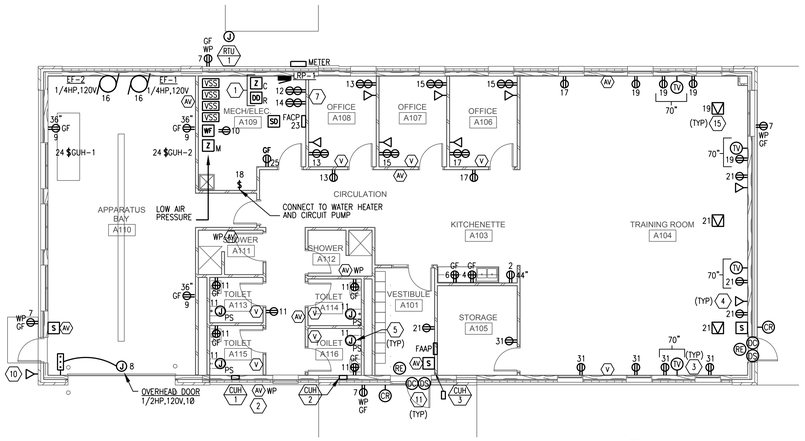
KEY NOTES:

1. PROVIDE A RETURN AIR DUCT MOUNTED SMOKE DETECTOR AND FAN SHUTDOWN MODULE FOR CONNECTION TO RTU-1
2. PROVIDE A FIRE ALARM AUDIO/VISUAL DEVICE, AS REQUIRED BY THE AHJ, FOR THE WATER FLOW INDICATION.
3. RUN A 3/4" EMPTY CONDUIT FROM EACH TELEVISION OUTLET UP TO THE NEAREST ACCESSIBLE CEILING SPACE, WITH GROMMETTED ENDS. PROVIDE RG6U JACK AND CABLE TO THE MAIN IT LOCATION SPLITTER/AMPLIFIER
4. RUN A 1" EMPTY CONDUIT FROM EACH TELEPHONE/DATA OUTLET UP TO THE NEAREST ACCESSIBLE CEILING SPACE, WITH GROMMETTED ENDS. PROVIDE (2) CAT6 JACKS AND CABLING TO THE WALL MOUNTED PATCH PANEL AT THE MAIN IT LOCATION.
5. PROVIDE A POWER CONNECTION TO THE CEILING MOUNTED PLUMBING FIXTURE POWER SUPPLY. PROVIDE ALL RACEWAYS AND WIRING REQUIRED TO EACH POWERED PLUMBING FIXTURE. COORDINATE ALL REQUIREMENTS WITH THE PLUMBING CONTRACTOR.
6. TERMINATE THE COMED PRIMARY CONDUITS TO WHERE DIRECTED BY COMED.
7. PROVIDE THE FOLLOWING AT THE MAIN IT LOCATION:
   - 48" X 96" X 1" FIRE RATED PLYWOOD TELEPHONE BOARD
   - GROUND BAR WITH #6 GROUND RUN TO THE SERVICE GROUND BAR
   - WALL MOUNTED CATV DISTRIBUTION
   - WALL MOUNTED PATCH PANEL FOR TELEPHONE/DATA
   - EMPTY CONDUITS FOR TELEPHONE/DATA/CABLE SERVICES STUBBED UP 6" ABOVE FLOOR. SEE SITE PLAN FOR CONTINUATION.
8. PROVIDE A 120 VOLT ADJUSTABLE FOOTCANDLE LEVEL PHOTOCELL FOR CONTROL OF EXTERIOR LIGHTING CIRCUIT 5a.
9. PROVIDE AN ASTRONOMIC TIMECLOCK FOR CONTROL OF EXTERIOR LIGHTING CIRCUIT 5b. SET THE TIMECLOCK TO OPERATED FROM DUSK TO 10PM.
10. PROVIDE A JUNCTION BOX WITH WEATHERPROOF COVER, MOUNTED AT 14'-0" A/GRADE, WITH (1) CAT6 CABLE RUN TO THE PATCH PANEL, FOR FUTURE CAMERA.
11. ALL DOOR ACCESS BOXES/CONDUITS ARE FOR FUTURE USE. PROVIDE 1/2" CONDUITS STUBBED UP TO THE CEILING SPACE AND PROVIDE BLANK COVER PLATES ON ALL JUNCTION BOXES.
12. REMOVE THE EXISTING POLE MOUNTED LIGHTING FIXTURE AND REPLACE WITH NEW TWIN LIGHTING FIXTURE TYPE "XA". MODIFY THE EXISTING POLE AND TENON AS REQUIRED TO INSTALL THE NEW FIXTURES. CONNECT TO THE EXISTING CIRCUITING.
13. DISCONNECT AND REMOVE THE ABANDONED ELECTRICAL METER FITTING, STRUCTURE AND TELEPHONE SERVICE.
14. TERMINATE THE TELEPHONE/DATA/CABLE CONDUITS WHERE DIRECTED BY THE UTILITY COMPANIES.
15. PROVIDE A CAST IRON, 2 GANG FLOOR BOX WITH ONE DUPLEX RECEPTACLE AND ONE DATA JACK LOCATION (PROVIDE 2 DATA JACKS) WITH BLACK COVER. RUN A 1" CONDUIT FROM THE DATA SECTION UP TO THE CEILING SPACE, WITH GROMMETTED ENDS.
16. PROVIDE A 1" CONDUIT, STUBBED UP 6" A/GRADE WITH CAP, FOR FUTURE GATE ACCESS EQUIPMENT. TERMINATE THE CONDUIT AT THE TELEPHONE BOARD IN MECH/ELECT A109
17. PROVIDE A 1" CONDUIT, STUBBED UP 6" A/GRADE WITH CAP, FOR FUTURE POWER TO GATE. TERMINATE THE CONDUIT IN PANEL LRP-1.



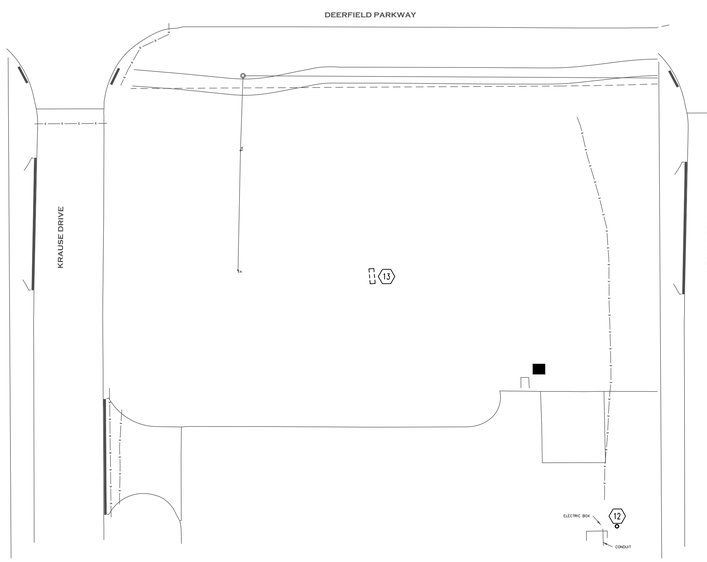
MAIN LEVEL LIGHTING PLAN

SCALE: 1/8" = 1' - 0"



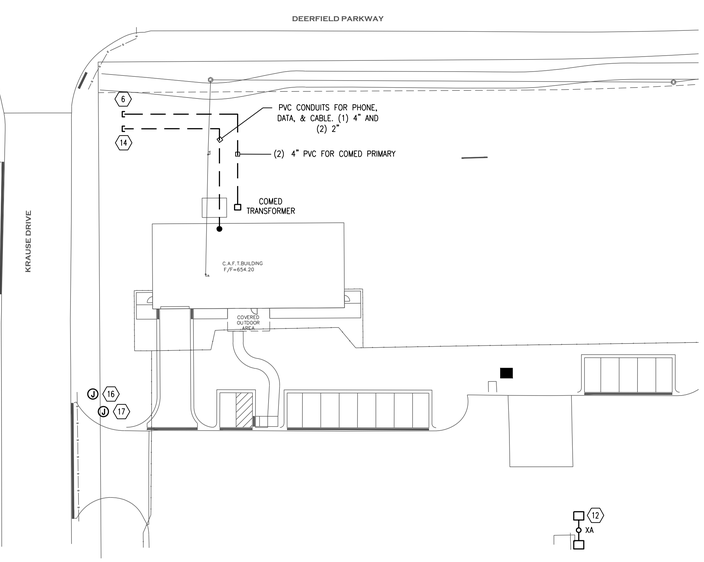
MAIN LEVEL POWER PLAN

SCALE: 1/8" = 1' - 0"



SITE DEMOLITION PLAN

SCALE: 1" = 30' - 0"



SITE ELECTRICAL PLAN

SCALE: 1" = 30' - 0"

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Exp: 11/30/19

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License Number: 062-048431 Date: 12-07-2017

Revisions		
ADDENDUM NO.1	08/03/2017	1
ISSUED FOR REBID	12/07/2017	2

Comm: 173013 / 17036
Date: DEC 7, 2017
Drawn: RS
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North

ELECTRICAL PLANS

Scale:

E101

IL

A

17038E101

LIGHTING CONTROL DEVICE SCHEDULE

TYPE	DESCRIPTION	MANUFACTUERER	MODEL	MOUNTING	NOTES
OS1	OVERRIDE SWITCH THAT PROVIDES LOCAL CONTROL OF ONE (1) LIGHTING ZONE	ACUITY - nLIGHT LEVITON LUTRON	#nPODM EQUIVALENT EQUIVALENT	WALL RECESSED	
OSD2	OVERRIDE RAISE/LOWER DIMMING SWITCH THAT PROVIDES LOCAL CONTROL OF TWO (2) LIGHTING ZONES	ACUITY - nLIGHT LEVITON LUTRON	#nPODM-DX-2P EQUIVALENT EQUIVALENT	WALL RECESSED	
MS1	WALL SENSOR W/ PIR/MICROPHONICS DETECTION THAT PROVIDES CONTROL OF ONE (1) LIGHTING ZONE. PROVIDES 180° COVERAGE BY 20' FOR SMALL AND 36' AWAY FOR LARGE MOTION	ACUITY - SENSOR SWITCH LEVITON LUTRON	#WSX PDT EQUIVALENT EQUIVALENT	WALL RECESSED	1
MS2	CEILING SENSOR W/ DUAL DETECTION (PIR/MICROPHONICS). PROVIDES 360° 500 SQ FT COVERAGE DESIGNED FOR SMALL MOTION DETECTION	ACUITY - nLIGHT LEVITON LUTRON	#nCM-PDT-9-RJB EQUIVALENT EQUIVALENT	CEILING SURFACE	1
MS3	CEILING SENSOR W/ DUAL DETECTION (PIR/MICROPHONICS). PROVIDES 360° 2000 SQ FT COVERAGE DESIGNED FOR LARGE MOTION DETECTION	ACUITY - nLIGHT LEVITON LUTRON	#nCM-PDT-10-RJB EQUIVALENT EQUIVALENT	CEILING SURFACE	1
MS8	CORNER WIDE VIEW SENSOR WITH DUAL DETECTION (PIR/MICROPHONICS). PROVIDES 120° BY 40' COVERAGE FOR SMALL MOTION AND 70' AWAY FOR LARGE MOTION DETECTION.	ACUITY - nLIGHT LEVITON LUTRON	#nWV PDT16 EQUIVALENT EQUIVALENT	WALL SURFACE	
PP1	POWER / RELAY PACK CAPABLE OF SWITCHING LOADS UP TO 16A	LEVITON	#nPP16 EQUIVALENT EQUIVALENT	ACCESSIBLE CEILING SPACE	2
PP2	POWER / RELAY PACK CAPABLE OF 0-10V DIMMING LOADS UP TO 16A	LUTRON	#nPP16-D EQUIVALENT EQUIVALENT	ACCESSIBLE CEILING SPACE	2
PC1	CEILING DAYLIGHT HARVESTING PHOTOCELL CAPABALE OF AUTOMATIC DIMMING CONTROL	ACUITY - nLIGHT LEVITON LUTRON	#nCM ADCX-RJB EQUIVALENT EQUIVALENT	CEILING SURFACE	

NOTES:
1. THE ADJACENT LETTER THAT FOLLOWS THE MOTION (MS1X) AND COMBINATION PHOTOCELL/MOTION (PCX)SENSORS WITHIN THE SYMBOL INDICATES LIGHTING CONTROL REQUIREMENTS. 'V' INDICATES VACANCY MODE (MANUAL ON/ AUTO OFF). 'O' INDICATES OCCUPANCY MODE (AUTO ON/ AUTO OFF).
2. POWER PACK SHALL RUN IN CONJUNCTION WITH THE LOCAL OVERRIDE SWITCH . MOUNT THE POWER PACK IN THE NEAREST ACCESSIBLE CEILING SPACE. EC SHALL VERIFY EXACT QUANTITY WITH THE MANUFACTURER, PRIOR TO BIDDING.
3. FOR THE LOCAL LIGHTING CONTROL SYSTEM, CONTRACTOR SHALL REFER TO THE LIGHTING CONTROL DEVICE SCHEDULE FOR FURTHER REQUIREMENTS. THE ELECTRICAL CONTRACTOR SHALL COORDINATE THE EXACT QUANTITY OF LIGHTING CONTROL DEVICES REQUIRED WITH THE MANUFACTURER'S SUBMITTED SHOP DRAWINGS FOR A COMPLETE AND FUNCTIONING SYSTEM, PRIOR TO BIDDING. THIS INCLUDES ALL OVERRIDE SWITCHES (OS), SENSORS (MS), POWER PACKS (PP), ETC. ANY CONFLICT, DISCREPANCY OR INCONSISTENCY THAT OCCURS WITHIN OR BETWEEN THE CONTRACT DOCUMENTS AND THE LIGHTING CONTROL SHOP DRAWINGS SHALL BE INCLUDED IN THE SCOPE WORK AT NO ADDITIONAL COST TO OWNER.

LRP-1 — 42 CIRCUITS

DISTRIBUTION SYSTEM: 208/120V 3Ø 4W

MAIN DEVICE: 200a,3P MAIN BREAKER
AIC RATING: 35 KAIC
MOUNTING: SURFACE
FED FROM:

CONNECTED LOAD	DEMAND LOAD
37.83 KVA	30.28 KVA
105.08 AMPS	84.11 AMPS

NOTES:
1 = PROVIDE LOCKOUT

CKT #	TRIP/ POLE	NOTE	LOAD TYPE	LOAD DESCRIPTION	CONNECTED LOAD (KVA) AØ		BØ		CØ		LOAD DESCRIPTION	LOAD TYPE	NOTE	TRIP/ POLE	CKT #
1	20/1	1	L	L	1.12	1.20					R - REFRIG.	A		20/1	2
3	20/1	1	L	L			1.18	1.20			R - MICROWAVE	A		20/1	4
5	20/1	1	L	L - EXTERIOR					0.23	1.20	R - COFFEE	A		20/1	6
7	20/1		R	R - EXTERIOR	0.72	1.00					DOOR	A		20/1	8
9	20/1		R	R - APPARATUS BAY			0.54	1.20			SPRINKLER AIR	M		20/1	10
11	20/1		R	R					0.90	1.08	R - IT	R		20/1	12
13	20/1		R	R	0.90	1.08					R - IT	R		20/1	14
15	20/1		R	R			1.08	1.40			EF-1 AND EF-2	M		20/1	16
17	20/1		R	R					0.72	0.40	H.W. HEATER & PUMP	M		20/1	18
19	20/1		R	R	0.90	1.50					CUH-1	H		20/1	20
21	20/1		R	R			0.90	1.50			CUH-2	H		20/1	22
23	20/1	1	M	FACP					0.20	0.40	GH-1,2	H		20/1	24
25	20/1		R	R	0.18						SPARE	R		20/1	26
27	20/2		H	CUH-3			1.50				SPARE	R		20/1	28
29			H						1.50		SPARE	R		20/1	30
31	20/1		R	R	0.90						SPARE	R		20/1	32
33	20/1			SPARE			0.00				SPARE	R		20/1	34
35	20/1			SPARE					0.00		SPD			60/3	36
37	45/3		C	RTU-1	3.70										38
39			C				3.70								40
41			C						3.70	0.10	L - EXITS	L	1	20/1	42
					8.42	4.78	8.90	5.30	7.25	3.18					
					13.20		14.20		10.43						

LOAD TYPE	CONNECTED LOAD (KVA)	DEMAND FACTOR (%)	DEMAND LOAD (KVA)
L - LIGHTING	2.63	1.00	2.63
R - RECEPTACLES	9.90	NEC TABLE 220.44	9.90
M - MOTORS	3.20	1.00	3.20
H - HEATING (NONCOINCIDENT)	6.40	1.00	6.40
C - COOLING (NONCOINCIDENT)	11.10	1.00	11.10
EH - ELECTRIC REHEAT	0.00	0.60	0.00
A - APPLIANCE	4.60	0.75	3.45
KE - KITCHEN EQUIPMENT	0.00	1.00	0.00

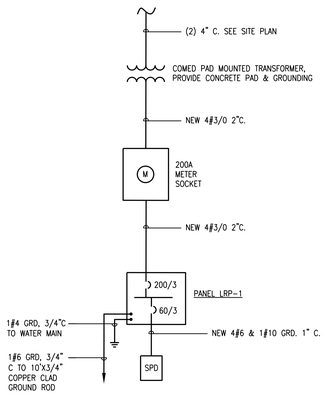
MECHANICAL EQUIPMENT SCHEDULE

TAG	EQUIPMENT	LOAD HP	LOAD KVA	LOAD FLA	SOURCE OF POWER	VOLTAGE/ PHASE	OCPD	CIRCUIT #	WIRE	CONDUIT	NOTES
RTU-1	CONDENSING UNIT		11.13		PANEL LRP-1	208/3	45A,3P	(37,39,41)	3#8 & 1#10 GRD	3/4"	UNIT HAS INTEGRAL DISCONNECT SWITCH
CUH-1	ELECTRIC CABINET UNIT HEATER		1.5		PANEL LRP-1	120/1	20A,1P	20	2#12 & 1#12 GRD	3/4"	UNIT HAS INTEGRAL DISCONNECT SWITCH
CUH-2	ELECTRIC CABINET UNIT HEATER		1.5		PANEL LRP-1	120/1	20A,1P	22	2#12 & 1#12 GRD	3/4"	UNIT HAS INTEGRAL DISCONNECT SWITCH
CUH-3	ELECTRIC CABINET UNIT HEATER		3		PANEL LRP-1	208/1	20A,2P	(27,29)	2#12 & 1#12 GRD	3/4"	UNIT HAS INTEGRAL DISCONNECT SWITCH

LUMINAIRE SCHEDULE

TYPE	DESCRIPTION	MANUFACTURER	MODEL NUMBER	VOLTS	LAMPS	MOUNTING	NOTES
A	4' LED WRAPAROUND WITH 0-10V DIMMING DRIVER	COLUMBIA LIGHTING	LAW-4-35-ML-ED-U	UNV	4700 LUMENS 3500K 48 WATTS	SUSPENDED AT 8'-0" AFF	SEE NOTE 1
B	2' X 4' LED ARCHITECTURAL TROFFER WITH 0-10V DIMMING DRIVER	COLUMBIA LIGHTING	LCAT-24-35-HL-G-ED-U	UNV	5600 LUMENS 3500K 44 WATTS	RECESSED IN GRID	SEE NOTES 1 AND 2
C	2' X 2' LED ARCHITECTURAL TROFFER WITH 0-10V DIMMING DRIVER	COLUMBIA LIGHTING	LCAT-22-35-HL-G-ED-U	UNV	3700 LUMENS 3500K 32 WATTS	RECESSED IN GRID	SEE NOTES 1 AND 2
D	2' X 4' LED ARCHITECTURAL TROFFER WITH 0-10V DIMMING DRIVER	COLUMBIA LIGHTING	LCAT-24-35-HL-G-ED-U	UNV	3460 LUMENS 3500K 30 WATTS	RECESSED IN GRID	SEE NOTES 1 AND 2
F	6" LED DOWNLIGHT WITH WET LOCATION RATING AND 0-10V DIMMING DRIVER	PRESCOLITE	LF6LEDG4-6LFLED5G4-35-WT	UNV	1100 LUMENS 3500K 15 WATTS	SUSPENDED AT 8'-0" AFF	SEE NOTE 1
G	LED EMERGENCY BATTERY LIGHT	DUALLITES	LZ-2-03L	UNV	LED	SURFACE WALL AT 8'-0" AFF	SEE NOTE 1
H	LED POLYCARBONATE EXIT SIGN. SEE PLANS FOR ARROW/FACE REQUIREMENTS	DUALLITES	EVE-U-R-W-E	UNV	LED	SURFACE WALL OR CEILING	SEE NOTE 2. SURFACE WALL UNITS SHALL BE MOUNTED 6" ABOVE THE DOOR FRAME
J	LED LOW BAY FIXTURE	COLUMBIA LIGHTING	MPL-4-35-ML-W-ED-U	UNV	8600 LUMENS 3500K 71 WATTS	SUSPENDED AT 12'-0" AFF	SEE NOTE 1
K	6" LED DOWNLIGHT WITH DAMP LOCATION RATING AND 0-10V DIMMING DRIVER	PRESCOLITE	LF6LEDG4-6LFLED6G4-35-WT	UNV	1500 LUMENS 3500K 19 WATTS	RECESSED IN DRYWALL	SEE NOTE 1
K1	6" LED DOWNLIGHT WITH DAMP LOCATION RATING AND 0-10V DIMMING DRIVER AND EMERGENCY BATTERY PACK	PRESCOLITE	LF6LEDG4-EM-6LFLED6G4-35-WT	UNV	1500 LUMENS 3500K 19 WATTS	RECESSED IN DRYWALL	SEE NOTE 1
M	LED WALLPACK WITH INTEGRAL BATTERY PACK	HUBBELL	LNC2-12L-120-4K-3-1-BBU	120	2800 LUMENS 4000K 28 WATTS	SURFACE WALL 12" ABOVE DOOR	SEE NOTE 1
N	LED EXTERIOR SCONCE			120	LED 20 WATTS	SURFACE WALL, SEE ARCH ELEVATION	PROVIDE $500 ALLOWANCE
XA	TWIN LED SHOEBOX WITH PHOTOCELL, INTEGRAL MOTION SENSOR (TAKE LIGHT LEVEL DOWN TO 60%) AND BRONZE FINISH	HUBBELL	ASL-A-24L-4K-210-4-U-DB-7PR-RPA-SCP_F-RETA2-DB-PTL-8	120	21000 LUMENS 4000K 169 WATTS	SURFACE WALL 12" ABOVE DOOR	SEE NOTE 1. COORDINATE TENON AND MOUNTING BRACKET REQUIREMENTS ON THE EXISTING POLE

LUMINAIRE SCHEDULE NOTES:
1. EQUIVALENT MANUFACTURERS FOR THE PRODUCT SPECIFIED IS: HE WILLIAMS, LITHONIA, EATON, PHILIPS
2. PROVIDE TWO INDIVIDUAL SUPPORT WIRES FOR EACH FIXTURE INDICATED, CONNECTED TO STRUCTURE



ONE LINE DIAGRAM

Combined Area Fire Training Facility Re-Bid
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Buffalo Grove, IL 60089

Village of Buffalo Grove
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GAGE CONSULTING ENGINEERS, INC.
PROFESSIONAL DESIGN FIRM LICENSE NO.
184.001566, EXPIRES ON 04/30/2019

LICENSED PROFESSIONAL ENGINEER DAVID R. MCVEY 062-048431 STATE OF ILLINOIS
Exp: 11/30/19

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed PROFESSIONAL ENGINEER under the laws of the State of ILLINOIS

License Number: 062-048431 Date: 12-07-2017

Revisions		
ISSUED FOR REBID	12/07/2017	2

Comm: 173013 / 17036
Date: DEC 7, 2017
Drawn: RS
Check: DM
North

ELECTRICAL SCHEDULES

Scale:

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