



Terry McKee, IT & Procurement Director

901 N. Broadway • Knoxville, TN 37917-6699
865.403.1133 • Fax 865.594.8858
procurementinfo@kcdc.org
www.kcdc.org

Invitation for Sealed Bids

Solicitation Name and Number	Construction of a Head Start Building at Western Heights C22001
Responses Must Arrive No Later Than	2:00 p.m. on July 20, 2021 (as KCDC's clocks indicate)
Deliver Responses to	Knoxville's Community Development Corporation Procurement Division 901 N. Broadway Knoxville, TN 37917
Electronic Copies of Documents	Bid documents are available on KCDC's webpage.
Printed Responses Required	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Solicitation Meeting	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Solicitation Meeting is Mandatory	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not Applicable
Solicitation Meeting Date and Time	July 8, 2021, at 9:00 a.m., via Zoom remote meeting system.
Solicitation Meeting Connection	Email procurementinfo@kcdc.org for the web link.
Questions About This Solicitation	KCDC will not accept questions via telephone. Submit questions to procurementinfo@kcdc.org by 6:00 p.m. on July 13, 2021.
Award Results	KCDC posts the award decision to its web page at: http://www.kcdc.org/procurement/ .
Open Records/Public Access to Documents	All document provided to KCDC are subject to the Tennessee Open Meetings Act (TCA 8-44-101) and open records requirements.
Plans/Blueprints	Blueprints/plans are available from Knoxville Blueprint
Check KCDC's webpage for addenda and changes before submitting your response	



General Information

1. Background and Intent

- a. Knoxville's Community Development Corporation (KCDC) is the public housing and redevelopment agency for the City of Knoxville and for Knox County in Tennessee. KCDC's affordable housing property portfolio includes 20 sites with approximately 3,525 dwelling units.
- b. KCDC uses "supplier" as inclusive of various words describing interested parties often called "supplier," "bidders," "contractors" and "proposers."
- c. This solicitation is for the construction of a new Head Start Building at KCDC's Western Heights property (office located at 1621 Jourolman Avenue, 37921). The general description of the work is to construct a two-story child-care facility, of approximately 22,265 GSF, and being comprised of load-bearing concrete masonry walls and both brick veneer and fiber cement siding, and including typical interior finishes, a two-stop passenger elevator, and roof-top mechanical units.
- d. See the Scope of Work section for additional technical details.

2. Bonds

Bid, payment and performance bonds are required if the bid exceeds \$100,000 in value. The supplier will include all bonding costs in the base bid. Bonding requirements include:

- a. A bid **bond** from each supplier equivalent to 5% of the bid price. Such bid bond must accompany the bid. Bid bonds will not be returned until a contract is signed.
- b. Performance and payment **bonds** for 100% of the contract price.
- c. All bonding companies must be listed in the "Federal Register, Department of the Treasury Fiscal Service, Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies; Notice." Companies licensed to do business in the State of Tennessee must issue all required bonds.

3. Changes after Award

It is possible that after award KCDC will need to revise the service needs or requirements specified in this document. KCDC reserves the right to make such changes after consultation with the supplier. Should additional costs arise, the supplier must document increased costs. KCDC reserves the right to accept or reject and negotiate these charges.

4. Codes and Ordinances

All work covered is to be done in full accord with national, state and local codes, ordinances and orders that are in effect at the time the work is performed.

5. Contact Policy

Only contact KCDC's Procurement Division about this solicitation from the issuance of this solicitation until award. Information obtained from an unauthorized officer, agent, or employee will not affect the risks or obligations assumed by the supplier or relieve the supplier from fulfilling any of the conditions of the resulting award for the purpose of this project. Such contact can disqualify the supplier from the solicitation process.

6. Contract Approval

The resulting contract is subject to KCDC's Board's approval.

7. Contract Documents

KCDC has posted a prototype of the standard contract and rider that will be used to its webpage. Please review these documents before submitting a bid.

8. COVID-19 Special Requirements

If COVID requirements are in effect, all workers assigned to work on this project must follow the same health and safety standards that KCDC employees do and agree to the following:

- a. General:
 - Workers will wash and/or sanitize his/her hands periodically throughout the workday.
 - Worker will maintain six feet of spacing and social distancing between himself and others.
 - Worker will wear a face mask if other persons are present.
- b. Worker will not enter the building or be on the premises if he/she answers "yes" to the existence of the any of the below symptoms or circumstances and will contact his/her supervisor immediately.
- c. Worker will leave the premises immediately if any of the below symptoms appear during the workday and will contact his/her supervisor of why he/she had to leave.
- d. Symptoms: Have you or anyone in your household had any of the following symptoms as new onset in the past 72 hours? (This does not include chronic conditions.)
 - Fever of 100 degrees or greater
 - New onset of cough
 - New onset of shortness of breath
 - New onset of sore throat
 - New onset of body aches
 - Diarrhea
 - New onset of headache
 - New onset of loss of taste or smell

9. Damage

The supplier is responsible for all damage to buildings, equipment, grounds, premises and all other types of potential damage resulting from the provision of the services requested herein.

10. Employees

Supplier will:

- a. Allow only personnel thoroughly trained and skilled to work on the job. Employees are not to be accompanied in their work area by acquaintances, family members, assistants or any person unless said person is an authorized employee of the supplier.
- b. Have sufficient personnel to complete the work in a timely manner.
- c. Provide adequate supervision and adequate discipline among his/her employees.
- d. Provide at least one employee on every job assignment with the ability to speak, read, write and understand English so owner's staff can communicate effectively with them.
- e. Ensure that employees have proper identification displayed while on the job site. Employees, while on site, must wear a company uniform or have photo identification displayed.

- f. Employees parking vehicles (whether corporately or privately owned) must ensure that company identification is on the vehicles. This may be by placards on the vehicle's side, laminated paper with the company name placed on the dashboard or other means.

11. Equipment

Supplier shall provide all necessary equipment, materials, supplies, et cetera needed for the work. Include the cost for such equipment, materials and supplies in the price quoted.

12. Evaluation

KCDC will evaluate this as a formal sealed bid and the award is to the "lowest and best." KCDC alone determines (using NIGP's definition and other relevant sources as appropriate) the supplier's "responsive" and "responsible" status prior to award. Responsible means a business with the financial and technical capacity to perform the requirements of the solicitation and subsequent contract. A responsive bid is one that fully conforms in all material respects to the solicitation document and all of its requirements, including all form and substance. KCDC reserves the right to request additional information to assist in the evaluation process; this includes references and business capacity information.

13. General Instructions to Suppliers

KCDC's General Instructions to Suppliers are at www.kcdc.org. Click on "Procurement" and the link to the instructions. The supplier's submittal means acceptance of the terms and conditions set forth in KCDC's "General Instructions to Suppliers." The following paragraphs of the General Instructions do not apply to this project: 1, 16, 24, 33, 42, 44a, 44c, 44d, 52, 57, 63, 65, and 69.

14. Insurance

See Appendix 1. These insurances and levels are required and not optional. If you or your insurance agent have concerns or believe that some coverages are not necessary, email procurementinfo@kcdc.org detailing any requested changes before this solicitation's due date. The supplier will include all insurance costs in the base bid.

15. Licensure

- a. Suppliers must possess and maintain proper licensure from the State of Tennessee and all other authorities having jurisdiction throughout the term of this award.
- b. In addition to any City or County licenses that may be required, all suppliers must be licensed as required by the State of Tennessee's "Contractor's Licensing Act of 1994."
- c. The Executive Director of the State Contractor Licensing Board says one of these licenses is required:
 - BC
 - BC-B
- d. Any subsequent rulings by the State Licensing Board automatically revise these specifications-irrespective of the timing of the notice from the State and irrespective of the status of this solicitation.
- e. Additional information is at <https://www.tn.gov/commerce/regboards/contractors.html>.

16. Liquidated Damages

Liquidated damages of \$500.00 per calendar day for each day beyond the scheduled completion date apply and are included in the award. This applies to the scheduled completion date for each phase of the approved project schedule.

17. Permits

The supplier (and/or any subcontractors) shall obtain and pay for all permits required to complete authorized work.

18. Safety/OSHA Guideline Compliance

- a. The supplier is responsible for providing and placing barricades, tarps, plastic, flag tape and other safety/traffic control equipment to protect the public, surrounding areas, equipment and vehicles.
- b. The supplier shall ensure that its employees exercise all necessary caution and discretion to avoid injury to persons or damage to property.
- c. Supplier shall use caution signs as required by OSHA Regulation 1910.144 and 1910.145 at no cost to KCDC. Caution signs shall be on-site at commencement of contract.
- d. Supplier shall comply with all other OSHA and TOSHA safety standards that apply.

19. Security

The successful supplier is responsible for providing any necessary security to equipment, materials, personnel, tools and the site that are required for this job. KCDC is not responsible for damage or losses to equipment, materials, personnel, tools or the site.

20. Smoke Free Policy

- a. KCDC's Smoke Free policy is applicable to you, your employees and subcontractors. The policy mandates:
 - No smoking on owner's property
 - No e-vape or similar usage on owner's property
 - The Smoke Free policy applies in personal or corporate vehicles on owner's property
- b. Applicable definitions include:
 - "Smoking" means inhaling, exhaling, burning or carrying any lighted or heated cigar, cigarette or pipe, or any other lighted or heated tobacco or plant product intended for inhalation, including hookahs and marijuana, whether natural or synthetic, in any manner or in any form. "Smoking" also includes the use of an electronic smoking device which creates an aerosol or vapor, in any manner or in any form.
 - "Electronic Smoking Device" means any product containing or delivering nicotine or any other substance intended for human consumption that can be used by a person in any manner for the purpose of inhaling vapor or aerosol from the product. The term includes any such device, whether manufactured, distributed, marketed or sold as an e-cigarette, e-cigar, e-pipe, e-hookah or vape pen or under any other product name or descriptor.

- Property means all buildings, parking lots, streets, structures and **land** owned by KCDC. Should Supplier's staff be observed violating these requirements, KCDC's Procurement Division will notify the supplier about the problem. Should there be recurrences, KCDC may ask the CMAR to not send the employee to KCDC's property. Repeated offenses may result in forfeiture of your awarded "contract."

21. Solicitation Requirements

Caution: Requirements in the solicitation are not optional. If you have concerns or issues with any of the stated requirements, raise them **before** the bid due date. Examples of past issues where suppliers made faulty assumptions include bonds, insurance requirements and payment expectations.

22. Storm Water and Street Ordinances

The City of Knoxville's Storm Water and Street Ordinances apply to this solicitation. The successful supplier will comply with the City's ordinances. Compliance includes but is not limited to:

- Retaining all sediments on the project site using structural drainage controls. Drainage control costs are incidental to the work.
- Not discharging any construction or demolition related materials, wastes, spills, or residues from the project site to streets, drainage facilities, or adjacent properties by wind or runoff.
- Containing non-storm water runoff from equipment and vehicle washing and any other activity at the project site.
- Additional information about NPDES, BMPs and the Land Development Manual at <http://www.cityofknoxville.org/engineering/stormwater/npdes.asp>.
- The successful supplier is responsible for all work, remediation, repair and monetary penalties or fines arising out of a Notice of Violation of the City of Knoxville's Storm Water and Street Ordinances. The supplier will be charged costs KCDC incurs to install structural drainage controls or remedy a Notice of Violation. KCDC shall also charge a \$50 fee per violation for related administrative costs.
- KCDC will prepare, submit and pay the permitting fees. Upon award, the successful supplier will be required to sign onto the permit and be responsible for implementing and maintaining all erosion control measures as required on the SWPPP.

23. Subcontractors

Subcontractors must:

- Be approved by KCDC prior to beginning work.
- Carry the insurance coverages as outlined herein.
- Not be on the general federal government, HUD's nor the State of Tennessee's debarment lists.
- Not be changed without owner's permission.

24. Time for Completion

Supplier will achieve Substantial Completion of the entire project on or before July 15, 2022, including the issuance of a Certificate of Occupancy by the City of Knoxville.

25. Weather

KCDC provides allowances for excessive inclement weather since this solicitation calls for liquidated damages-provided the supplier exceeds the guaranteed number of days for completion.

a. Extensions of Contract Time

If the basis exists for an extension of time in accordance with this solicitation, then an extension of time based on weather may be granted only for the number of weather delay days in excess of the number of weather days listed as the Standard Baseline for that month.

b. Standard Baseline for Average Climatic Range

The Standard Baseline is the normal and anticipated number of calendar days for each month during which adverse weather will prevent activity. Suspension of activity for the number of days each month as listed in the Standard Baseline is to be included in the work and not eligible for an extension of the contract time. The baseline is:

Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
12	11	8	7	7	6	7	5	4	5	6	11

c. Adverse Weather and Weather Delay Days

- 1) Adverse weather is the occurrence of one or more of the following conditions which prevents only exterior activity or access to the site within a twenty-four-hour period:
 - a) Precipitation (rain, snow or ice) in excess of one-tenth inch (0.10") liquid measure.
 - b) Temperatures which do not rise above 32 degrees Fahrenheit by 10:00 a.m.
 - c) Standing snow in excess of one inch (1.00").
- 2) Adverse weather may include, if appropriate, "dry-out" or "mud" days when all of the following are met:
 - a) For rain above the Standard Baseline.
 - b) Only if there is a hindrance to site access or site work or excavation and supplier has taken all reasonable accommodations to avoid such hindrance.
 - c) At a rate, no greater than one make-up day for each day or consecutive days of rain beyond the Standard Baseline that total 1.0 inch or more, liquid measure, unless specifically recommended otherwise by the KCDC.
- 3) A weather delay day occurs only if adverse weather prevents work on the project for 50 percent or more of the supplier's scheduled workday, including a weekend day or holiday if the supplier has scheduled construction activity that day.

d. Documentation and Submittals

- 1) Submit Daily Jobsite Work Log showing which and to what extent activities were affected by weather on a monthly basis.

- 2) Submit actual weather data to support a claim for the time extension obtained from nearest NOAA weather station or other independently verified source approved by the KCDC at the beginning of the project.
- 3) Maintain a rain gauge, thermometer and clock at the jobsite. Keep daily records of precipitation, temperature and the time of each occurrence throughout the project.
- 4) Use the Standard Baseline data provided in this section when documenting actual delays due to weather in excess of the average.
- 5) Organize claim documentation on calendar month periods and submit in accordance with the procedures for claims established by the KCDC.

e. Approval by KCDC

- 1) If the extension of the contract time is appropriate, it will occur in accordance with the provisions of this solicitation.
- 2) KCDC shall not incur extra costs for any extra time increase to the contract.

Scope of Work

MHM

PROJECT NUMBER: 20015

HEAD START AT WESTERN HEIGHTS

Knoxville's Community Development Corporation
901 North Broadway
Knoxville, TN 37902

CONSTRUCTION DOCUMENTS PACKAGE
ISSUED: MAY 17, 2021

PROJECT MANUAL

McCARTY HOLSAPLE McCARTY

MHM

PROJECT NUMBER: 20015

HEAD START AT WESTERN HEIGHTS

Knoxville's Community Development Corporation
901 North Broadway
Knoxville, TN 37902

CONSTRUCTION DOCUMENTS PACKAGE
ISSUED: MAY 17, 2021

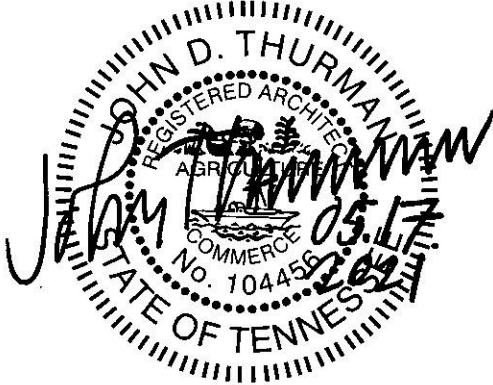
PROJECT MANUAL

McCARTY HOLSAPLE McCARTY

SECTION 00.01.07 - SEALS PAGE

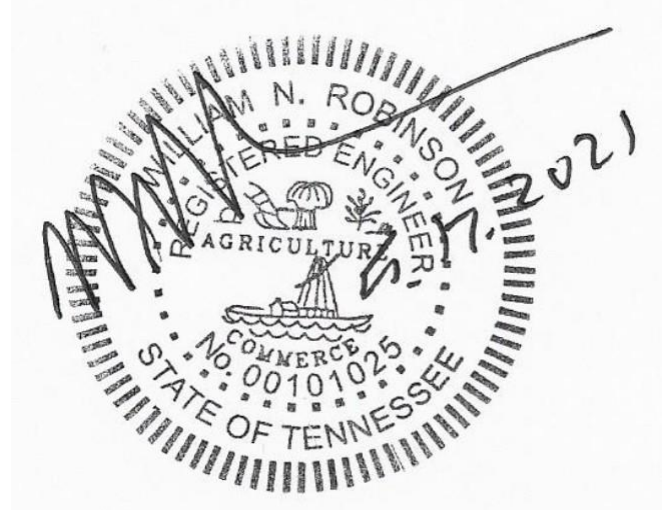
McCARTY HOLSAPLE McCARTY, INC.

ARCHITECT



WILL ROBINSON ASSOCIATES

CIVIL ENGINEER



HAINES STRUCTURAL GROUP

STRUCTURAL ENGINEER



ENGINEERING SERVICES GROUP, INC.

FIRE SUPPRESSION / PLUMBING ENGINEER



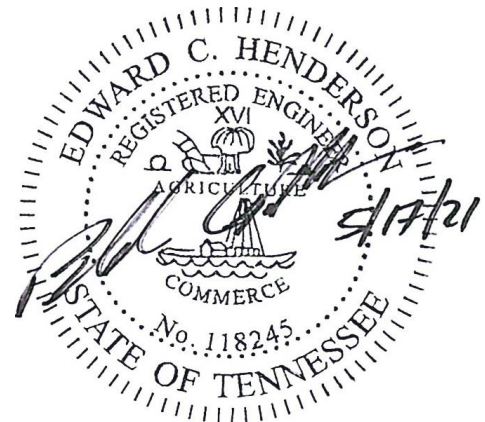
ENGINEERING SERVICES GROUP, INC.

MECHANICAL ENGINEER



ENGINEERING SERVICES GROUP, INC.

ELECTRICAL ENGINEER



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M201	SCHEDULES – HVAC
M202	DETAILS – HVAC
M203	KITCHEN SCHEDULES & DETAILS – HVAC

FIRE PROTECTION

FP101	FLOOR PLANS – FIRE PROTECTION
FP102	ATTIC PLAN – FIRE PROTECTION
FP201	FIRE PROTECTION SCHEDULES & DETAILS
FP202	HYDRAULIC CALCULATIONS

PLUMBING

P100	FLOOR PLANS – UNDERGROUND PLUMBING
P101	FLOOR PLANS – WASTE-VENT
P201	FLOOR PLANS – SERVICES
P202	ROOF PLAN – PLUMBING
P301	ENLARGED FLOOR PLANS – PLUMBING
P401	WASTE-VENT ISOMETRICS
P402	WASTE-VENT ISOMETRICS
P403	NATURAL GAS ISOMETRIC
P501	PLUMBING SCHEDULES
P502	PLUMBING DETAILS
P503	FIRESTOPPING DETAILS

ELECTRICAL

E001	SITE PLAN – ELECTRICAL
E002	SITE PLAN – PHOTOMETRICS
E101	FLOOR PLAN – LIGHTING
E102	FLOOR PLAN – POWER
E103	FLOOR PLAN – COMMUNICATIONS
E104	FLOOR PLAN – FIRE ALARM AND HVAC CONNECTIONS
E105	ENLARGED KITCHEN PLAN – ELECTRICAL
E201	ELECTRICAL LEGEND & SCHEDULES
E202	ELECTRICAL DETAILS
E203	PANEL SCHEDULES

FOOD SVC

FS100	FOOD SERVICE EQUIP. LAYOUT & WASTE LAYOUT PLAN
FS200	FOOD SERVICE EQUIP., PLUMB. & ELECT. LAYOUT PLAN
FS300	FOOD SERVICE EQUIP. DETAILS

END OF SECTION 00.01.15

SECTION 01.10.00
SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Knoxville Head Start at Western Heights.
- B. Owner's Name: Knoxville's Community Development Corporation.
- C. Architect's Name: McCarty Holsaple McCarty, Inc..
- D. The Project consists of the construction of a new child care facility.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00.50.00 - Contracting Forms and Supplements, refer to KCDC website.

1.03 DESCRIPTION OF ALTERATIONS WORK - NONE

1.04 WORK BY OWNER

- A. Owner will supply and install the following:
 - 1. Tack boards.
 - 2. Building security control system - all rough-ins are by Contractor.
 - 3. Furniture.
- B. Owner will supply the following for installation by Contractor:
 - 1. Residential appliances.

1.05 OWNER OCCUPANCY

- A. Owner intends to occupy the Project upon Substantial Completion.
- B. Schedule the Work to accommodate Owner occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Provide access to and from site as required by law and by Owner:
 - 1. Do not obstruct roadways, sidewalks, or other public ways without permit.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01.20.00
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Correlation of Contractor submittals based on changes.
- E. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

- A. Section 00.50.00 - Contracting Forms and Supplements: Forms to be used.
- B. Section 00.72.00 - General Conditions: Additional requirements for progress payments, final payment, changes in the Work.
- C. Section 00.73.00 - Supplementary Conditions: Percentage allowances for Contractor's overhead and profit.
- D. Section 01.22.00 - Unit Prices: Monetary values of unit prices; Payment and modification procedures relating to unit prices.
- E. Section 01.78.00 - Closeout Submittals: Project record documents.

1.03 SCHEDULE OF VALUES

- A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
- E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.
- F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Percentage of Completion.
 - 9. Balance to Finish.
 - 10. Retainage.
- F. Execute certification by signature of authorized officer.

- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- I. Submit electronic copies of each Application for Payment.
- J. Include the following with the application:
 - 1. Transmittal letter as specified for submittals in Section 01.30.00.
 - 2. Construction progress schedule, revised and current as specified in Section 01.30.00.
 - 3. Affidavits attesting to off-site stored products.
- K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
- C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.
- D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within ____ days.
- E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01.60.00.
- F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 - 3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
- G. Substantiation of Costs: Provide full information required for evaluation.
 - 1. On request, provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 - 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.

- d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
- 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- K. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
 - 1. All closeout procedures specified in Section 01.70.00.

END OF SECTION

SECTION 01.22.00
UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. List of unit prices, for use in preparing Bids.
- B. Measurement and payment criteria applicable to Work performed under a unit price payment method.
- C. Defect assessment and non-payment for rejected work.

1.02 RELATED REQUIREMENTS

- A. Document 00.43.22 - Unit Prices Form: List of Unit Prices as supplement to Bid Form
- B. Section 01.20.00 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 COSTS INCLUDED

- A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.04 UNIT QUANTITIES SPECIFIED

- A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.05 MEASUREMENT OF QUANTITIES

- A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.
- B. Take all measurements and compute quantities. Measurements and quantities will be verified by Architect.
- C. Assist by providing necessary equipment, workers, and survey personnel as required.
- D. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
- E. Measurement by Area: Measured by square dimension using mean length and width or radius.
- F. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.
- G. Perform surveys required to determine quantities, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.
- H. Contractor's Engineer Responsibilities: Sign surveyor's field notes or keep duplicate field notes, calculate and certify quantities for payment purposes.

1.06 PAYMENT

- A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.
- B. Payment will not be made for any of the following:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined as unacceptable before or after placement.
 - 3. Products not completely unloaded from the transporting vehicle.
 - 4. Products placed beyond the lines and levels of the required Work.
 - 5. Products remaining on hand after completion of the Work.
 - 6. Loading, hauling, and disposing of rejected Products.

1.07 DEFECT ASSESSMENT

- A. Replace Work, or portions of the Work, not complying with specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct one of the following remedies:
 - 1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Architect.
- C. The individual specification sections may modify these options or may identify a specific formula or percentage price reduction.
- D. The authority of Architect to assess the defect and identify payment adjustment is final.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01.25.00
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

- A. Section 00.63.25 - Substitution Request Form - During Construction: Required form for substitution requests made after award of contract (During construction).
- B. Section 01.22.00 - Unit Prices, for additional unit price requirements.
- C. Section 01.30.00 - Administrative Requirements: Submittal procedures, coordination.
- D. Section 01.60.00 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.
- E. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions: Restrictions on emissions of indoor substitute products.

1.03 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability.
 - b. Regulatory changes.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. A Substitution Request for specified installer constitutes a representation that the submitter:
 - 1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.
- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
 - 1. Note explicitly any non-compliant characteristics.

- D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
- E. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form (after award of contract):
 - 1. Submit substitution requests by completing the form in Section 00.63.25; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- C. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
 - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
 - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
 - 3. Bear the costs engendered by proposed substitution of:
 - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
- D. Substitutions will not be considered under one or more of the following circumstances:
 - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 - 2. Without a separate written request.

3.03 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.
 - 1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.04 ACCEPTANCE

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 01.78.00 - Closeout Submittals, for closeout submittals.
- B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

END OF SECTION

01 26 25 – WEATHER DELAY REPORT

KCDC Project Number and Project Name:		Month and Year Reported Below:
Date	Weather condition causing delay	Work scheduled on critical path for this day that was delayed.
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		
	Total number of days this month with delay due to weather	
	Baseline number	
	Total – Baseline = claimable days	

END OF SECTION

SECTION 01.30.00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Preconstruction meeting.
- C. Progress meetings.
- D. Contractor's daily reports.
- E. Coordination drawings.
- F. Submittals for review, information, and project closeout.
- G. Number of copies of submittals.
- H. Requests for Interpretation (RFI) procedures.
- I. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 00.72.00 - General Conditions: Dates for applications for payment.
- B. Section 01.32.16 - Construction Progress Schedule: Form, content, and administration of schedules.
- C. Section 01.60.00 - Product Requirements: General product requirements.
- D. Section 01.70.00 - Execution and Closeout Requirements: Additional coordination requirements.
- E. Section 01.78.00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 REFERENCE STANDARDS

- A. AIA G716 - Request for Information; 2004.
- B. AIA G810 - Transmittal Letter; 2001.

1.04 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01.70.00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
 - 1. Requests for Interpretation (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

1.05 PROJECT COORDINATOR

- A. Project Coordinator: General Contractor.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for construction area access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator.

- D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01.10.00 - Summary.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Project Coordinator will schedule a meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
 - 4. Major Subcontractors.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 - 5. Submission of initial Submittal schedule.
 - 6. Designation of personnel representing the parties to Contract and Architect.
 - 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 8. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.
- B. Attendance Required:
 - 1. Contractor.
 - 2. Owner.
 - 3. Architect.
 - 4. Special consultants, as required and specifically scheduled.
 - 5. Contractor's superintendent.
 - 6. Major subcontractors.
- C. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review of RFIs log and status of responses.
 - 7. Review of off-site fabrication and delivery schedules.
 - 8. Maintenance of progress schedule.
 - 9. Corrective measures to regain projected schedules.

10. Planned progress during succeeding work period.
 11. Coordination of projected progress.
 12. Maintenance of quality and work standards.
 13. Effect of proposed changes on progress schedule and coordination.
 14. Other business relating to work.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01.32.16

3.04 DAILY CONSTRUCTION REPORTS

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
- B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
1. Date.
 2. High and low temperatures, and general weather conditions.
 3. List of subcontractors at Project site.
 4. Safety, environmental, or industrial relations incidents.
 5. Meetings and significant decisions.
 6. Unusual events (submit a separate special report).
 7. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
 8. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
 9. Change Orders received and implemented.
 10. Testing and/or inspections performed.
 11. List of verbal instruction given by Owner and/or Architect.
 12. Signature of Contractor's authorized representative.

3.05 COORDINATION DRAWINGS

- A. Provide information required by Project Coordinator for preparation of coordination drawings.
- B. Review drawings prior to submission to Architect.

3.06 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition: A request seeking one of the following:
1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 2. Prepare in a format and with content acceptable to Owner.
 - a. Use AIA G716 - Request for Information .

3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01.60.00 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
 1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 2. Owner's, Architect's, and Contractor's names.
 3. Discrete and consecutive RFI number, and descriptive subject/title.
 4. Issue date, and requested reply date.
 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 2. Note dates of when each request is made, and when a response is received.
 3. Highlight items requiring priority or expedited response.
 4. Highlight items for which a timely response has not been received to date.
- H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.07 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
 1. Submit at the same time as the preliminary schedule specified in Section - 01.32.16 - Construction Progress Schedule.
 2. Coordinate with Contractor's construction schedule and schedule of values.
 3. Format schedule to allow tracking of status of submittals throughout duration of construction.
 4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
 5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
 - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.08 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01.78.00 - Closeout Submittals.

3.09 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 1. Design data.
 2. Certificates.
 3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions.
 6. Manufacturer's field reports.
 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.10 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.

- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01.78.00 - Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Bonds.
 - 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.11 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Extra Copies at Project Closeout: See Section 01.78.00.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.12 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a single transmittal for related items.
 - 2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
 - 3. Transmit using approved form.
 - a. Use Form AIA G810.
 - 4. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 - 5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 - 6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 - 7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Send submittals in electronic format via email to Architect.
 - 8. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
 - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
 - 9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 - 10. Provide space for Contractor and Architect review stamps.
 - 11. When revised for resubmission, identify all changes made since previous submission.
 - 12. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 - 13. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
 - 14. Submittals not requested will be recognized, and will be returned "Not Reviewed",

- B. Product Data Procedures:
 - 1. Submit only information required by individual specification sections.
 - 2. Collect required information into a single submittal.
 - 3. Submit concurrently with related shop drawing submittal.
 - 4. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
 - 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 - 2. Do not reproduce Contract Documents to create shop drawings.
 - 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
 - 1. Transmit related items together as single package.
 - 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
 - 3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.13 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
 - 1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.
- D. Architect's and consultants' actions on items submitted for review:
 - 1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Approved", or language with same legal meaning.
 - b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
 - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
 - c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
 - 1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
 - 2) Non-responsive resubmittals may be rejected.
 - 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".
 - 1) Resubmit revised item, with review notations acknowledged and incorporated.
 - 2) Non-responsive resubmittals may be rejected.
 - b. "Rejected".
 - 1) Submit item complying with requirements of Contract Documents.
- E. Architect's and consultants' actions on items submitted for information:
 - 1. Items for which no action was taken:
 - a. "Received" - to notify the Contractor that the submittal has been received for record only.
 - 2. Items for which action was taken:
 - a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

SECTION 01.32.16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

1.02 RELATED SECTIONS

- A. Section 01.10.00 - Summary: Work sequence.
- B. Section 01.30.00 - Administrative Requirements.

1.03 REFERENCE STANDARDS

- A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

1.04 SUBMITTALS

- A. Within 10 days after date of Agreement, submit preliminary schedule.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.
- F. Submit in PDF format.
- G. Submit under transmittal letter form specified in Section 01.30.00 - Administrative Requirements.

1.05 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.06 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Diagram Sheet Size: Maximum 22 x 17 inches.
- C. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.

- D. Provide sub-schedules to define critical portions of the entire schedule.
- E. Include conferences and meetings in schedule.
- F. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- G. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
- H. Indicate delivery dates for owner-furnished products.
- I. Coordinate content with schedule of values specified in Section 01.20.00 - Price and Payment Procedures.
- J. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.
- G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

3.06 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

SECTION 01.35.53
SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Security measures including entry control and personnel identification.

1.02 RELATED REQUIREMENTS

- A. Section 01.10.00 - Summary: use of premises and occupancy.
- B. Section 01.50.00 - Temporary Facilities and Controls: Temporary lighting.

1.03 SECURITY PROGRAM

- A. Protect Work and Owner's operations from theft, vandalism, and unauthorized entry.
- B. Initiate program at project mobilization.
- C. Maintain program throughout construction period until Owner occupancy.

1.04 ENTRY CONTROL

- A. Restrict entrance of persons and vehicles into Project site .
- B. Allow entrance only to authorized persons with proper identification.
- C. Maintain log of workers and visitors, make available to Owner on request.

1.05 PERSONNEL IDENTIFICATION

- A. Provide identification badge to each person authorized to enter premises.
- B. Badge To Include: Personal photograph, name, assigned number, expiration date and employer.
- C. Maintain a list of accredited persons, submit copy to Owner on request.
- D. Require return of badges at expiration of their employment on the Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01.40.00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Quality assurance.
- B. References and standards.
- C. Testing and inspection agencies and services.
- D. Contractor's design-related professional design services.
- E. Control of installation.
- F. Mock-ups.
- G. Tolerances.
- H. Manufacturers' field services.
- I. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Document 00.72.00 - General Conditions: Inspections and approvals required by public authorities.
- B. Section 01.30.00 - Administrative Requirements: Submittal procedures.
- C. Section 01.42.19 - Reference Standards.
- D. Section 01.60.00 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).
- B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2016.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2015a.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2014a.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2015.
- G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.
- H. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2010.

1.04 DEFINITIONS

- A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.
- B. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
 - 1. Design Services Types Required:
 - a. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

1.05 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
 - 1. Submit a Request for Interpretation to Architect if the criteria indicated are not sufficient to perform required design services.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
 - 1. Structural Design of Reinforcement Splices: As described in Section 03.01.00 - Maintenance of Concrete.
 - 2. Structural Design of Formwork: As described in Section 03.10.00 - Concrete Forming and Accessories.
 - 3. Concrete Mix Design: As described in Section 03.30.00 - Cast-in-Place Concrete. No specific designer qualifications are required.
 - 4. Structural Design of Steel Connections: As described in Section 05.12.00 - Structural Steel Framing.
 - 5. Structural Design of Steel Connections: As described in Section 05.21.00 - Steel Joist Framing.
 - 6. Structural Design of Stairs: As described in Section 05.51.00 - Metal Stairs.
 - 7. Structural Design of Railings: As described in Section 05.52.13 - Pipe and Tube Railings.
 - 8. Structural Design of Wood Trusses: As described in Section 06.17.53 - Shop-Fabricated Wood Trusses
 - 9. Structural Design: Include physical characteristics, engineering calculations, and resulting dimensional limitations as described in Section 08.43.13 - Aluminum-Framed Storefronts.
 - 10. Structural Design of Canopy: As described in Section 10.73.16.13 - Metal Canopies.

1.06 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
 - 1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
 - a. Full name.
 - b. Professional licensure information.
 - c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.
- C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
 - 1. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
 - 2. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.

- i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
- 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.07 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 - 1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.
- B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- C. Contractor's Quality Control (CQC) Plan:
 - 1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
 - a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
 - b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.

1.08 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.09 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Contractor shall employ and pay for services of an independent testing agency to perform specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. Contractor Employed Agency:
 - 1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
 - 2. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
 - 3. Laboratory: Authorized to operate in the State in which the Project is located.
 - 4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
 - 5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Room Mock-ups: Construct room mock-ups as indicated on drawings. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Architect to evaluate quality of the mock-up.

- E. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- F. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- G. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- H. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- I. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
 - 1. Architect will issue written comments within five (5) working days of initial review and each subsequent follow up review of each mock-up.
 - 2. Make corrections as necessary until Architect's approval is issued.
- J. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- K. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.

- d. To provide storage and curing of test samples.
- 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
- 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect 30 days in advance of required observations.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01.41.00
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY OF REFERENCE STANDARDS

- A. Regulatory requirements applicable to this project are the following:
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. FED-STD-795 - Uniform Federal Accessibility Standards (UFAS); 1988.
- D. 29 CFR 1910 - Occupational Safety and Health Standards; current edition.
- E. State of Tennessee amendments to some or all of the following.
- F. City of Knoxville amendments to some or all of the following.
- G. ICC (IBC) - International Building Code; 2018 - City of Knoxville; 2012 - State of Tennessee.
- H. ICC (IFC) - International Fire Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. NFPA 1 - Fire Code; 2018.
- J. NFPA 101 - Life Safety Code; 2015.
- K. NFPA 5000 - Building Construction and Safety Code; 2018.
- L. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. ICC (IMC) - International Mechanical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. ICC (IFGC) - International Fuel Gas Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- P. ICC (IECC) - International Energy Conservation Code; 2012.

1.02 RELATED REQUIREMENTS

- A. Section 01.40.00 - Quality Requirements.

1.03 QUALITY ASSURANCE

- A. Contractor's Designer Qualifications: Refer to Section - 01.40.00 - Quality Requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01.45.33

CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Code-required special inspections.
- B. Testing services incidental to special inspections.
- C. Submittals.

1.02 RELATED REQUIREMENTS

- A. Document 00.72.00 - General Conditions: Inspections and approvals required by public authorities.
- B. Section 01.30.00 - Administrative Requirements: Submittal procedures.
- C. Section 01.40.00 - Quality Requirements.
- D. Section 01.60.00 - Product Requirements: Requirements for material and product quality.

1.03 ABBREVIATIONS AND ACRONYMS

- A. AHJ: Authority having jurisdiction.
- B. IAS: International Accreditation Service, Inc.
- C. NIST: National Institute of Standards and Technology.

1.04 DEFINITIONS

- A. Code or Building Code: ICC (IBC), International Building Code, Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements and specifically, Chapter 17 - Special Inspections and Tests.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. Special Inspection:
 - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved Contract Documents and the referenced standards.
 - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.05 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2016).
- B. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.
- D. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2021.
- E. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2017.
- F. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
- G. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2014a.

- H. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2015.
- I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).
- J. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.
- K. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.
- L. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2010.
- M. IAS AC291 - Accreditation Criteria for Special Inspection Agencies; 2017.
- N. ICC (IBC) - International Building Code; 2015.
- O. SDI (QA/QC) - Standard for Quality Control and Quality Assurance for Installation of Steel Deck; 2017.
- P. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders; 2020.
- Q. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.06 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
 - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
 - 4. Submit documentation that Special Inspection Agency is accredited by IAS according to IAS AC291.
- C. Testing Agency Qualifications: Prior to the start of work, the Testing Agency is required to:
 - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Testing Agency is acceptable to AHJ.
 - 4. Submit documentation that Testing Agency is accredited by IAS according to IAS AC89.
- D. Fabricator's Qualification Statement: Fabricator is required to submit documentation of fabrication facilities and methods as well as quality control procedures.
- E. Special Inspection Reports: After each special inspection, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to the AHJ.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of special inspection.
 - h. Date of special inspection.
 - i. Results of special inspection.
 - j. Compliance with Contract Documents.
- F. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to AHJ.

1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of fabricated item and specification section.
 - f. Location in the Project.
 - g. Results of special inspection.
 - h. Verification of fabrication and quality control procedures.
 - i. Compliance with Contract Documents.
 - j. Compliance with referenced standard(s).
- G. Test Reports: After each test or inspection, promptly submit at least two copies of report; one to Architect and one to AHJ.
 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test or inspection.
 - h. Date of test or inspection.
 - i. Results of test or inspection.
 - j. Compliance with Contract Documents.
- H. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.
 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect and AHJ.

1.07 SPECIAL INSPECTION AGENCY

- A. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.08 TESTING AND INSPECTION AGENCIES

1.09 QUALITY ASSURANCE

- A. Special Inspection Agency Qualifications:
 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 2. Accredited by IAS according to IAS AC291.
- B. Testing Agency Qualifications:
 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 2. Accredited by IAS according to IAS AC89.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
 - 1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.02 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

- A. Cold-Formed Steel Deck: Comply with quality assurance inspection requirements of SDI (QA/QC).
- B. Open-Web Joists and Joist Girders: Comply with requirements of ICC (IBC), Table 1705.2.3.
 - 1. End Connections - Welding or Bolted: Comply with requirements of SJI 100; periodic.
 - 2. Bridging - Horizontal or Diagonal:
 - a. Standard Bridging: Comply with requirements of SJI 100; periodic.
 - b. Bridging That Differs From the SJI Specifications: Periodic inspection.
- C. Welding:
 - 1. Structural Steel and Cold Formed Steel Deck:
 - a. Complete and Partial Joint Penetration Groove Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - b. Multipass Fillet Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - c. Single Pass Fillet Welds Less than 5/16 inch Wide: Verify compliance with AWS D1.1/D1.1M; periodic.
 - d. Plug and Slot Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - e. Single Pass Fillet Welds 5/16 inch or Greater: Verify compliance with AWS D1.1/D1.1M; continuous.
 - f. Floor and Roof Deck Welds: Verify compliance with AWS D1.3/D1.3M; continuous.
 - 2. Reinforcing Steel: Verify items listed below comply with AWS D1.4/D1.4M and ACI 318, Section 3.5.2.
 - a. Verification of weldability; periodic.
 - b. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames as well as boundary elements of special structural walls of concrete and shear reinforcement; continuous.
 - c. Shear reinforcement; continuous.
 - d. Other reinforcing steel; periodic.

3.03 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

- A. Reinforcing Steel, Including Prestressing of Tendons and Placement: Verify compliance with approved Contract Documents and ACI 318, Sections 3.5 and 7.1 through 7.7; periodic.
- B. Reinforcing Bar Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, 26.6.4; periodic.
- C. Reinforcing Steel Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, Section 3.5.2; periodic.
- D. Anchors Cast in Concrete: Verify compliance with ACI 318, 17.8.2; periodic.
- E. Bolts Installed in Concrete: Where allowable loads have been increased or where strength design is used, verify compliance with approved Contract Documents and ACI 318, Sections 8.1.3 and 21.2.8 prior to and during placement of concrete; continuous.
- F. Anchors Post-Installed in Hardened Concrete: Verify compliance with ACI 318.

1. Adhesive Anchors: Verify horizontally or upwardly-inclined orientation installations resisting sustained tension loads - Section 17.8.2.4; continuous.
- G. Design Mix: Verify plastic concrete complies with the design mix in approved Contract Documents and with ACI 318, Chapter 4 and 5.2; periodic.
- H. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M and ACI 318, Chapter 26.5, 26.12, and record the following, continuous:
 1. Slump.
 2. Air content.
 3. Temperature of concrete.
- I. Specified Curing Temperature and Techniques: Verify compliance with approved Contract Documents and ACI 318, Sections 5.11 through 5.13; periodic.
- J. Concrete Strength in Situ: Verify concrete strength complies with approved Contract Documents and ACI 318, Section 6.2, for the following.
- K. Formwork Shape, Location and Dimensions: Verify compliance with approved Contract Documents and ACI 318, Section 6.1.1; periodic.
- L. Welding of Reinforcing Bars: Conduct special inspections and verify Special Inspector's qualifications in accordance with requirements of AWS D1.4/D1.4M.

3.04 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

- A. Masonry Structures Subject to Special Inspection:
 1. Engineered masonry in structures classified as "low hazard..." and "substantial hazard to human life in the event of failure".

3.05 SPECIAL INSPECTIONS FOR PREFABRICATED WOOD CONSTRUCTION

- A. Metal Plate Connected Wood Trusses with Clear Span of 60 feet or More: Verify compliance of each item below with approved Contract Documents in general and with approved truss submittal package in particular.
 1. Temporary restraint and bracing.
 2. Permanent individual truss member restraint and bracing.

3.06 SPECIAL INSPECTIONS FOR SOILS

- A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
 1. Design bearing capacity of material below shallow foundations; periodic.
 2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
 3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
 4. Subgrade, prior to placement of compacted fill verify proper preparation; periodic.
- B. Testing: Classify and test excavated material; periodic.

3.07 SPECIAL INSPECTIONS FOR CAST-IN-PLACE DEEP FOUNDATIONS

- A. Materials, Equipment and Final Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
 1. Element length; continuous.
 2. Element diameters and bell diameters; continuous.
 3. Embedment into bedrock; continuous.
 4. End bearing strata capacity; continuous.
 5. Placement locations and plumbness; continuous.
 6. Type and size of hammer; continuous.
- B. Drilling Operations: Observe and maintain complete and accurate records for each element; continuous.
- C. Material Volume: Record concrete and grout volumes.

- D. Concrete Elements Associated with Cast-in-Place Deep Foundations: Perform additional inspections as required by the Special Inspections for Concrete Construction article of this section.

3.08 SPECIAL INSPECTIONS FOR VERTICAL MASONRY FOUNDATION ELEMENTS

- A. Vertical Masonry Foundation Elements are subject to the same special inspection requirements listed in the "Special Inspections for Masonry Construction" Article of this section.

3.09 SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

- A. Designated Seismic System Verification: Verify label, anchorage or mounting complies with certificate of compliance provided by manufacturer or fabricator.
- B. Structural Observations for Seismic Resistance: Visually observe structural system for general compliance with the approved Contract Documents; periodic.

3.10 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agency shall:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified reference standards.
 - 3. Ascertain compliance of materials and products with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests or inspections specified.
- B. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- C. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.11 TESTING AGENCY DUTIES AND RESPONSIBILITIES

- A. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests or inspections specified.
- B. Limits on Testing or Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the work.
- C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.
- D. Contractor will pay for re-testing required because of non-compliance with specified requirements.

3.12 CONTRACTOR DUTIES AND RESPONSIBILITIES

- A. Contractor Responsibilities, General:

1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
 2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
 3. Provide incidental labor and facilities:
 - a. To provide access to work to be tested or inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
 - c. To facilitate tests or inspections.
 - d. To provide storage and curing of test samples.
 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
 5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- B. Contractor Responsibilities, Seismic Force-Resisting System, Designated Seismic System, and Seismic Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

END OF SECTION

SECTION 01.50.00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dewatering
- B. Temporary utilities.
- C. Temporary telecommunications services.
- D. Temporary sanitary facilities.
- E. Temporary Controls: Barriers, enclosures, and fencing.
- F. Security requirements.
- G. Vehicular access and parking.
- H. Waste removal facilities and services.
- I. Project identification sign.
- J. Field offices.

1.02 RELATED REQUIREMENTS

- A. Section 01.35.53 - Security Procedures

1.03 DEWATERING

- A. Provide temporary means and methods for dewatering all temporary facilities and controls.
- B. Maintain temporary facilities in operable condition.

1.04 TEMPORARY UTILITIES

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.05 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - 2. Internet Connections: Minimum of one; DSL modem or faster.

1.06 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.07 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.08 FENCING

- A. Construction: Commercial grade chain link fence.

- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.09 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.10 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.11 SECURITY - SEE SECTION 01.35.53

1.12 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
- F. Do not allow vehicle parking on existing pavement.

1.13 WASTE REMOVAL

- A. See Section 01.74.19 - Construction Waste Management and Disposal, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.
- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.14 PROJECT IDENTIFICATION

- A. Provide project identification sign of design and construction indicated on drawings.
- B. Erect on site at location established by Architect.
- C. No other signs are allowed without Owner permission except those required by law.

1.15 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.16 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated. Clean and repair damage caused by installation or use of temporary work.
- C.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01.57.13 - TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 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. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 RELATED REQUIREMENTS

- A. Section 31.22.00 - Grading: Temporary and permanent grade changes for erosion control.

1.03 PERFORMANCE REQUIREMENTS

- A. Comply with all requirements of U.S. Environmental Protection Agency for erosion and sedimentation control, as specified for the National Pollutant Discharge Elimination System (NPDES), Phases I and II, under requirements for the 2003 Construction General Permit (CGP), whether the project is required by law to comply or not.
- B. Also comply with all more stringent requirements of State of Tennessee Erosion and Sedimentation Control Manual.
- C. Comply with all requirements of Knox County for erosion and sedimentation control.
- D. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.
- E. 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.
- F. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- G. 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.
- H. 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.
- I. 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.

- J. 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.
- K. 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.
- L. Open Water: Prevent standing water that could become stagnant.
- M. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Erosion and Sedimentation Control Plan:
 - 1. Submit not less than 30 days prior to anticipated start of clearing, grading, or other work involving disturbance of ground surface cover.
 - 2. Include:
 - a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
 - b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
 - c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
 - d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
 - e. Other information required by law.
 - f. Format required by law is acceptable, provided any additional information specified is also included.
 - 3. Obtain the approval of the Plan by authorities having jurisdiction.
 - 4. Obtain the approval of the Plan by Owner.
- C. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 – PRODUCTS

Specific products are called out on the project plans.

PART 3 EXECUTION

2.01 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

2.02 PREPARATION

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

2.03 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. Clean out temporary sediment control structures weekly and relocate soil on site.
- D. Place sediment in appropriate locations on site; do not remove from site.

2.04 CLEAN UP

- A. Clean out temporary sediment control structures that are to remain as permanent measures.
- B. 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 01.60.00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 01.25.00 - Substitution Procedures: Substitutions made during construction phase.
- B. Section 01.40.00 - Quality Requirements: Product quality monitoring.
- C. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- D. Section 01.74.19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 REFERENCE STANDARDS

- A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content; Current Edition.
- B. ISO 14025 - Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures; 2006.
- C. ISO 21930 - Sustainability in building construction -- Environmental declaration of building products; 2007.
- D. NSF 332 - Sustainability Assessment for Resilient Floor Coverings; 2015.

1.04 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.05 QUALITY ASSURANCE

- A. Composite Wood and Agrifiber: Products made of wood particles and/or plant material pressed and bonded with adhesive or resin such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores.
- B. Health Product Declarations (HPD): Complete, published declaration with full disclosure of known hazards, prepared using one of the HPDC (HPD-OLT) online tools.
- C. Manufacturer's Inventory of Product Content: Publicly available inventory of every ingredient identified by name and Chemical Abstract Service Registration Number (CAS RN).
 - 1. For ingredients considered a trade secret or intellectual property, the name and CAS RN may be omitted, provided the ingredient's role, amount, and GreenScreen Benchmark are given.

- D. Rapidly Renewable Materials: Made from agricultural products that are typically harvested within a 10-year or shorter cycle.
- E. Recycled Content: Determine percentage of post-consumer and pre-consumer (post-industrial) content separately, using the guidelines contained in 16 CFR 260.13.
 - 1. Previously used, reused, refurbished, and salvaged products are not considered recycled.
 - 2. Wood fabricated from timber abandoned in transit to original mill is considered reused, not recycled.
 - 3. Determine percentage of recycled content of any item by dividing the weight of recycled content in the item by the total weight of materials in the item.
 - 4. Determine value of recycled content of each item separately, by multiplying the content percentage by the value of the item.
 - 5. Acceptable Evidence:
 - a. For percentage of recycled content, information from manufacturer.
 - b. For cost, Contractor's cost data.
- F. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 100 miles from the Project site.
- G. Sustainably Harvested Wood: Solid wood, wood chips, and wood fiber certified or labeled by an organization accredited by one of the following:
 - 1. The Forest Stewardship Council, The Principles for Natural Forest Management; for Canada visit <http://www.fscCanada.org>, for the USA visit <http://www.fscus.org>.
 - 2. Sustainable Forestry Board, under The Sustainable Forestry Initiative® of the American Forest & Paper Association; refer to <http://www.afandpa.org>.
 - 3. Acceptable Evidence: Copies of invoices bearing the certifying organization's certification numbers.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
 - 1. Made outside the United States, its territories, Canada, or Mexico.
 - 2. Made using or containing CFC's or HCFC's.
 - 3. Made of wood from newly cut old growth timber.
 - 4. Containing lead, cadmium, or asbestos.
- C. Where other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions, as defined in Section 01.61.16.
 - 2. If wet-applied, have lower VOC content, as defined in Section 01.61.16.
 - 3. Are extracted, harvested, and/or manufactured closer to the location of the project.
 - 4. Result in less construction waste. See Section 01.74.19
 - 5. Are made of vegetable materials that are rapidly renewable.
 - 6. Are made of recycled materials.
 - 7. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.

2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

- A. See Section 01.25.00 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01.74.19.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.
- F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- G. For exterior storage of fabricated products, place on sloped supports above ground.
- H. Provide off-site storage and protection when site does not permit on-site storage or protection.
- I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- J. Comply with manufacturer's warranty conditions, if any.
- K. Do not store products directly on the ground.
- L. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- M. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

- N. Prevent contact with material that may cause corrosion, discoloration, or staining.
- O. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- P. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01.61.16

VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.
- C. Requirement for installer certification that they did not use any non-compliant products.

1.02 RELATED REQUIREMENTS

- A. Section 01.30.00 - Administrative Requirements: Submittal procedures.
- B. Section 01.40.00 - Quality Requirements: Procedures for testing and certifications.
- C. Section 01.60.00 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.
- D. Section 07.92.00 - Joint Sealants: Emissions-compliant sealants.

1.03 DEFINITIONS

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
 - 1. Concrete.
 - 2. Clay brick.
 - 3. Metals that are plated, anodized, or powder-coated.
 - 4. Glass.
 - 5. Ceramics.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2013).
- C. BIFMA e3 - Furniture Sustainability Standard; Business and Institutional Furniture Manufacturers Association; 2012.
- D. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; California Department of Public Health; v1.1, 2010.
- E. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board; current edition.
- F. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2007.
- G. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.

- H. CRI (GLP) - Green Label Plus Testing Program - Certified Products; www.carpet-rug.org; current edition.
- I. GreenSeal GS-36 - Adhesives for Commercial Use; 2013.
- J. SCAQMD 1113 - South Coast Air Quality Management District Rule No.1113; current edition.
- K. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.
- L. SCS (CPD) - SCS Certified Products; current listings at www.scs-certified.com.
- M. UL (GGG) - GREENGUARD Gold Certified Products; current listings at <http://productguide.ulenvironment.com/QuickSearch.aspx>.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
- C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

1.06 QUALITY ASSURANCE

- A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
 - 1. Wet-Applied Products: State amount applied in mass per surface area.
 - 2. Paints and Coatings: Test tinted products, not just tinting bases.
 - 3. Evidence of Compliance: Acceptable types of evidence are the following;
 - a. Current UL (GGG) certification.
 - b. Current SCS (CPD) Floorscore certification.
 - c. Current SCS (CPD) Indoor Advantage Gold certification.
 - d. Current listing in CHPS (HPPD) as a low-emitting product.
 - e. Current CRI (GLP) certification.
 - f. Test report showing compliance and stating exposure scenario used.
 - 4. Product data submittal showing VOC content is NOT acceptable evidence.
 - 5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
- B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
- C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scs-certified.com.
 - b. Report of laboratory testing performed in accordance with requirements.
 - c. Published product data showing compliance with requirements.
- D. Furnishings Emissions Standard and Test Method: BIFMA e3 Sections 7.6.1 and 7.6.2, tested in accordance with BIFMA M7.1.
 - 1. Evidence of Compliance:
 - a. Test report showing compliance and stating exposure scenario used.
- E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
- B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
 - 1. Furnishings: Furnishings are Owner-supplied.
 - 2. Inherently Non-Emitting Materials.
- C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
 - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
 - 2. Aerosol Adhesives: GreenSeal GS-36.
 - 3. Joint Sealants: SCAQMD 1168 Rule.
 - 4. Paints and Coatings: Each color; most stringent of the following:
 - a. 40 CFR 59, Subpart D.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 01.70.00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Cutting and patching.
- C. Surveying for laying out the work.
- D. Cleaning and protection.
- E. Starting of systems and equipment.
- F. Demonstration and instruction of Owner personnel.
- G. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- H. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01.30.00 - Administrative Requirements: Submittals procedures.
- B. Section 01.40.00 - Quality Requirements: Testing and inspection procedures.
- C. Section 01.50.00 - Temporary Facilities and Controls: Temporary exterior enclosures.
- D. Section 01.50.00 - Temporary Facilities and Controls: Temporary interior partitions.
- E. Section 01.50.00 - Temporary Facilities and Controls: Temporary utilities; field offices and sheds; vehicular access and parking; temporary project signage.
- F. Section 01.57.13 - Temporary Erosion and Sediment Control: Additional erosion and sedimentation control requirements.
- G. Section 01.71.23 - Field Engineering: Additional requirements for field engineering and surveying work.
- H. Section 01.74.19 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- I. Section 01.78.00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
- J. Section 01.79.00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
- K. Section 02.41.00 - Demolition: Selective demolition of existing site concrete work; site utility demolition.
- L. Section 07.84.00 - Firestopping.

1.03 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.

2. Integrity of weather exposed or moisture resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,
- B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

1.06 PROJECT CONDITIONS

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- C. Perform dewatering activities, as required, for the duration of the project.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
- F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
- G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- H. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.
- I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Control datum for survey is that indicated on drawings.
- E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- H. Utilize recognized engineering survey practices.
- I. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- J. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and _____.

2. Grid or axis for structures.
 3. Building foundation, column locations, ground floor elevations, and _____.
- K. Periodically verify layouts by same means.
- L. Maintain a complete and accurate log of control and survey work as it progresses.

3.04 GENERAL INSTALLATION REQUIREMENTS

- A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
- B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
 1. Complete the work.
 2. Fit products together to integrate with other work.
 3. Provide openings for penetration of mechanical, electrical, and other services.
 4. Match work that has been cut to adjacent work.
 5. Repair areas adjacent to cuts to required condition.
 6. Repair new work damaged by subsequent work.
 7. Remove samples of installed work for testing when requested.
 8. Remove and replace defective and non-complying work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07.84.00, to full thickness of the penetrated element.
- I. Patching:
 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 2. Match color, texture, and appearance.
 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.06 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.07 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
- G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- H. Prohibit traffic from landscaped areas.
- I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.08 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.09 DEMONSTRATION AND INSTRUCTION

- A. See Section 01.79.00 - Demonstration and Training.

3.10 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Section 23.05.93 - Testing, Adjusting, and Balancing for HVAC.

3.11 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Use cleaning materials that are nonhazardous.

- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.12 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect and Owner.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Owner will occupy all of the building as specified in Section 01.10.00.
- F. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- G. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- H. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- I. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.13 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01.71.23
FIELD ENGINEERING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Field engineering services by Contractor.
- B. Land surveying services by Contractor.

1.02 RELATED REQUIREMENTS

- A. Section 01.22.00 - Unit Prices: Bid pricing for hourly salary-and-benefits rates for personnel providing field engineering services if required.

1.03 DESCRIPTION OF SERVICES

- A. Specific services listed in this section are in addition to, and do not supersede, general Execution and Closeout Requirements.
- B. Sole responsibility for establishing all locations, dimensions and levels of items of work.
- C. Sole responsibility for provision of all materials required to establish and maintain benchmarks and control points, including batter boards, grade stakes, structure elevation stakes, and other items.
- D. Keeping a transit, theodolite, or TST (total station theodolite with electronic distance measurement device); leveling instrument; and related implements such as survey rods and other measurement devices, at the project site at all times.
- E. Provision of facilities and assistance necessary for Architect to check lines and grade points placed by Contractor.
 - 1. Performance of excavation or embankment work until after all cross-sectioning necessary for determining payment quantities for Unit Price work have been completed and accepted by Architect.
- F. Preparation and maintenance of professional-quality, accurate, well organized, legible notes of all measurements and calculations made while surveying and laying out the work.
- G. Prior to backfilling operations, surveying - locating, and recording on a copy of Contract Documents - an accurate representation of buried work and Underground Facilities encountered.

1.04 REFERENCE STANDARDS

- A. FGDC-STD-007.1 - Geospatial Positioning Accuracy Standards - Part 1: Reporting Methodology; 1998.
- B. FGDC-STD-007.2 - Geospatial Positioning Accuracy Standards - Part 2: Standards for Geodetic Networks; 1998.
- C. FGDC-STD-007.4 - Geospatial Positioning Accuracy Standards - Part 4: Architecture, Engineering, Construction, and Facilities Measurement; 2002.
- D. State Plane Coordinate System for the State in which the Project is located.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.06 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Submit in addition to items required in Section 01.70.00 - Execution and Closeout Requirements.
- C. Informational Submittals: Submit the following:
 - 1. Field Engineering: Submit daily reports, with content as indicated in this section.

- a. When requested by Architect, submit for Record documentation verifying accuracy of field engineering including, but not limited to, Contractor's survey notes and field notes.
2. Final property survey.

1.07 QUALITY ASSURANCE

- A. Field Engineer's Qualifications: As established in Section 01.70.00 - Execution and Closeout Requirements.
- B. Use adequate number of skilled and thoroughly-trained workers to perform the work of this section in a timely and comprehensive manner.
- C. Minimum accuracy for required work is as follows:
 1. Grade: Horizontal Tolerance: Plus or minus 0.5 feet, Vertical Tolerance: Plus or minus 0.05 feet.
 2. Culverts and ditches: Horizontal Tolerance: Plus or minus 0.5 feet, Vertical Tolerance: Plus or minus 0.05 feet.
 3. Structures: Horizontal Tolerance: Plus or minus 0.5 feet (location), Vertical Tolerance: Plus or minus 0.05 feet.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. Notify Owner's Representative and Architect of any discrepancies immediately in writing before proceeding to lay out the work. Locate and protect existing benchmarks and base line. Preserve permanent reference points during construction.
- B. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify existing conditions.

3.02 FIELD ENGINEERING

- A. Maintain field office files, drawings, specifications, and record documents.
- B. Coordinate field engineering services with Contractor's subcontractors, installers, and suppliers as appropriate.
- C. Prepare layout and coordination drawings for construction operations.
- D. Check and coordinate the work for conflicts and interferences, and immediately advise Architect and Owner of all discrepancies of which Contractor is aware.
- E. Cooperate as required with Architect and Owner in observing the work and performing field inspections.
- F. Review and coordinate work on a regular basis with shop drawings and Contractor's other submittals.
- G. In general, match existing adjacent grades and maintain existing flow lines.
- H. Check the location, line and grade of every major element as the work progresses. Notify the Architect when deviations from required lines or grades exceed allowable tolerances. Include in such notifications a thorough explanation of the problem, and a proposed plan and schedule for remedying the deviation. Do not proceed with remedial work without Owner's concurrence of the remediation plan.
- I. Check all formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping, other materials and equipment for compliance with shop drawings and Contract Documents requirements.
- J. Check all bracing and shoring for structural integrity and compliance with designs prepared by the Contractor.

3.03 LAND SURVEYING

- A. General: Follow standards for geospatial positioning accuracy.
 - 1. FGDC-STD-007.1 as amended by Authority Having Jurisdiction.
 - 2. FGDC-STD-007.2 as amended by Authority Having Jurisdiction.
 - 3. FGDC-STD-007.4 as amended by Authority Having Jurisdiction.
- B. Coordinate survey data with the State Plane Coordinate System of the State in which the Project is located.
- C. Contractor is responsible for the restoration of all property corners and control monuments damaged or destroyed by construction-related activities. Any disturbed monuments must be replaced at Contractor's expense by a surveyor licensed in the State in which the Project is located, and approved by the Architect.
 - 1. Temporarily suspend work at such points and for such reasonable times as the Owner may require for resetting monuments. The Contractor will not be entitled to any additional compensation or extension of time.

3.04 CONSTRUCTION SURVEYING

- A. General: Perform surveying as applicable to specific items necessary for proper execution of work.
 - 1. Alignment Staking: Provide alignment stakes at 50 foot intervals on tangent, and at 25 foot intervals on curves.
 - 2. Slope Staking: Provide slope staking at 50 foot intervals on tangent, and at 25 foot intervals on curves. Re-stake at every ten-foot difference in elevation.
 - 3. Structure: Stake out structures, including elevations, and check prior to and during construction.
 - 4. Pipelines: Stake out pipelines including elevations, and check prior to and during construction.
 - 5. Site Utilities: Stake out utility lines including elevations, and check prior to and during construction.
 - 6. Road: Stake out roadway elevations at 50 foot50-foot intervals on tangent, and at 25 foot intervals on curves.
 - 7. Cross-sections: Provide original, intermediate, and final staking as required, for site work and other locations as necessary for quantity surveys.
 - 8. Record Staking: Provide permanent stake at each blind flange and each utility cap is provided for future connections. Use stakes for record staking of material(s) acceptable to Architect.
- B. Surveying to Determine Quantities for Payment.
 - 1. For each application for progress payment, perform such surveys and computations necessary to determine quantities of work performed or placed. Perform surveys necessary for Architect to determine final quantities of work in place.
- C. Record Log: Maintain a log of layout control work. Record any deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used.
- D. Accuracy:
 - 1. Establish Contractor's temporary survey references points for Contractor's use to at least second-order accuracy (e.g., 1:10000). Set construction staking used as a guide for the work to at least third-order accuracy (e.g., 1:5000). Provide the absolute margin for error specified below on the basis established by such orders.
 - a. Horizontal accuracy of easement staking: Plus or minus 0.1 feet.
 - b. Accuracy of other staking shall be plus or minus 0.04 feet horizontally and plus or minus 0.02 feet vertically.
 - c. Include an error analysis sufficient to demonstrate required accuracy in survey calculations.

2. Owner reserves the right to check the Contractor's survey, measurements, and calculations. The requirement for accuracy will not be waived, whether this right is exercised or not.

3.05 REPORTS

- A. Submit two copies of Contractor's daily reports at Architect's field office (or electronically) by 9:00 AM the next working day after the day covered in the associated report. Daily report shall be signed by responsible member of Contractor's staff, such as project manager or superintendent, or foreman designated by Contractor as having authority to sign daily reports.

3.06 RECORDS

- A. Maintain at the Site a complete and accurate log of control and survey work as it progresses.
 1. Organize and record survey data in accordance with recognized professional surveying standards, Laws and Regulations, and prevailing standards of practice in the State in which the Project is located. Record Contractor's surveyor's original field notes, computations, and other surveying data in Contractor-furnished hard-bound field books. Contractor is solely responsible for completeness and accuracy of survey work, and completeness and accuracy of survey records, including field books. Survey records, (including field books) may be rejected by Owner due to failure to organize and maintain survey records in a manner that allows reasonable and independent verification of calculations, and/or allows identification of elevations, dimensions, and grades of the work.
 2. Illegible notes or data, and erasures on any page of field books, are unacceptable. Do not submit copied notes or data. Corrections by ruling or lining out errors will be unacceptable unless initialed by the surveyor. Violation of these requirements may require re-surveying the data questioned by Architect.
- B. Submit three copies of final property survey to Owner. Include on the survey a certification, signed by the surveyor, that principal metes, bounds, lines, and levels of the Project are accurately positioned as shown on the survey. Include the following information:
 1. Structure locations from property lines, and distances to adjacent buildings.
 2. Dimensions and locations of drives, walks, walls, underground utilities, appurtenances, and major site features.
 3. Location of easements.
 4. Final grading topographic survey.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01.78.00 - Closeout Submittals, for closeout submittals.
- B. See Section 01.79.00 - Demonstration and Training, for additional requirements.

END OF SECTION

SECTION 01.74.19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
 - 1. Aluminum and plastic beverage containers.
 - 2. Corrugated cardboard.
 - 3. Wood pallets.
 - 4. Clean dimensional wood.
 - 5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31.10.00 - Site Clearing for use options.
 - 6. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
 - 7. Bricks: May be used on project if whole, or crushed and used as landscape cover, sub-base material, or fill.
 - 8. Concrete masonry units: May be used on project if whole, or crushed and used as sub-base material or fill.
 - 9. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - 10. Gypsum drywall and plaster.
 - 11. Plastic buckets.
 - 12. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (<http://flooring.dupont.com>) and Interface (www.interfaceinc.com) conduct reclamation programs.
 - 13. Asphalt roofing shingles.
 - 14. Paint.
 - 15. Plastic sheeting.
- E. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.
- F. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
 - 5. Incineration, either on- or off-site.
- G. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

- A. Section 01.30.00 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 01.50.00 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01.60.00 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

- D. Section 01.70.00 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.
- E. Section 31.10.00 - Site Clearing: Handling and disposal of land clearing debris.

1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Waste Management Plan: Include the following information:
 - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
 - 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
 - 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 - 4. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
 - 5. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

- A. See Section 01.60.00 - Product Requirements for substitution submission procedures.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01.60.00:
 - 1. Relative amount of waste produced, compared to specified product.
 - 2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
 - 3. Proposed disposal method for waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01.50.00 for additional requirements related to trash/waste collection and removal facilities and services.
- B. See Section 01.60.00 for waste prevention requirements related to delivery, storage, and handling.
- C. See Section 01.70.00 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1. Prebid meeting.
 - 2. Preconstruction meeting.
 - 3. Job safety meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. As a minimum, provide:
 - a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
 - b. Separate dumpsters for each category of recyclable.
 - c. Recycling bins at worker lunch area.
 - 2. Provide containers as required.
 - 3. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 - 4. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

END OF SECTION

SECTION 01.78.00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 00.72.00 - General Conditions and 00.73.00 - Supplementary Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 01.30.00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Section 01.70.00 - Execution and Closeout Requirements: Contract closeout procedures.
- D. Individual Product Sections: Specific requirements for operation and maintenance data.
- E. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.

- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish first floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
 - 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - 1. Include HVAC outdoor and exhaust air damper calibration strategy.
 - a. Include provisions which ensure that full closure of dampers can be achieved.
 - 2. Include Frost Mitigation Strategy for ventilation heat-recovery system.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports.
- P. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:

1. Project Directory.
2. Table of Contents, of all volumes, and of this volume.
3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Operation and maintenance data.
 - c. Field quality control data.
 - d. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION

SECTION 01.79.00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Plumbing equipment.
 - 4. Electrical systems and equipment.
 - 5. Landscape irrigation.
 - 6. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
 - 2. Finishes, including flooring, wall finishes, ceiling finishes.
 - 3. Fixtures and fittings.
 - 4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

- A. Section 01.78.00 - Closeout Submittals: Operation and maintenance manuals.
- B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Submit to Architect for transmittal to Owner.
 - 2. Submit not less than four weeks prior to start of training.
 - 3. Revise and resubmit until acceptable.
 - 4. Provide an overall schedule showing all training sessions.
 - 5. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.
 - e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - g. Media to be used, such as slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
 - 1. Include applicable portion of O&M manuals.
 - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- D. Training Reports:
 - 1. Identification of each training session, date, time, and duration.
 - 2. Sign-in sheet showing names and job titles of attendees.

3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
- E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
 1. Format: DVD Disc.
 2. Label each disc and container with session identification and date.

1.04 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstration may be combined with Owner personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

- A. Conduct training on-site unless otherwise indicated.
- B. Owner will provide classroom and seating at no cost to Contractor.
- C. Provide training in minimum two hour segments.
- D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 3. Typical uses of the O&M manuals.
- F. Product- and System-Specific Training:
 1. Review the applicable O&M manuals.
 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.

3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 6. Discuss common troubleshooting problems and solutions.
 7. Discuss any peculiarities of equipment installation or operation.
 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 10. Review spare parts and tools required to be furnished by Contractor.
 11. Review spare parts suppliers and sources and procurement procedures.
- G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 03.05.16
UNDERSLAB VAPOR BARRIER - STEGO

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sheet vapor barrier under concrete slabs on grade.

1.02 RELATED REQUIREMENTS

- A. Section 03.10.00 - Concrete Forming and Accessories: Forms and accessories for formwork.
- B. Section 03.20.00 - Concrete Reinforcing.
- C. Section 03.30.00 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

1.03 REFERENCE STANDARDS

- A. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011.
- B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products.
- C. Test Data: Submit report of tests showing compliance with specified requirements.
- D. Samples: Submit samples of underslab vapor barrier to be used.
- E. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Underslab Vapor Barrier:
 - 1. Water Vapor Permeance: Not more than 0.010 perms, maximum.
 - 2. Complying with ASTM E1745 Class A.
 - 3. Thickness: 15 mils.
 - 4. Basis of Design:
 - a. Stego Industries LLC; Stego Wrap Vapor Barrier (15-mil):
www.stegoindustries.com/#sle.
 - b. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

3.02 INSTALLATION

- A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.
- B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.
- C. Lap joints minimum 6 inches.

- D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.
- E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.
- F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION

SECTION 03.30.00 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 07.92.00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.02 REFERENCE STANDARDS

- A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- C. ACI 301 - Specifications for Structural Concrete; 2016.
- D. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- F. ACI 308R - Guide to External Curing of Concrete; 2016.
- G. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).
- H. ACI 347R - Guide to Formwork for Concrete; 2014, with Errata (2017).
- I. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.
- J. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.
- K. ASTM C150/C150M - Standard Specification for Portland Cement; 2020.
- L. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
- M. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.
- N. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019.
- O. ASTM C845/C845M - Standard Specification for Expansive Hydraulic Cement; 2018.
- P. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2019.
- Q. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.
- R. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.
- S. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017.

1.03 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.

2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
- D. Samples: Submit samples of underslab vapor retarder to be used.
- E. Test Reports: Submit report for each test or series of tests specified.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
 1. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
 2. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches (38 mm) of concrete surface.

2.02 REINFORCEMENT MATERIALS

- A. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type II - Moderate Portland type.
- B. Blended, Expansive Hydraulic Cement: ASTM C845/C845M, Type K.
- C. Fine and Coarse Aggregates: ASTM C33/C33M.
- D. Water: ASTM C1602/C1602M; clean, potable, 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 and Retarding Admixture: ASTM C494/C494M Type G.
- D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
- E. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
- F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
- G. Waterproofing Admixture: Admixture formulated to reduce permeability to liquid water, with no adverse effect on concrete properties.

2.05 ACCESSORY MATERIALS

- A. Underslab Vapor Retarder:
 1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.
 2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.

2.06 BONDING AND JOINTING PRODUCTS

- A. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.

2.07 CURING MATERIALS

- A. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
- B. Curing and Sealing Compound, Moisture Emission-Reducing, Membrane-Forming: Liquid, membrane-forming, clear sealer, for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.
 - 1. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.
 - 2. Comply with ASTM C309 and ASTM C1315 Type I Class A.
 - 3. VOC Content: Less than 100 g/L.
- C. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish 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.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
- E. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.
- F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches (150 mm). Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

- B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.
- C. 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.

3.04 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- 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.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. An independent testing agency, as specified in Section 01.40.00, will inspect finished slabs for compliance with specified tolerances.
- B. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch (6 mm) or more in height.
- C. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 - 1. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.08 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. 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 for period necessary for hydration of cement and hardening of concrete.
- C. Surfaces Not in Contact with Forms:
 - 1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
 - 2. Final Curing: Begin after initial curing but before surface is dry.

3.09 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01.40.00 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.

3.10 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 complying with required lines, details, dimensions, tolerances or specified requirements.

3.11 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 04.20.00
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Clay facing brick.
- C. Mortar and grout.
- D. Reinforcement and anchorage.
- E. Flashings.
- F. Lintels.
- G. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03.10.00 - Concrete Forming and Accessories: Dovetail slots for masonry anchors.
- B. Section 03.20.00 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
- C. Section 03.30.00 - Cast-in-Place Concrete: Installation of dovetail slots for masonry anchors.
- D. Section 05.50.00 - Metal Fabrications: Loose steel lintels.
- E. Section 07.13.00 - Sheet Waterproofing: Sheet waterproofing applied to concrete masonry work at below-grade locations.
- F. Section 07.21.00 - Thermal Insulation: Insulation for cavity spaces.
- G. Section 07.25.00 - Weather Barriers: Water-resistive barriers or air barriers applied to the exterior face of the backing sheathing or masonry.
- H. Section 07.84.00 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.
- I. Section 07.92.00 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.
- C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).
- D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2016, with Editorial Revision (2018).
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.
- F. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2012.
- G. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.
- H. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.
- I. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.
- J. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.
- K. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
- L. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2017a.

- M. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- N. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
- O. ASTM C476 - Standard Specification for Grout for Masonry; 2016.
- P. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2016a.
- Q. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2014).
- R. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2016.
- S. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2016.
- T. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2014a.
- U. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
- V. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.
- W. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
- X. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.
- Y. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.
 - 1. Include calculations or selections from the manufacturer's prescriptive design tables that indicate compliance with the applicable building code and project conditions.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 MOCK-UP

- A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, and flashings (with lap joint, corner, and end dam) in mock-up.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
 - 2. Load-Bearing Units: ASTM C90, normal weight.
 - a. Hollow block, as indicated.
 - b. Exposed Faces: Manufacturer's standard color and texture where indicated.

2.02 BRICK UNITS

- A. Manufacturers:
 - 1. Belden Brick: www.beldenbrick.com/#sle.
 - 2. Endicott Clay Products Co; Face Brick - FBX: www.endicott.com/#sle.
 - 3. General Shale Brick: www.generalshale.com/#sle.
- B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
 - 1. Color and texture: As selected by Architect.
 - 2. Nominal size: As indicated on drawings.
 - 3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
 - 4. Provide solid brick where indicated on Drawings.

2.03 MORTAR AND GROUT MATERIALS

- A. Masonry Cement: ASTM C91/C91M, Type N.
 - 1. Colored Mortar: Premixed cement as required to match Architect's color sample.
- B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
 - 1. Not more than 0.60 percent alkali.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Mortar Aggregate: ASTM C144.
- E. Grout Aggregate: ASTM C404.
- F. Water: Clean and potable.
- G. Accelerating Admixture: Nonchloride type for use in cold weather.
- H. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
 - 1. Color: Standard gray.
- I. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.
 - 1. Type: Fine.

2.04 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
 - 1. Hohmann & Barnard, Inc; X-Seal Anchor: www.h-b.com/#sle.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi), deformed billet bars; galvanized.
- C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- D. Single Wythe Joint Reinforcement: ASTM A951/A951M.
 - 1. Type: Truss or ladder.
 - 2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3.

3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.
- E. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.
- F. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
 3. Vertical adjustment: Not less than 3-1/2 inches.

2.05 FLASHINGS

- A. Metal Flashing Materials - Basis of Design: Hohmann and Barnard products.
- B. Combination Asphaltic Flashing Materials - Copper:
 1. Copper/Asphalt Flashing: 3 oz/sq ft copper sheet coated with elastic asphalt compound on both sides.
- C. Factory-Fabricated Flashing Corners and End Dams: Copper.
- D. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.
- E. Termination Bars: Stainless steel; compatible with membrane and adhesives.
- F. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.06 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
- C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
 1. Full-Height Airspace Maintenance and Drainage Material: Mesh panels fitted between masonry ties.
 - a. Drainage Material Thickness: 3/8 inch.
 - b. Manufacturers:
 - 1) CavClear/Archovations, Inc; CavClear Masonry Mat: www.cavclear.com/#sle.
 2. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
 - a. Manufacturers:
 - 1) Mortar Net Solutions; MortarNet: www.mortarnet.com/#sle.
- D. Weeps:
 1. Type: Polyester mesh.
 2. Color(s): As selected by Architect from manufacturer's full range.
- E. Cavity Vents:
 1. Type: Preformed aluminum vents with sloping louvers.
 2. Color(s): As selected by Architect from manufacturer's full range.
- F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.07 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
 1. Masonry below grade and in contact with earth: Type M.
 2. Exterior, loadbearing masonry: Type S.

- 3. Interior, loadbearing masonry: Type S.
- B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
- C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.
- D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave where exposed to view; flush where sheet waterproofing is to be applied.
- D. Brick Units:
 - 1. Bond: Running.
 - 2. Coursing: Three units and three mortar joints to equal 8 inches.
 - 3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Interlock intersections and external corners, except for units laid in stack bond. Refer to Drawings for special conditions related to thru-wall brick expansion joints.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

- I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 WEEPS/CAVITY VENTS

- A. Install weeps in veneer and cavity walls at 16 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.
- B. Install cavity vents in veneer and cavity walls at 32 inches on center horizontally below shelf angles and lintels and near top of walls.

3.07 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
- C. Install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions.
 - 1. Verify that airspace width is no more than 3/8 inch greater than panel thickness.
 - 2. Hold cavity mortar control panel tight to face wythe.
 - 3. Install horizontally between joint reinforcement.
 - 4. Stagger end joints in adjacent rows.
 - 5. Fit to perimeter construction and penetrations without voids.
- D. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, AND CAVITY WALL MASONRY

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.
- E. Lap joint reinforcement ends minimum 6 inches.
- F. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.
- G. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.
- H. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches with at least 5/8 inch mortar cover to the outside face of the anchor.

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 36 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.
- B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.10 REINFORCEMENT AND ANCHORAGES - MULTIPLE WYTHE UNIT MASONRY

- A. Use individual metal ties installed in horizontal joints to bond wythes together. Provide ties spaced as indicated on drawings.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

3.11 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - 1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch, minimum, to form watertight pan at non-masonry construction.
 - 2. Remove or cover protrusions or sharp edges that could puncture flashings.
 - 3. Seal lapped ends and penetrations of flashing before covering with mortar.
- B. Terminate flashing up 8 inches minimum on vertical surface of backing:
 - 1. Install vertical leg of flashing behind water-resistive barrier sheet over backing.
 - 2. Terminate vertical leg of flashing into bed joint in masonry or reglet in concrete.
 - 3. Anchor vertical leg of flashing into backing with a termination bar and sealant.
 - 4. Apply cap bead of sealant on top edge of self-adhered flashing.
- C. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.
- D. Extend metal flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel flat drip with hemmed edge.
- E. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.12 LINTELS

- A. Install loose steel lintels over openings.
- B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
 - 1. Openings to 42 inches: Place two, No. 3 reinforcing bars 1 inch from bottom web.
 - 2. Openings from 42 inches to 78 inches: Place two, No. 5 reinforcing bars 1 inch from bottom web.
 - 3. Openings over 78 inches: Reinforce openings as detailed.
 - 4. Do not splice reinforcing bars.
 - 5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
 - 6. Place and consolidate grout fill without displacing reinforcing.
 - 7. Allow masonry lintels to attain specified strength before removing temporary supports.
- C. Maintain minimum 8 inch bearing on each side of opening.

3.13 GROUTED COMPONENTS

- A. Lap splices minimum 24 bar diameters.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.

3.14 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- C. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.
- D. Form expansion joint as detailed on drawings.

3.15 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
 - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

3.16 TOLERANCES

- A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.17 CUTTING AND FITTING

- A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.18 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01.40.00 - Quality Requirements.
- B. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.19 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.20 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05.12.00 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 05.21.00 - Steel Joist Framing.
- B. Section 05.31.00 - Steel Decking: Support framing for small openings in deck.
- C. Section 05.50.00 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.02 REFERENCE STANDARDS

- A. AISC (MAN) - Steel Construction Manual; 2017.
- B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014, with Editorial Revision (2017).
- F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2020.
- G. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2015.
- H. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric); 2007 (Reapproved 2013).
- I. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2020.
- J. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019, with Editorial Revision (2020).
- K. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.
- L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- M. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- N. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

1.03 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
 - 2. Connections not detailed.
 - 3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- E. Fabricator's Qualification Statement.

1.04 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
- B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Angles and Plates: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Rolled Steel Structural Shapes: ASTM A992/A992M.
- D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade C.
- E. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M, Class C.
- F. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.
- G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- H. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Fabricate connections for bolt, nut, and washer connectors.

2.03 FINISH

- A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

- A. Erect structural steel in compliance with AISC 303.
- B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- D. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

END OF SECTION

SECTION 05.21.00 - STEEL JOIST FRAMING

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 05.12.00 - Structural Steel Framing: Grouting base plates and bearing plates. Superstructure framing.
- B. Section 05.12.00 - Structural Steel Framing: Superstructure framing.
- C. Section 05.31.00 - Steel Decking: Bearing plates and angles.
- D. Section 05.50.00 - Metal Fabrications: Non-framing steel fabrications attached to joists.

1.02 REFERENCE STANDARDS

- A. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2015.
- B. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric); 2007 (Reapproved 2013).
- C. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019, with Editorial Revision (2020).
- D. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.
- E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.
- F. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders; 2020.
- G. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.
- H. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- I. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.03 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, bridging, connections, and attachments.

1.04 QUALITY ASSURANCE

- A. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.
- C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Open Web Joists: SJI Type K Joists:
 - 1. Finish: Shop primed.
- B. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.
- C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 FINISH

- A. Shop prime joists as specified.
- B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

PART 3 EXECUTION

3.01 ERECTION

- A. Erect joists with correct bearing on supports.
- B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.
- C. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.
- D. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.
- E. Do not field cut or alter structural members without approval of joist manufacturer.

END OF SECTION

SECTION 05.31.00 - STEEL DECKING

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 03.30.00 - Cast-in-Place Concrete: Concrete topping over metal deck.
- B. Section 04.20.00 - Unit Masonry: Placement of anchors for bearing plates embedded in unit masonry assemblies.
- C. Section 05.12.00 - Structural Steel Framing: Placement of embedded steel anchors for bearing plates in cast-in-place concrete.
- D. Section 05.21.00 - Steel Joist Framing: Placement of embedded steel anchors for bearing plates and joist seats in cast-in-place concrete.
- E. Section 05.50.00 - Metal Fabrications: Steel angle concrete stops at deck edges.

1.02 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- C. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.
- E. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.
- F. ICC-ES AC70 - Acceptance Criteria for Fasteners Power Driven into Concrete, Steel and Masonry Elements; 2016.
- G. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.

1.03 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
- D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.04 QUALITY ASSURANCE

- A. Design deck layout, spans, fastening, and joints under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 STEEL DECK

- A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.
 - 1. Calculate to structural working stress design and structural properties specified.
- B. Roof Deck: Non-composite type, fluted steel sheet:

1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
- C. Composite Floor Deck: Fluted steel sheet embossed to interlock with concrete:
 1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
- D. Metal Form Deck: Corrugated sheet steel:
 1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.

2.02 ACCESSORY MATERIALS

- A. Bearing Plates and Angles: ASTM A36/A36M steel, galvanized per ASTM A123/A123M.
- B. Stud Shear Connectors: Forged steel, headed, uncoated.
- C. Welding Materials: AWS D1.1/D1.1M.
- D. Fasteners: Galvanized hardened steel, self tapping.
- E. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.

2.03 FABRICATED DECK ACCESSORIES

- A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gauge, 0.0299 inch (0.76 mm) thick sheet steel; of profile and size as indicated; finished same as deck.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

- A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
- B. On concrete and masonry surfaces provide minimum 4 inch (100 mm) bearing.
- C. On steel supports provide minimum 1-1/2 inch (38 mm) bearing.
- D. Weld deck in accordance with AWS D1.3/D1.3M.
- E. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

SECTION 05.50.00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel and aluminum items.

1.02 RELATED REQUIREMENTS

- A. Section 03.30.00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 04.20.00 - Unit Masonry: Placement of metal fabrications in masonry.
- C. Section 05.12.00 - Structural Steel Framing: Structural steel column anchor bolts.
- D. Section 05.21.00 - Steel Joist Framing: Structural joist bearing plates, including anchorage.
- E. Section 05.31.00 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.
- F. Section 05.51.33 - Metal Ladders.
- G. Section 05.52.13 - Pipe and Tube Railings.
- H. Section 07.71.23 - Manufactured Gutters and Downspouts: Downspout boots.
- I. Section 09.91.13 - Exterior Painting: Paint finish.
- J. Section 09.91.23 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.
- G. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2019a.
- H. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- I. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.
- L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).
- M. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2008.
- N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- O. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.

- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

- A. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.
- B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- F. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.
- D. Bolts, Nuts, and Washers: Stainless steel.
- E. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

- A. Bollards: Steel pipe, concrete filled, steel crowned cap, as detailed; prime paint finish.
 - 1. Bottom portion of ballard to 1" above finish grade: To receive Coal Cat asphaltic paint, or approved substitute paint product.
- B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.

- C. Lintels: As detailed; prime paint finish.
- D. Elevator Hoistway Installation Beam: Beam sections; prime paint finish.

2.05 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.

2.06 FINISHES - ALUMINUM

- A. Exterior Aluminum Surfaces: Class I color anodized.
- B. Interior Aluminum Surfaces: Class I natural anodized.
- C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
- D. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.07 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Obtain approval prior to site cutting or making adjustments not scheduled.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05.51.00
METAL STAIRS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 03.30.00 - Cast-in-Place Concrete: Concrete fill in stair pans; mesh reinforcement for landings.
- B. Section 03.30.00 - Cast-in-Place Concrete: Placement of metal anchors in concrete.
- C. Section 04.20.00 - Unit Masonry: Placement of metal fabrications in masonry.
- D. Section 05.50.00 - Metal Fabrications.
- E. Section 05.52.13 - Pipe and Tube Railings: Metal handrails and balusters other than specified in this section.
- F. Section 09.91.13 - Exterior Painting: Paint finish.
- G. Section 09.91.23 - Interior Painting: Paint finish.

1.02 REFERENCE STANDARDS

- A. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.
- B. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2019.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.
- G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.
- H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
- I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.
- J. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.
- K. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2015.
- L. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013, with Editorial Revision.
- M. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.
- N. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- O. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).

- Q. NAAMM AMP 510 - Metal Stairs Manual; 1992.
- R. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- S. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- T. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
- U. UL 1994 - Luminous Egress Path Marking Systems; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Include the design engineer's seal and signature on each sheet of shop drawings.
- C. Design Data: As required by authorities having jurisdiction.
- D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- E. Designer's Qualification Statement.
- F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.

1.04 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
- B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.
- C. Fabricator Qualifications:
 - 1. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

- A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
 - 1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
 - 2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
 - 3. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
 - 4. At exit stairwells, provide unit stair towers designed for stacking to height of building as a self-supporting structure.
 - 5. Dimensions: As indicated on drawings.
 - 6. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
 - 7. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
 - 8. Separate dissimilar metals using paint or permanent tape.
- B. Metal Jointing and Finish Quality Levels:

1. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view.
 - a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
 - b. Welds Exposed to View: Ground smooth and flush.
 - c. Mechanical Joints: Butted tight, flush, and hairline.
 - d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
 - e. Exposed Edges and Corners: Eased to small uniform radius.
 - f. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for satin or matte finish.
- C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
- D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH CONCRETE TREADS

- A. Jointing and Finish Quality Level: Commercial, as defined above.
- B. Risers: Closed.
- C. Treads: Metal pan with field-installed concrete fill.
 1. Concrete Depth: 1-1/2 inches, minimum.
 2. Tread Pan Material: Steel sheet.
 3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch minimum.
 4. Concrete Reinforcement: Welded wire mesh.
 5. Concrete Finish: For resilient floor covering.
- D. Risers: Same material and thickness as tread pans.
 1. Riser/Nosing Profile: Sloped riser with rounded nosing of minimum radius.
 2. Nosing Depth: Not more than 1-1/2 inch overhang.
 3. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.
- E. Stringers: Rolled steel channels.
 1. Stringer Depth: 10 inches.
 2. End Closure: Sheet steel of same thickness as risers welded across ends.
- F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.
- G. Railings: Steel pipe railings.
- H. Finish: Shop- or factory-prime painted.
- I. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

2.03 HANDRAILS AND GUARDS

- A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
 1. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
- B. Guards:
 1. Top Rails: Round pipe or tube rails unless otherwise indicated.
 - a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
 2. Infill at Picket Railings: Vertical pickets.
 - a. Horizontal Spacing: Maximum 4 inches on center.
 - b. Material: Solid steel bar.
 - c. Shape: Square.
 - d. Size: 1/2 inch square.
 - e. Top Mounting: Welded to underside of top rail.
 - f. Bottom Mounting: Welded to top surface of stringer.
 3. Infill at Pipe Railings: Pipe or tube rails sloped parallel to stair.

- a. Outside Diameter: 1 inch.
- b. Material: Steel pipe or tube, round.
- c. Vertical Spacing: Maximum 4 inches on center.
- d. Jointing: Welded and ground smooth and flush.
- 4. End and Intermediate Posts: Same material and size as top rails.
 - a. Horizontal Spacing: As indicated on drawings.
 - b. Mounting: Welded to top surface of stringer.

2.04 MATERIALS

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.
- C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
 - 1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
 - 2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
- F. Concrete Fill: See Section 03.30.00.
- G. Concrete Reinforcement: Mesh type as detailed, galvanized.

2.05 ACCESSORIES

- A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.
- B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- C. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.

2.06 SHOP FINISHING

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime Painting: Use specified shop- and touch-up primer.
 - 1. Preparation of Steel: In accordance with SSPC-SP 2, Hand Tool Cleaning.
 - 2. Number of Coats: One.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. When field welding is required, clean and strip primed steel items to bare metal.
- B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

- D. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.
- E. Obtain approval prior to site cutting or creating adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 05.51.33
METAL LADDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop-fabricated metal ladders.
- B. Ladder safety systems.

1.02 RELATED REQUIREMENTS

- A. Section 05.51.00 - Metal Stairs.
- B. Section 05.52.13 - Pipe and Tube Railings.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1910.23 - Ladders; current edition.
- B. 29 CFR 1910.28 - Duty to have Fall Protection and Falling Object Protection; Current Edition.
- C. 29 CFR 1910.29 - Fall Protection Systems and Falling Object Protection - Criteria and Practices; Current Edition.
- D. 29 CFR 1910.140 - Personal fall protection systems; Current Edition.
- E. 29 CFR 1926.1053 - Ladders; Current Edition.
- F. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.
- G. ANSI/ASSP Z359.11 - Safety Requirements for Full Body Harnesses; 2014.
- H. ANSI/ASSP Z359.12 - Connecting Components for Personal Fall Arrest Systems; 2009.
- I. ANSI/ASSP Z359.15 - Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems; 2014.
- J. ANSI/ASSP Z359.16 - Safety Requirements for Climbing Ladder Fall Arrest Systems; 2016.
- K. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- L. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- M. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- N. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- O. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.
- P. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.
- Q. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.
- R. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- S. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- T. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).
- U. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2008.
- V. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2017.
- W. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- X. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including installation instructions.
- C. Shop Drawings:
 - 1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- D. Certificate: Provide documentation that ladder safety system products of this section meet or exceed cited 29 CFR 1910.28, 29 CFR 1910.29, ANSI/ASSP Z359.16, and ANSI A14.3 requirements.
- E. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

- A. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.
- B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Bolts, Nuts, and Washers: ASTM A307, plain.
- F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED LADDERS

- A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
 - 1. Side Rails: 3/8 by 2 inches members spaced at 20 inches.
 - 2. Rungs: One inch diameter solid round bar spaced 12 inches on center.
 - 3. Space rungs 7 inches from wall surface.

2.04 LADDER SAFETY SYSTEMS

- A. Climbing Ladder Fall Arrest System (CLAFS): Comply with 29 CFR 1910.29, 29 CFR 1926.1053, Section 7 of ANSI A14.3 and ANSI/ASSP Z359.16; climbing ladder fall arrest system allows worker to climb up and down using both hands; does not require employee continuously, hold, push, or pull any part of system while climbing.
 - 1. Install on new fixed ladders over 24 feet in height.
 - 2. Anchorage: Fixed ladder meeting requirements of 29 CFR 1910.23.
 - 3. Flexible Carrier: Fixed 3/8 inch diameter stainless steel wire rope lifeline with shock absorber and top, bottom and intermediate supports; meeting requirements of ANSI/ASSP Z359.16.
 - a. Provide with stainless steel extension post at top of ladder; meeting requirements of ANSI/ASSP Z359.16.
 - 4. Fall Arrester: Stainless steel and aluminum automatic pass-through carrier sleeve fall arrester meeting requirements of ANSI/ASSP Z359.15 and ANSI/ASSP Z359.16; compatible with carrier.
 - a. If designed to be removable from carrier, arrester removable only by at least two deliberate manual action(s) by user.
 - b. Includes an anti-inversion device to prevent installation of carrier sleeve upside down on carrier.
 - c. Carrier sleeve movement is automatic and does not require continuous manual intervention during climbing or descending.
 - d. Includes panic grab (secondary locking mechanism) feature.
 - 5. Manufacturers; ANSI/ASSP Z359.16-compliant:
 - a. 3M Personal Safety Division: www.3M.com/FallProtection/#sle.
 - b. MSA Safety Incorporated: www.msasafety.com/#sle.

2.05 FINISHES - STEEL

- A. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.
- B. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.06 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Confirm that the ladder structure to which the ladder safety system is installed is capable of withstanding the loads applied by the system in the event of a fall.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Install ladder safety system in accordance with manufacturer's instructions.
- C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D. Obtain approval prior to site cutting or making adjustments not scheduled.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05.52.13
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Balcony railings and guardrails.

1.02 RELATED REQUIREMENTS

- A. Section 03.30.00 - Cast-in-Place Concrete: Placement of anchors in concrete.
- B. Section 05.51.00 - Metal Stairs: Handrails other than those specified in this section.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.
- D. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2016.
- E. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2020.
- F. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications; 2020.
- G. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013, with Editorial Revision.
- H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- I. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- J. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2017.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Include the design engineer's seal and signature on each sheet of shop drawings.
- C. Samples: Submit two, 6 inch long samples of handrail. Submit two samples of elbow, wall bracket, and end stop.
- D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated within the previous 12 months.
- E. Fabricator's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
- B. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months.
- C. Fabricator Qualifications:

1. A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
2. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.
- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935.
- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935.
- D. Allow for expansion and contraction of members and building movement without damage to connections or members.
- E. Dimensions: See drawings for configurations and heights.
- F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
- G. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
 1. Ease exposed edges to a small uniform radius.

2.02 ALUMINUM MATERIALS

- A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.
- B. Aluminum Tube: Minimum wall thickness of 0.127 inch; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.
- C. Solid Bars and Flats: ASTM B211/B211M.
- D. Welding Fittings: No exposed fasteners; cast aluminum.
- E. Straight Splice Connectors: Concealed spigot; cast aluminum.
- F. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

2.03 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- D. Welded Joints:
 1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 2. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

2.04 ALUMINUM FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.
- B. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Anchor railings securely to structure.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 06.10.00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural dimension lumber framing.
- B. Nonstructural dimension lumber framing.
- C. Rough opening framing for doors, windows, and roof openings.
- D. Sheathing.
- E. Subflooring.
- F. Roof-mounted curbs.
- G. Roofing nailers.
- H. Roofing cant strips.
- I. Preservative treated wood materials.
- J. Fire retardant treated wood materials.
- K. Communications and electrical room mounting boards.
- L. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

- A. Section 06.17.53 - Shop-Fabricated Wood Trusses.
- B. Section 06.20.00 - Finish Carpentry: Plywood closet shelving with hardwood nosings.
- C. Section 07.25.00 - Weather Barriers: Water-resistive barrier over sheathing.
- D. Section 07.62.00 - Sheet Metal Flashing and Trim: Sill flashings.
- E. Section 07.72.00 - Roof Accessories: Prefabricated roof curbs.
- F. Section 09.21.16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- C. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- D. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2015.
- E. AWPA U1 - Use Category System: User Specification for Treated Wood; 2016.
- F. ICC-ES AC308 - Acceptance Criteria for Termite Physical Barrier Systems; 2014, with Editorial Revision (2017).
- G. PS 1 - Structural Plywood; 2009.
- H. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.
- I. PS 20 - American Softwood Lumber Standard; 2015.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials and application instructions.
- C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Southern Pine, unless otherwise indicated.
 - 2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
- B. Provide sustainably harvested wood; see Section 01.60.00 - Product Requirements for requirements.
- C. Provide wood harvested within a 500 mile radius of the project site.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Stud Framing (2 by 2 through 2 by 6):
 - 1. Grade: As listed in the Structural Drawings.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 STRUCTURAL COMPOSITE LUMBER

- A. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.

2.04 CONSTRUCTION PANELS

- A. Roof Sheathing: PS 2 type, rated Structural I Sheathing.
 - 1. Bond Classification: Exterior.
 - 2. Span Rating: 60.
 - 3. Performance Category: 3/4 PERF CAT.
- B. Wall Sheathing: PS 2 type.
 - 1. Bond Classification: Exterior.
 - 2. Grade: Structural I Sheathing.
 - 3. Span Rating: 24.
 - 4. Performance Category: 5/16 PERF CAT.
 - 5. Edge Profile: Tongue and groove..
- C. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - 1. Size: Floor to ceiling.
- D. Other Applications:

1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
3. Other Locations: PS 1, C-D Plugged or better.

2.05 ACCESSORIES

- A. Fasteners and Anchors:
 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
- B. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.
- C. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.
- D. Termite-Resistant Sill Plate Barrier: Self-adhesive, film-backed barrier with release sheet; adheres to concrete substrates and blocks termite access.
 1. Thickness: 68 mils (0.068 inch).
 2. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.
 3. Water Vapor Permeance: 0.035 perm, maximum, when tested in accordance with ASTM E96/E96M.
- E. Sill Flashing: As specified in Section 07.62.00.
- F. Water-Resistive Barrier: As specified in Section 07.25.00.

2.06 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Fire Retardant Treatment:
 1. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat rough carpentry items as indicated .
 - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Preservative Treatment:
 1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber exposed to weather.
 - c. Treat lumber in contact with roofing, flashing, or waterproofing.
 - d. Treat lumber in contact with masonry or concrete.
 - e. Treat lumber less than 18 inches above grade.

PART 3 EXECUTION

3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.

- B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
- B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- C. Install structural members full length without splices unless otherwise specifically detailed.
- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.
- E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.
- F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
- G. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- E. Provide the following specific nonstructural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Chalkboards and marker boards.
 - 8. Wall paneling and trim.
 - 9. Joints of rigid wall coverings that occur between studs.

3.05 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

- B. Provide wood curb at all roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.

3.06 INSTALLATION OF CONSTRUCTION PANELS

- A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
 - 1. Nail panels to framing; staples are not permitted.
- B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using screws.
 - 1. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.
- C. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.

3.07 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.
- C. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.08 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements, for additional requirements.

3.09 CLEANING

- A. Waste Disposal: See Section 01.74.19 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06.17.53 - SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 06.10.00 - Rough Carpentry: Installation requirements for miscellaneous framing.
- B. Section 06.10.00 - Rough Carpentry: Material requirements for blocking, bridging, plates, and miscellaneous framing.

1.02 REFERENCE STANDARDS

- A. ANSI/TPI 1 - National Design Standard for Metal-Plate-Connected Wood Truss Construction; 2014.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- C. SPIB (GR) - Grading Rules; 2014.
- D. TPI BCSI 1 - Building Component Safety Information Booklet: The Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses; 2018.
- E. TPI DSB-89 - Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses; 1989.

1.03 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on plate connectors, bearing plates, and metal bracing components.
- C. Shop Drawings: Show truss configurations, sizes, spacing, size and type of plate connectors, cambers, framed openings, bearing and anchor details, and bridging and bracing.
 - 1. Provide shop drawings stamped or sealed by design engineer.
 - 2. Submit design calculations.

1.04 QUALITY ASSURANCE

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Handle and erect trusses in accordance with TPI BCSI 1.
- B. Store trusses in vertical position resting on bearing ends.

PART 2 PRODUCTS

2.01 TRUSSES

- A. Wood Trusses: Designed and fabricated in accordance with ANSI/TPI 1 and TPI DSB-89 to achieve structural requirements indicated.
 - 1. Connectors: Steel plate.
 - 2. Structural Design: Comply with applicable code and Structural Drawings for structural loading criteria.

2.02 MATERIALS

- A. Lumber:
 - 1. Moisture Content: Between 7 and 9 percent.
 - 2. Lumber fabricated from old growth timber is not permitted.

- B. Steel Connectors: Hot-dipped galvanized steel sheet, ASTM A653/A653M Structural Steel (SS) Grade 33/230, with G90/Z275 coating; die stamped with integral teeth; thickness as indicated.
- C. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

2.03 ACCESSORIES

- A. Wood Blocking, Bridging, Plates, and Miscellaneous Framing: As specified in Section 06.10.00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that supports and openings are ready to receive trusses.

3.02 PREPARATION

- A. Coordinate placement of bearing items.

3.03 ERECTION

- A. Install trusses in accordance with manufacturer's instructions and TPI DSB-89 and TPI BCSI 1; maintain a copy of each TPI document on site until installation is complete.
- B. Set members level and plumb, in correct position.
- C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.
- D. Do not field cut or alter structural members without approval of Architect.
- E. Install permanent bridging and bracing.
- F. Install headers and supports to frame openings required.
- G. Frame openings between trusses with lumber in accordance with Section 06.10.00.

END OF SECTION

SECTION 06.20.00
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items.

1.02 RELATED REQUIREMENTS

- A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 06.10.00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- C. Section 10.56.17 - Wall Mounted Shelving Standards.

1.03 REFERENCE STANDARDS

- A. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.
- D. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.
- E. PS 20 - American Softwood Lumber Standard; 2015.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
 - 2. Include certification program label.
- C. Samples: Submit two samples of finished plywood shelf, 12 x 12 inch in size illustrating wood grain, specified finish and hardwood nosing.
- D. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Quality Certification:
 - 1. Provide labels or certificates indicating that the work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 2. Provide designated labels on shop drawings as required by certification program.
 - 3. Provide designated labels on installed products as required by certification program.
 - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- B. Protect from moisture damage.
- C. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Interior Woodwork Items:
 - 1. Shelf Edge Banding/Nosings: Poplar or better hardwood, same dimensions as plywood; prepare for paint finish.
 - 2. Loose Shelving: Birch plywood; prepare for paint finish.

2.02 SHEET MATERIALS

- A. Hardwood Plywood: Face species birch or better, plain sawn, veneer core, glue type as recommended for application.

2.03 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Primer and Finish Coats: Alkyd primer sealer (one coat), alkyd finish coats (two).
- C. Wood Filler: Solvent base, tinted to match surface finish color.

2.04 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. Fit exposed sheet material edges with 3/8 inch matching hardwood edging. Use one piece for full length only.
- C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.05 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Opaque:
 - a. System - 8, Acrylic Cross Linking, Water-based.
 - b. Color: As selected by Architect.
 - c. Sheen: Satin.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

- A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.03 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 07.05.53
FIRE AND SMOKE ASSEMBLY IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Identification markings for fire and smoke rated partitions, and fire rated walls.

1.02 RELATED REQUIREMENTS

- A. Section 09.91.23 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ICC (IBC) - International Building Code; 2015.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.
- C. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.
- D. Samples: Submit two samples of each type of marking proposed for use, of size similar to that required for project, illustrating font, wording, and method of application.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 FIELD CONDITIONS

- A. Do not install adhered markings when ambient temperature is lower than recommended by label or sign manufacturer.
- B. Do not install painted markings when ambient temperature is lower than recommended by coating manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Partition Identification Labels:
 - 1. Fire Wall Signs, Inc: www.firewallsigns.com/#sle.
 - 2. Safety Supply Warehouse, Inc: www.safetysupplywarehouse.com/#sle.

2.02 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

- A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of ICC (IBC).
- B. Adhered Fire and Smoke Assembly Identification Signs: Printed vinyl or paper sign with factory applied adhesive backing.
- C. Applied Fire and Smoke Assembly Identification: Identification markings applied to partition with paint and a code compliant stencil. See Section 09.91.23 for products.
- D. Languages: Provide sign markings in English.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 PREPARATION

- A. See Section 09.91.23 for substrate preparation for painted markings.

3.03 INSTALLATION

- A. Locate markings as required by ICC (IBC).
- B. Install adhered markings in accordance with manufacturer's instructions.
- C. Install applied markings in accordance with Section 09.91.23.
- D. Install neatly, with horizontal edges level.
- E. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

END OF SECTION

SECTION 07.13.00
SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sheet Waterproofing:
 - 1. Self-adhered HDPE sheet membrane, post applied.

1.02 RELATED REQUIREMENTS

- A. Section 03.30.00 - Cast-in-Place Concrete: Concrete substrate.
- B. Section 07.62.00 - Sheet Metal Flashing and Trim: Metal parapet, coping, and counterflashing.
- C. Section 07.92.00 - Joint Sealants: Sealing moving joints in waterproofed surfaces that are not required to be treated in this section.

1.03 ABBREVIATIONS

- A. HDPE - High-Density Polyethylene.

1.04 REFERENCE STANDARDS

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2015a).
- B. ASTM D751 - Standard Test Methods for Coated Fabrics; 2019.
- C. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2012.
- D. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2017).
- E. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test); 2008, with Editorial Revision (2015).
- F. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2015a.
- G. ASTM D5295/D5295M - Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems; 2018.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- I. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for membrane.
- C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- D. Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- I. Specimen Warranty.

1.06 QUALITY ASSURANCE

- A. Membrane Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.08 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.
- C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 WATERPROOFING APPLICATIONS

- A. Self-Adhered Modified Bituminous Sheet Membrane:
 - 1. Location: Cast-in-Place Concrete Retaining Wall.
 - 2. Cover with protection board.

2.02 MEMBRANE MATERIALS

- A. Self-Adhered HDPE Sheet Membrane, Post-Applied: Recommended by manufacturer for placement on outside face of below grade concrete and concrete masonry unit (CMU) backfilled walls and select horizontal applications.
 - 1. Sheet Thickness: 30 mil, 0.030 inch, minimum, and with 20 mil, 0.020 inch thick adhesive.
 - 2. Low Temperature Flexibility: Unaffected when tested in accordance with ASTM D1970/D1970M at minus 25 degrees F, 180 degree bend on 1 inch mandrel.
 - 3. Hydrostatic Resistance: Resists pressure of 400 psi when tested in accordance with ASTM D751.
 - 4. Elongation at Break: 577 percent, minimum, measured in accordance with ASTM D412.
 - 5. Tensile Strength, Film: 5,000 psi, minimum, measured in accordance with ASTM D882.
 - 6. Lap Adhesion: 6.8 lb per inch, minimum, when tested in accordance with ASTM D1876.
 - 7. Water Vapor Permeance: Less than 0.1 perm, measured in accordance with ASTM E96/E96M.
 - 8. Peel Strength: 6.7 lb per inch, minimum, when tested in accordance with ASTM D903.
 - 9. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
 - 10. Manufacturers:
 - a. GCP Applied Technologies; Bituthene 3000: www.gcpat.com/#sle.

2.03 ACCESSORIES

- A. Seaming Materials: As recommended by membrane manufacturer.
- B. Membrane Sealant: As recommended by membrane manufacturer..
- C. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.
- D. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.
 - 1. Composition: Dimpled polystyrene, polyethylene, or polypropylene core; polypropylene filter fabric.
 - 2. Manufacturers:
 - a. GCP Applied Technologies; Hydroduct 600 Coil/Hydroduct 220: www.gcpat.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
- C. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

- A. Protect adjacent surfaces from damage not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.
- C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.
- D. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.
- E. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.
- F. Prepare building expansion joints at locations as indicated on drawings.
- G. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.
- H. Concrete Surfaces for Adhesive Bonding: Prepare concrete substrate according to ASTM D5295/D5295M.
 - 1. Remove substances that inhibit adhesion including form release agents, curing compounds admixtures, laitance, moisture, dust, dirt, grease and oil.
 - 2. Repair surface defects including honeycombs, fins, tie holes, bug holes, sharp offsets, rutted cracks, ragged corners, deviations in surface plane, spalling and delaminations, as described in the reference standard.
 - 3. Remove and replace areas of defective concrete as specified in Section 03.30.00.
 - 4. Prepare concrete for adhesive bonded waterproofing using mechanical or chemical methods described in the referenced standard.
 - 5. Test concrete surfaces as described in the referenced standards. Verify surfaces are ready to receive adhesive bonded waterproofing membrane system.

3.03 INSTALLATION - MEMBRANE

- A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- B. Roll out membrane, and minimize wrinkles and bubbles.
- C. Adhesive Bonded Membrane: Apply adhesive in accordance with manufacturer's instructions, and bond sheet to substrate except in those areas directly over or within 3 inches of a control or expansion joint.
- D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.
- E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
- F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.
- G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
- H. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 6 inches above horizontal surface for first ply and 8 inches at subsequent plies laid in shingle fashion.
- I. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD

- A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward. Scribe and cut boards around projections, penetrations, and interruptions.

3.05 FIELD QUALITY CONTROL

- A. Upon completion of horizontal membrane installation, dam installation area in preparation for flood testing.
 - 1. Flood to minimum depth of 1 inch with clean water, and after 48 hours inspect for leaks.
 - 2. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test, and repair damage to building.
 - 3. When area is proven watertight, drain water and remove dam.

3.06 PROTECTION

- A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 07.21.00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at cavity wall construction, perimeter foundation wall, and underside of floor slabs.

1.02 RELATED REQUIREMENTS

- A. Section 07.21.19 - Foamed-In-Place Insulation: Plastic foam insulation other than boards, spray-applied to locations shown on Drawings.
- B. Section 07.25.00 - Weather Barriers: Separate air barrier and vapor retarder materials.
- C. Section 07.54.23 - Thermoplastic-Polyolefin Roofing (TPO): Installation requirements for board insulation over low slope roof deck specified in that Section.

1.03 REFERENCE STANDARDS

- A. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2016a.
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
- C. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2009).
- D. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2016.
- E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- H. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2011.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- C. Insulation Inside Masonry Cavity Walls: Extruded polystyrene (XPS) board.
- D. Insulation Over Wood Stud Framed Walls, Continuous: Extruded polystyrene board.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.

1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
5. Board Edges: Square.
6. Type and Water Absorption: Type IV, 0.3 percent by volume, maximum, by total immersion.
7. Products:
 - a. DuPont de Nemours, Inc; Styrofoam Brand Cavitymate Ultra: building.dupont.com/#sle.
 - b. Kingspan Insulation LLC; GreenGuard XPS Type IV, 25 psi: www.kingspan.com/#sle.
 - c. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.
 - d. _____.

2.03 ACCESSORIES

- A. Sheet Vapor Barrier: See Section 07.25.00.
- B. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.
- C. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
- D. Adhesive: Gun grade, interior and exterior, and compatible with insulation and substrates; complies with ASTM C557.
 1. Application Temperature: 40 to 100 degrees F at contact surfaces.
 2. Volatile Organic Content (VOC): Less than 7 percent by weight.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Adhere a 6 inches wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.
 1. Tape seal joints.
- B. Apply adhesive to back of boards:
 1. Three continuous beads per board length.
- C. Install boards horizontally on foundation perimeter.
 1. Place boards to maximize adhesive contact.
 2. Install in running bond pattern.
 3. Butt edges and ends tightly to adjacent boards and to protrusions.
- D. Extend boards over expansion joints, unbonded to foundation on one side of joint.
- E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Adhere 6 inches wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
 1. Tape seal joints between sheets.
 2. Extend sheet full height of joint.
- B. Apply adhesive to back of boards:
 1. Three continuous beads per board length.

- C. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches on center with manufacturer recommended mechanical fasteners, and tape joints with manufacturer's minimum 4 inches wide sealant tape; comply with ASTM E2357.
- D. Install boards horizontally on walls.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and protrusions.
- E. Extend boards over expansion joints, unbonded to wall on one side of joint.
- F. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- G. Place 6 inches wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames, and tape seal in place to ensure continuity of vapor retarder and air seal.
- H. Tape insulation board joints.

3.04 BOARD INSTALLATION UNDER CONCRETE SLABS

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.05 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07.21.19
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Foamed-in-place insulation.
 - 1. In exterior wall crevices.
 - 2. At junctions of dissimilar wall and roof materials.
 - 3. In underside of roofs and ceilings.
 - 4. In underside of floor decks.
 - 5. In attics and crawlspaces.
- B. Protective intumescent coating.

1.02 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2015.
- B. ASTM D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics; 2016.
- C. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- F. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

1.03 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
- C. Certificates: Certify that products of this section meet or exceed specified requirements.
- D. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- E. Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.

1.05 FIELD CONDITIONS

- A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
- B. Do not apply foam when temperature is within 5 degrees F of dew point.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 MATERIALS

- A. Foamed-In-Place Insulation: Low-density, flexible, open or closed cell, water vapor permeable polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.

1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment, and overcoat limitations.
2. Thermal Resistance: R-value of 3.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
3. Air Permeance: 0.04 cfm per square foot, maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf.
4. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
5. Basis of Design:
 - a. Icynene-Lapolla; Icynene Classic Plus: www.icynene.com/#sle.
6. Other Acceptable Manufacturers:
 - a. BASF Corporation; ENERTITE NM: www.spf.basf.com/#sle.
 - b. Carlisle Spray Foam Insulation; SealTite Pro High Yield: www.carlislesfi.com/#sle.
 - c. Johns Manville; JM ocSPF Open Cell Spray Polyurethane Foam: www.jm.com/#sle.

2.03 ACCESSORIES

- A. Primer: As required by insulation manufacturer.
- B. Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.
- C. Soffit Edge Seal: Prefabricated, flexible seal designed for unventilated attic spaces.
 1. Applications: Sealing space between wood framing top plate and underside of roof sheathing.
 2. Material: Polyvinyl chloride (PVC).
 3. Roof Joist/Truss Spacing: 16 inch on center, nominal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify work within construction spaces or crevices is complete prior to insulation application.
- B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION

- A. Mask and protect adjacent surfaces from over spray or dusting.
- B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply insulation by spray method, to a uniform monolithic density without voids.
- C. Apply to achieve a thermal resistance R-value of per Drawings.
- D. Patch damaged areas.
- E. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.
- F. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.04 FIELD QUALITY CONTROL

- A. Field inspections and tests will be performed by an independent testing agency under provisions of Section 01.40.00 - Quality Requirements.
- B. Inspection will include verification of insulation and overcoat thickness and density.

3.05 PROTECTION

- A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07.25.00
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vapor Retarders: Materials to make exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls water vapor resistant and air tight.
- B. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

- A. Section 03.30.00 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.
- B. Section 07.54.00 - Thermoplastic Membrane Roofing: Vapor retarder installed as part of roofing system.
- C. Section 07.62.00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.
- D. Section 07.92.00 - Joint Sealants: Sealing building expansion joints.
- E. Section 09.21.16 - Gypsum Board Assemblies: Water-resistive barrier under exterior cladding.

1.03 DEFINITIONS

- A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.
- C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
 - 1. Water Vapor Permeance: For purposes of conversion, $57.2 \text{ ng}/(\text{Pa s sq m}) = 1 \text{ perm}$.
- D. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 2014.
- C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2015a).
- D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2015a.
- E. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay; 2000 (Reapproved 2010).
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- H. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.
- I. ICC-ES AC308 - Acceptance Criteria for Water-Resistive Barriers; ICC Evaluation Service, Inc; 2013.
- J. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; ICC Evaluation Service, Inc; 2011.

- K. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; ICC Evaluation Service, Inc; 2015.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.
- E. Manufacturer's Installation Instructions: Indicate preparation.
- F. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- G. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.
- H. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.06 QUALITY ASSURANCE

- A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:
 - 1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
 - 2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

1.07 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

1.08 SPECIAL BUILDING ENCLOSURE WARRANTY

- A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
- B. Installation Warranty for Building Rainscreen Assembly: Installer of exterior rainscreen assembly (including air/vapor barrier and attachments, framing, and exterior panels) to provide 10-year warranty that includes coverage for defective materials and/or workmanship. This warranty will also clearly include materials, labor, necessary activity to access these areas, and removal of any materials to effect repairs and restore to watertight conditions.
www.edacontractors.com/#sle

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

- A. Air Barrier:
 - 1. On outside surface of sheathing of exterior walls use air barrier sheet, mechanically fastened type.
- B. Exterior Vapor Retarder:

2.02 WATER-RESISTIVE BARRIER MATERIALS (NEITHER AIR BARRIER OR VAPOR RETARDER)

2.03 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

- A. Air Barrier Sheet, Mechanically Fastened:

1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
2. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (Desiccant Method) at 73.4 degrees F.
3. Water Penetration Resistance: Withstand a water head of 21 inches, minimum, for minimum of 5 hours, when tested in accordance with AATCC Test Method 127.
4. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 180 days of weather exposure.
5. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
6. Water Resistance: Comply with applicable water-resistive requirements of ICC-ES AC308.
7. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches wide, compatible with sheet material; unless otherwise specified.
8. Manufacturers:
 - a. DuPont de Nemours, Inc; Tyvek CommercialWrap D with Tyvek Fluid Applied Flashing - Brush Formulation, Tyvek Fluid Applied Flashing and Joint Compound, FlexWrap NF, StraightFlash, StraightFlash VF, Tyvek Wrap Caps, and Tyvek Tape: building.dupont.com/#sle.
 - b. Substitutions: See Section 01.60.00 - Product Requirements.

2.04 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

- A. Vapor Retarder Sheet: Neoprene, black color.
 1. Thickness: 45 mil, 0.045 inch.
 2. Water Vapor Permeance: 0.1 perm, maximum, when tested in accordance with ASTM E96/E96M.
 3. Seam Lap and Perimeter Adhesive: Elastomeric, same composition as sheet or other compatible material.

2.05 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
 1. Manufacturers:
 - a. DuPont de Nemours, Inc; DuPont FlexWrap: building.dupont.com/#sle.
 - b. DuPont de Nemours, Inc; DuPont StraightFlash: building.dupont.com/#sle.
 - c. DuPont de Nemours, Inc; DuPont VersaFlange: building.dupont.com/#sle.
- C. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.
 1. Width: 3-1/2 inches.
 2. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.
- D. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Water-Resistive Barriers: Install continuous barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.
- C. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- D. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- E. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
- F. Mechanically Fastened Sheets - On Exterior:
 - 1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
 - 2. Overlap seams as recommended by manufacturer but at least 6 inches.
 - 3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
 - 4. Attach to framed construction with fasteners extending through sheathing into framing. Space fasteners at 12 to 18 inches on center along each framing member supporting sheathing.
 - 5. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
 - 6. Where stud framing rests on concrete or masonry, extend lower edge of sheet at least 4 inches below bottom of framing and seal to foundation with sealant.
 - 7. Install water-resistive barrier over jamb flashings.
 - 8. Install air barrier and vapor retarder underneath the jamb flashings.
 - 9. Install head flashings under weather barrier.
 - 10. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.
- G. Mechanically Fastened Sheets - Vapor Retarder On Interior:
 - 1. When insulation is to be installed in assembly, install vapor retarder over insulation.
 - 2. Anchor to wood framing using large-headed nails or staples at 12 to 18 inches on center along each framing member covered; cover fasteners with seam tape.
 - 3. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, making air tight seal.
 - 4. Locate laps at a framing member; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet.
 - 5. Seal entire perimeter to structure, window and door frames, and other penetrations.
 - 6. Where conduit, pipes, wires, ducts, outlet boxes, and other items are installed in insulation cavity, pass vapor retarder sheet behind item but over insulation and maintain air tight seal.
- H. Openings and Penetrations in Exterior Weather Barriers:
 - 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
 - 2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
 - 3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
 - 4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
 - 5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.

6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements for additional requirements.
- B. Coordination of ABAA Tests and Inspections:
 1. Provide testing and inspection required by ABAA QAP.
 2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
 3. Cooperate with ABAA testing agency.
 4. Allow access to air barrier work areas and staging.
 5. Do not cover air barrier work until tested, inspected, and accepted.
- C. Do not cover installed weather barriers until required inspections have been completed.
- D. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
- E. Take digital photographs of each portion of the installation prior to covering up.

3.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07.31.13
ASPHALT SHINGLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Asphalt shingle roofing.
- B. Flexible sheet membranes for eave protection, underlayment, and valley protection.
- C. Associated metal flashings and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06.15.00 - Wood Decking: Roof decking.
- B. Section 07.62.00 - Sheet Metal Flashing and Trim: Edge and cap flashings.
- C. Section 07.71.23 - Manufactured Gutters and Downspouts.

1.03 REFERENCE STANDARDS

- A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2015a.
- B. ASTM D3161/D3161M - Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2020.
- C. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules; 2019.
- D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).
- E. ASTM D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing; 2016a (Reapproved 2021).
- F. ASTM D7158/D7158M - Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method); 2020.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- H. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2017.
- I. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2018a.
- J. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments; 2012, with Editorial Revision (2015).
- K. ICC-ES AC207 - Acceptance Criteria for Polypropylene Roof Underlayments; 2012, with Editorial Revision (2015).
- L. NRCA (RM) - The NRCA Roofing Manual; 2017.
- M. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.
- N. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating material characteristics.
- C. Shop Drawings: For metal flashings, indicate specially configured metal flashings.
- D. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern; for color selection.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01.60.00 - Product Requirements, for additional provisions.
2. Extra Shingles: 100 sq ft of each type and color.

1.05 QUALITY ASSURANCE

- A. Products are Required to Comply with Fire Resistance Criteria: UL (DIR) listed and labeled.

1.06 FIELD CONDITIONS

- A. Do not install shingles or eave protection membrane when surface temperatures are below 45 degrees F.

1.07 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide lifetime manufacturer's warranty for coverage against black streaks caused by algae.
- D. Provide 10 year manufacturer's warranty for wind damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Algae Resistant Asphalt Shingles:
1. GAF; Timberline Ultra HD Shingles with StainGuard Plus: www.gaf.com/#sle.
 2. Owens Corning Corp: www.owenscorning.com/#sle.

2.02 ASPHALT SHINGLES

- A. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462/D3462M.
1. Fire Resistance: Class A, complying with ASTM E108.
 2. Wind Resistance: Class A, when tested in accordance with ASTM D3161/D3161M.
 3. Warranted Wind Speed: Not greater than 90 mph.
 4. Algae Resistant.
 5. Self-sealing type.
 6. Style: Square.
 7. Color: As selected by Architect.

2.03 SHEET MATERIALS

- A. Eave Protection Membrane:
1. Eave Protection Membrane: Self-adhering polymer-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil total thickness; with strippable treated release paper and polyethylene sheet top surface.
- B. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.
1. Type: Woven polypropylene with anti-slip polyolefin coating on both sides.
 2. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
 3. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
 4. Flammability: Minimum of Class A, when tested in accordance with ASTM E108.
 5. Ultraviolet (UV) Resistance and Weatherability: Approved in writing by manufacturer for exposure to weather for minimum of six months.
 6. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
 7. Water Vapor Permeance: Vapor retarder; maximum of 0.1 perm, when tested in accordance with ASTM E96/E96M Procedure A (desiccant method).
 8. Liquid Water Transmission: Passes ASTM D4869/D4869M.
 9. Functional Temperature Range: Minus 70 degrees F to 212 degrees F.
 10. Fasteners: As recommended by manufacturer or building code qualification report or approval.

2.04 ACCESSORIES

- A. Roofing Nails: Standard round wire shingle type, galvanized steel, stainless steel, aluminum roofing nails, or copper roofing nails, minimum 3/8 inch head diameter, 12 gauge, 0.109 inch nail shank diameter, 1-1/2 inch long and complying with ASTM F1667.
- B. Staples: Standard wire shingle type, of hot dipped zinc coated steel, 16 wire gauge, 0.0508 inch diameter, 15/16 inch crown width, of sufficient length to penetrate through roof sheathing or 3/4 inch into roof sheathing or decking.
- C. Plastic Cement: ASTM D4586/D4586M, asphalt roof cement.
- D. Lap Cement: Fibrated cutback asphalt type, recommended for use in application of underlayment, free of toxic solvents.
- E. Plastic Ridge Vents: Extruded plastic with vent openings that do not permit direct water or weather entry; flanged to receive shingles.

2.05 METAL FLASHINGS

- A. Metal Flashings: Provide sheet metal eave edge, gable edge, open valley flashing, and other flashing indicated.
 - 1. Form flashings to profiles indicated on drawings.
 - 2. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
 - 3. Hem exposed edges of flashings minimum 1/4 inch on underside.
 - 4. Coat concealed surfaces of flashings with bituminous paint.
- B. Steel Sheet Metal: Prefinished and galvanized steel sheet, 26 gauge, 0.0179 inch minimum thickness, G90/Z275 hot-dipped galvanized; PVC coated, _____ color.
- C. Bituminous Paint: Acid and alkali resistant type; black color.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.
- B. Verify that roof deck is of sufficient thickness to accept fasteners.
- C. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.
- D. Verify roof openings are correctly framed.
- E. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.02 PREPARATION

- A. Seal roof deck joints wider than 1/16 inch as recommended by shingle manufacturer.
- B. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.
- C. Broom clean deck surfaces before installing underlayment or eave protection.
- D. Install eave edge flashings tight with fascia boards, weather lap joints 2 inches and seal with plastic cement, and secure flange with nails spaced _____ inches on center.

3.03 INSTALLATION - EAVE PROTECTION MEMBRANE

- A. Install eave protection membrane in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

3.04 INSTALLATION - UNDERLAYMENT

- A. Underlayment At Roof Slopes Up to 4:12: Install two layers of underlayment over area not protected by eave protection, with ends and edges weather lapped minimum 4 inches, stagger end laps of each consecutive layer, and nail in place.

- B. Underlayment At Roof Slopes Greater Than 4:12: Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 4 inches, stagger end laps of each consecutive layer, nail in place, and weather lap minimum 4 inches over eave protection.
- C. Weather lap and seal watertight with plastic cement any items projecting through or mounted on roof.

3.05 INSTALLATION - VALLEY PROTECTION

- A. At Exposed Valleys: Install one layer of sheet metal flashing, minimum 24 inches wide, centered over open valley and crimped to guide water flow, weather lap joints minimum 2 inch wide band of lap cement along each edge of first layer, press roll roofing into cement, nail in place minimum 18 inches on center and 1 inch from edges.

3.06 INSTALLATION - METAL FLASHING AND ACCESSORIES

- A. Install flashings in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.
- C. Secure in place with nails at 8 inches on center, and conceal fastenings.
- D. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.

3.07 INSTALLATION - SHINGLES

- A. Install shingles in accordance with manufacturer's instructions manufacturer's instructions and NRCA (RM) applicable requirements.
 - 1. Fasten individual shingles using two nails per shingle, or as required by manufacturer and local building code, whichever is greater.
 - 2. Fasten strip shingles using four nails per strip, or as required by manufacturer and local building code, whichever is greater.
- B. Place shingles in straight coursing pattern with 5 inch weather exposure to produce double thickness over full roof area, and provide double course of shingles at eaves.
- C. Project first course of shingles 3/4 inch beyond fascia boards.
- D. Extend shingles 1/2 inch beyond face of gable edge fascia boards.
- E. Extend shingles on one slope across valley and fasten, trim shingles from other slope 2 inches from valley center line to achieve closed cut valley, and concealing valley protection.
- F. Cap hips with individual shingles, maintaining 5-inch weather exposure, and place to avoid exposed nails.
- G. After installation, place one daub of plastic cement, 1-inch diameter under each individual shingle tab exposed to weather, to prevent lifting.
- H. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counterflashings.
- I. Complete installation to provide weather tight service.

3.08 PROTECTION

- A. Do not permit traffic over finished roof surface.

END OF SECTION

SECTION 07.46.46
FIBER-CEMENT SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiber-cement siding.

1.02 RELATED REQUIREMENTS

- A. Section 07.25.00 - Weather Barriers: Weather barrier under siding.
- B. Section 07.92.00 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.
- C. Section 09.21.16 - Gypsum Board Assemblies: Siding substrate.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- D. ASTM C1186 - Standard Specification for Flat Fiber Cement Sheets; 2008 (Reapproved 2012).

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's requirements for related materials to be installed by others.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods, including nail patterns.
- C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, _____, and methods of anchorage.
- D. Test Report: Applicable model code authority evaluation report (e.g. ICC-ES).
- E. Installer's Qualification Statement.
- F. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.
- G. Warranty: Submit copy of manufacturer's warranty, made out in Owner's name, showing that it has been registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products under waterproof cover and elevated above grade, on a flat surface.

1.07 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Provide multi-year manufacturer warranty as indicated under Siding article sub-heading "Warranty".

PART 2 PRODUCTS

2.01 FIBER-CEMENT SIDING

- A. Lap Siding: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
 - 1. Style: Standard lap style.
 - 2. Texture: Smooth.
 - 3. Length: 12 ft, nominal.
 - 4. Width (Height): 5-1/4 inches.
 - 5. Thickness: 5/16 inch, nominal.
 - 6. Finish: Unfinished.
 - 7. Color: As selected by Architect from manufacturers full range of available colors.
 - 8. Warranty: 50 year limited; transferable.
 - 9. Products:
 - a. James Hardie Building Products, Inc; Hardie Plank: www.jameshardie.com/#sle.
- B. Panel Siding: Vertically oriented panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
 - 1. Texture: Smooth.
 - 2. Length (Height): 72 inches, nominal.
 - 3. Width: 18 inches.
 - 4. Thickness: 5/8 inch, nominal.
 - 5. Finish: Unfinished.
 - 6. Color: As selected by Architect from manufacturers full range of available colors.
 - 7. Warranty: 50 year limited; transferable.
 - 8. Products:
 - a. James Hardie Building Products, Inc; Hardie Panel Siding: www.jameshardie.com/#sle.
 - b. Substitutions: See Section 01.60.00 - Product Requirements.
- C. Soffit Panels: Panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
 - 1. Texture: Smooth.
 - 2. Length: 96 inches, nominal.
 - 3. Width: 48 inches.
 - 4. Thickness: 5/16 inch, nominal.
 - 5. Finish: Unfinished.
 - 6. Color: As selected by Architect from manufacturers full range of available colors.
 - 7. Manufacturer: Same as siding.

2.02 ACCESSORIES

- A. Cladding Support Clips: Thermally-broken, galvanized steel clips for support of cladding z-girts, angles, channels and other framing.
 - 1. Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 galvanized coating.
- B. Furring Strips, Metal: Galvanized metal channels.
- C. Trim: Same material and texture as siding.
- D. Fasteners: Galvanized or corrosion resistant; length as required to penetrate, 1-1/4 inch, minimum.
- E. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.
- B. Verify that weather barrier has been installed over substrate completely and correctly.
- C. Do not begin until unacceptable conditions have been corrected.
- D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Install Sheet Metal Flashing:
 - 1. Above door and window trim and casings.
 - 2. Above horizontal trim in field of siding.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
 - 1. Read warranty and comply with terms necessary to maintain warranty coverage.
 - 2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
 - 3. Use trim details indicated on drawings.
 - 4. Touch up field cut edges before installing.
 - 5. Pre-drill nail holes if necessary to prevent breakage.
- B. Over Foam Sheathing: Read and comply with sheathing manufacturer's recommendations.
 - 1. For sheathing of less than 1 inch thickness, nail through sheathing into studs using correspondingly longer nails.
 - 2. For sheathing greater than 1 inch thickness, install furring strips over studs and fasten siding through furring and into studs.
- C. Over Steel Studs: Use hot-dipped galvanized self-tapping screws, with the points of at least three screws penetrating each stud the panel crosses and at panel ends.
- D. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.
- E. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.
- F. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.
- G. Do not install siding less than 6 inches from surface of ground nor closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.
- H. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.

3.04 PROTECTION

- A. Protect installed products until Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07.54.23
THERMOPLASTIC-POLYOLEFIN ROOFING (TPO)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Thermoplastic membrane roofing system, including components specified.
- B. Disposal of construction waste is the responsibility of Contractor. Perform disposal in manner complying with applicable federal, state, and local regulations.
- C. Comply with published recommendations and instructions of roofing membrane manufacturer at; <https://www.firestonebpco.com/us-en>.
- D. Commencement of work by Contractor constitutes acknowledgement by Contractor that this specification can be satisfactorily executed, under the project conditions and with necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

1.02 RELATED REQUIREMENTS

- A. Section 06.10.00 - Rough Carpentry: Wood nailers associated with roofing and roof insulation.
- B. Section 07.62.00 - Sheet Metal Flashing and Trim: Formed metal flashing and trim items associated with roofing.
- C. Section 07.71.00 - Roof Specialties: Manufactured copings, fascias, gravel stops, and other flashing-related items.
- D. Section 07.72.00 - Roof Accessories: Vents, roof hatch and manufactured curbs.

1.03 DEFINITIONS

- A. Roofing Terminology: See ASTM D1079 for definition of terms related to roofing work not otherwise defined in section.
- B. LTTR: Long Term Thermal Resistance, as defined by CAN-ULC-S770.

1.04 REFERENCE STANDARDS

- A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2017.
- B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
- C. ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulating Board; 2015.
- D. ASTM C473 - Standard Test Methods for Physical Testing of Gypsum Panel Products; 2015.
- E. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2015.
- F. ASTM C728 - Standard Specification for Perlite Thermal Insulation Board; 2016.
- G. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
- H. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2016.
- I. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer; 2009 (Reapproved 2014).
- J. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.
- K. ASTM D828 - Standard Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus; 2016, with Editorial Revision (2018).
- L. ASTM D1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting; 2013.
- M. ASTM D1079 - Standard Terminology Relating to Roofing and Waterproofing; 2016.

- N. ASTM D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics; 2016.
- O. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2020.
- P. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.
- Q. ASTM D6164/D6164M - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements; 2011.
- R. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing; 2013.
- S. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- T. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2016.
- U. CAN-ULC-S770 - Standard Test Method Determination of L-Term Thermal Resistance Of Closed-Cell Thermal Insulating Foams; 2009.
- V. FM (AG) - FM Approval Guide; current edition.
- W. FM 4470 - Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for use in Class 1 and Noncombustible Roof Deck Construction; 2016.
- X. ISO 9000 - Quality management systems -- Fundamentals and vocabulary; 2015.
- Y. ISO 9001 - Quality management systems -- Requirements; 2008.
- Z. PS 1 - Structural Plywood; 2009.
- AA. PS 20 - American Softwood Lumber Standard; 2015.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Conference: Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.
 - 1. Require attendance by parties directly influencing quality of roofing work or affected by performance of roofing work.
 - 2. Notify Architect well in advance of meeting.

1.06 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide membrane manufacturer's printed data sufficient to show that components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.
- C. Samples: Submit samples of at least the following:
 - 1. Sample of roof membrane.
 - 2. Sample of walkway pads.
 - 3. Sample of each insulation type.
- D. Shop Drawings: Provide:
 - 1. The roof membrane manufacturer's standard details customized for this project for relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.
 - 2. For tapered insulation, provide project-specific layout and dimensions for each board.
- E. Specimen Warranty: Submit prior to starting work.
- F. Installer Qualifications: Letter from manufacturer attesting that the roofing installer meets the specified qualifications.

- G. Pre-Installation Notice: Copy to show that manufacturer's required Pre Installation Notice (PIN) has been accepted and approved by the manufacturer.
- H. Executed Warranty.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Provide roofing installer with the following:
 - 1. Current Firestone Master Contractor status.
 - 2. Current Firestone Red Shield Licensed Contractor status with Master Contractor status at least once in the last three years.
 - 3. Current approval, license, or authorization as applicator by the manufacturer.
 - 4. Fully staffed office within 100 miles of the job site.
 - 5. At least five years experience in installing specified system.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.
- B. Store materials clear of ground and moisture with weather protective covering.
- C. Keep combustible materials away from ignition sources.

1.09 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals for additional warranty requirements.
- B. Comply with warranty procedures required by manufacturer, including notifications, scheduling, and inspections.
- C. Warranty: Firestone Limited Warranty covering membrane, roof insulation, and other indicated components of the system, for the term indicated.
 - 1. Limit of Liability: No dollar limitation.
 - 2. Scope of Coverage: Repair leaks in the roofing system caused by:
 - a. Ordinary wear and tear of the elements.
 - b. Manufacturing defect in Firestone brand materials.
 - c. Defective workmanship used to install these materials.
 - d. Damage due to winds up to 90 mph.
 - e. Hail up to 1 inches in diameter.
 - 3. Not Covered:
 - a. Damage due to winds in excess of 90 mph.
 - b. Damage due hurricanes or tornadoes.
 - c. Intentional damage.
 - d. Unintentional damage due to normal rooftop inspections, maintenance, or service.
- D. Insulation Warranty: Separate Firestone ISO 95+ Insulation Warranty with warranty term coinciding with Red Shield Warranty.
 - 1. Limit of Liability: No dollar limitation
 - 2. Scope of Coverage: Provide replacement for insulation that warps, bows, or is on the point of causing a roof leak as a result of manufacturing defect.
- E. Metal Roof Edging: Firestone full-system warranty for roof edge system, covering blow-off from winds up to 90 mph.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer - Roofing System: Firestone Building Products LLC, Nashville, TN: www.firestonebpco.com/#sle.
 - 1. Roofing systems manufactured by others are acceptable provided the roofing system is completely equivalent in materials and warranty conditions and the manufacturer meets the following qualifications:
 - a. Specializing in manufacturing the roofing system to be provided.

- b. Minimum ten years of experience manufacturing the roofing system to be provided.
 - c. ISO 9000 and ISO 9001 certified.
- B. Manufacturer of Insulation and Cover Boards: Same manufacturer as roof membrane.
- C. Manufacturer of Metal Roof Edging: Same manufacturer as roof membrane.

2.02 ROOFING SYSTEM DESCRIPTION

- A. Roofing System: Thermoplastic polyolefin (TPO) single-ply membrane.
 - 1. Membrane Attachment: Fully self-adhered.
 - 2. Warranty: Full system warranty; Firestone 25 year Red Shield Limited Warranty covering membrane, roof insulation, and membrane accessories.
 - 3. Comply with applicable local building code requirements.
 - 4. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification.
- B. Roofing System Components: Listed in order from top of roof down:
 - 1. Membrane: Thickness as specified.
 - 2. Base Sheet Over Insulation: Cold adhesive attached.
 - 3. Insulation Cover Board: High density polyisocyanurate; cold adhesive attached.
 - 4. Insulation:
 - a. Tapered: Slope as indicated; provide minimum R-value at thinnest point; place tapered layer on bottom.
 - b. Total R-value of 30, minimum.
 - c. Maximum Thickness: 6 inches.
 - d. Top Layer: Polyisocyanurate foam board, non-composite; mechanically fastened.
 - e. Bottom Layer: Polyisocyanurate foam board, non-composite; mechanically fastened.
 - f. Crickets: Tapered insulation of same type as specified for top layer; slope as indicated.
 - 5. Deck Cover Board: Gypsum-based board, 1/4 inch thick; loose-laid, no attachment.
 - 6. Base Sheet: Fire-rated coated glass fiber slip sheet, loose-laid.

2.03 MEMBRANE MATERIALS

- A. Membrane: Flexible, heat weldable sheet composed of thermoplastic polyolefin polymer and ethylene propylene rubber; complying with ASTM D6878/D6878M, with polyester weft inserted reinforcement and the following additional characteristics:
 - 1. Thickness: 0.060 inch plus/minus 10 percent, with coating thickness over reinforcement of 0.024 inch plus/minus 10 percent.
 - 2. Puncture Resistance: 265 lbf, minimum, when tested in accordance with FTM 101C - Method 2031.
 - 3. Solar Reflectance: ____, minimum, when tested in accordance with ASTM C1549.
 - 4. Acceptable Product: UltraPly TPO by Firestone.
- B. Slip Sheet: Coated glass fiber mat; qualified as part of Class A assembly over combustible and non-combustible decks, complying with ASTM D828 tensile testing.
- C. Membrane Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.
- D. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 18 inches wide.
- E. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyolefin polymer and ethylene propylene rubber.
 - 1. Thickness: 0.060 inch plus/minus 10 percent.
 - 2. Tensile Strength: 1,550 psi, minimum, when tested in accordance with ASTM D638 after heat aging.
 - 3. Elongation at Break: 650 percent, minimum, when tested in accordance with ASTM D638 after heat aging.
 - 4. Tearing Strength: 12 lbf, minimum, when tested in accordance with ASTM D1004 after heat aging.

5. Color: White.
6. Acceptable Product: UltraPly TPO Flashing by Firestone.
- F. Tape Flashing: 5-1/2 inches nominal wide TPO membrane laminated to cured rubber polymer seaming tape, overall thickness 0.065 inch nominal; TPO QuickSeam Flashing by Firestone.
- G. Bonding Adhesive: Neoprene and SBR rubber blend, formulated for compatibility with the membrane other substrate materials, including masonry, wood, and insulation facings; UltraPly Bonding Adhesive by Firestone.
- H. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing; Pourable Sealer by Firestone.
- I. Seam Plates: Steel with barbs and Galvalume coating; corrosion-resistance complying with FM 4470.
- J. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches wide by 0.10 inch thick; Firestone Termination Bar by Firestone.
- K. Cut Edge Sealant: Synthetic rubber-based, for use where membrane reinforcement is exposed; available in white, gray, and tan; UltraPly TPO Cut Edge Sealant by Firestone.
- L. General Purpose Sealant: EPDM-based, one part, white general purpose sealant; UltraPly TPO General Purpose Sealant by Firestone.
- M. Molded Flashing Accessories: Unreinforced TPO membrane pre-molded to suit a variety of flashing details, including pipe boots, inside corners, outside corners, etc.; UltraPly TPO Small and Large Pipe Flashing by Firestone.
- N. Roof Walkway Pads: Non-reinforced TPO walkway pads, 0.130 inch by 30 inches by 40 feet long with patterned traffic bearing surface; UltraPly TPO Walkway Pads by Firestone.

2.04 ROOF INSULATION AND COVER BOARDS

- A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with glass reinforced mat laminated to faces, complying with ASTM C1289 Type II Class 1, and the following additional characteristics:
 1. Thickness: As indicated elsewhere.
 2. Size: 48 inches by 96 inches, nominal.
 - a. Exception: Insulation to be attached using adhesive or asphalt may be no larger than 48 inches by 48 inches, nominal.
 3. R-value (LTTR):
 - a. 1.0 inch Thickness: 6.0, minimum.
 - b. 1.25 inch Thickness: 7.5, minimum.
 - c. 1.5 inch Thickness: 9.0, minimum.
 - d. 1.75 inch Thickness: 10.5, minimum.
 - e. 2.0 inch Thickness: 12.1, minimum.
 - f. 3.0 inch Thickness: 18.5, minimum.
 - g. 4.0 inch Thickness: 25.0, minimum.
 4. Compressive Strength: 20 psi when tested in accordance with ASTM C1289.
 5. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
 6. Recycled Content: 19 percent post-consumer and 15 percent pre-consumer (post-industrial), average.
 7. Acceptable Product: ISO 95+ GL Polyisocyanurate Insulation by Firestone.
- B. High Density Polyisocyanurate Cover Board: Non-combustible, water resistant, high density closed cell polyisocyanurate core with coated glass mat facers, and the following characteristics:
 1. Size: 48 inches by 96 inches, nominal.
 2. Thickness: 1/2 inch.
 3. Thermal Value: R-value of 2.5, when tested in accordance with ASTM C518 and ASTM C177.
 4. Surface Water Absorption: 3 percent, maximum, when tested in accordance with ASTM C209.

5. Compressive Strength: 120 psi, when tested in accordance with ASTM D1621.
 6. Density: 5 pcf, when tested in accordance with ASTM D1622.
 7. Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
 8. Mold Growth Resistance: Passing ASTM D3273.
 9. Acceptable Product: ISOGARD HD Cover Board by Firestone.
- C. Gypsum-Based Cover Board: Non-combustible, water resistant gypsum core with embedded glass mat facers, complying with ASTM C1177/C1177M, and the following additional characteristics:
1. Size: 48 inches by 96 inches, nominal.
 - a. Exception: Board to be attached using adhesive or asphalt may be no larger than 48 inches by 48 inches, nominal.
 2. Thickness: As indicated elsewhere.
 3. Surface Water Absorption: 2.5 g, maximum, when tested in accordance with ASTM C473.
 4. Spanning Capability: Recommended by manufacturer for following minimum flute spans:
 5. Surface Burning Characteristics: Flame spread index of 0 (zero), smoke developed index of 0 (zero), when tested in accordance with ASTM E84.
 6. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
 7. Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
 8. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D3273 for minimum of 4 weeks.
 9. Acceptable Product: DensDeck by Georgia-Pacific.
- D. Insulation Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.
- E. Adhesive for Insulation Attachment: Type as required by roof membrane manufacturer for roofing system and warranty to be provided; use only adhesives furnished by roof membrane manufacturer.

2.05 METAL ACCESSORIES

- A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailer.
1. Wind Performance:
 - a. Membrane Pull-Off Resistance: 100 lb/ft, minimum, when tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-1.
 - b. Fascia Pull-Off Resistance: At least minimum required when tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-2.
 - c. Provide product listed in FM (AG) with at least FM 1-270 rating.
 2. Fascia Face Height: 6-1/2 inches.
 3. Edge Member Height Above Nailers: 1-1/4 inches.
 4. Length: 144 inches.
 5. Functional Characteristics: Fascia retainer supports while allowing for free thermal cycling of fascia.
 6. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion.
 7. Anchor Bar Cleat: 20 gauge, 0.036 inch G90 coated commercial type galvanized steel with pre-punched holes.
 8. Curved Applications: Factory modified.
 9. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted.
 10. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; minimum 14-inch long legs on corner pieces.
 11. Scuppers: Welded watertight.
 12. Accessories: Provide matching brick wall cap, downspout, extenders, and other special fabrications as shown on the drawings.

- B. Parapet Copings: Formed metal coping with galvanized steel anchor/support cleats for capping any parapet wall; watertight, maintenance free, without exposed fasteners; butt type joints with concealed splice plates; mechanically fastened as indicated; Firestone PTCF.
1. Wind Performance:
 - a. At least minimum required when tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3.
 - b. Provide product listed in FM (AG) with at least FM 1-90 rating.
 2. Description: Coping sections allowed to expand and contract freely while locked in place on anchor cleats by mechanical pressure from hardened stainless steel springs factory attached to anchor cleats; 8-inch wide splice plates with factory applied dual non-curing sealant strips capable of providing watertight seal.
 3. Material and Finish: 22 gauge, 0.03 inch thick galvanized steel with Kynar 500 finish in manufacturer's standard color; matching concealed joint splice plates; factory-installed protective plastic film.
 4. Dimensions:
 - a. Wall Width: As indicated on the drawings.
 - b. Piece Length: Minimum 144 inches.
 - c. Curved Application: Factory fabricated in true radius.
 5. Anchor/Support Cleats: 20 gauge, 0.036 inch thick prepunched galvanized cleat with 12 inch wide stainless steel spring mechanically locked to cleat at 72 inches on center.
 6. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, corners, intersections, curves, pier caps, and end caps; minimum 14 inch long legs on corner, intersection, and end pieces.
 7. Fasteners: Factory-furnished; electrolytically compatible; minimum pull out resistance of 240 lb for actual substrate used; no exposed fasteners.

2.06 ACCESSORIES

- A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir, or PS 1 APA Exterior Grade plywood; pressure preservative treated.
1. Width: 3-1/2 inches, minimum, or as wide as nailing flange of roof accessory being attached to it.
 2. Thickness: Same as thickness of roof insulation.
- B. Cant Strips and Tapered Edge Strips: 45 degree face slope and minimum 5-inch face dimension; provide at angle changes between vertical and horizontal planes that exceed 45 degrees.
1. Type: Non-flammable perlite, complying with ASTM C728.
 2. Install using hot asphalt (Type IV), roofing mastic, or mechanically fastened using fasteners and plates approved by roofing manufacturer.

PART 3 INSTALLATION

3.01 GENERAL

- A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.
- B. Obtain relevant instructions and maintain copies at project site for duration of installation period.
- C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.
- D. Perform work using competent and properly equipped personnel.
- E. Temporary closures, which ensure that moisture does not damage any completed section of new roofing system, are responsibility of applicator. Completion of flashings, terminations, and temporary closures to be completed as required to provide a watertight condition.
- F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow

proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F.

- G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
 - 1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
 - 2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
 - 3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.
- H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.
- I. Comply with membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep adhesives, sealants, primers and cleaning materials away from sources of ignition.

3.02 EXAMINATION

- A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.
- B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.
- C. Examine roof substrate to verify that it is properly sloped to drains.
- D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptance of project conditions and requirements.
- E. Verify that wood nailers have been properly installed.

3.03 PREPARATION

- A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.
- B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.
- C. Fill surface voids in immediate substrate that are greater than 1/4 inch wide with fill material acceptable insulation to membrane manufacturer.
- D. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.
- E. Wood Nailers: Provide wood nailers at perimeters and other locations where indicated on drawings, of total height matching total thickness of insulation being used.
 - 1. Install with 1/8 inch gap between each length and at each change of direction.
 - 2. Mechanically fasten to deck to resist force of 200 lbf/linear foot.

3.04 INSULATION AND COVER BOARD INSTALLATION

- A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.
- B. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.
- C. Lay roof insulation in courses parallel to roof edges.
- D. Neatly and tightly fit insulation to penetrations, projections, and nailers, with gaps not greater than 1/4 inch. Fill gaps greater than 1/4 inch with acceptable insulation. Do not leave roofing membrane unsupported over a space greater than 1/4 inch wide.
- E. Mechanical Fastening: Using specified fasteners and insulation plates engage fasteners through insulation into deck to depth and in pattern required by membrane manufacturer.

3.05 SINGLE-PLY MEMBRANE INSTALLATION

- A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.
- B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.
- C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.
- D. Install membrane adhered to the substrate, with edge securement as specified.
- E. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures.
- F. Edge Securement: Secure membrane at locations where membrane terminates or goes through an angle change greater than 2 in 12 inches using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.
 - 1. Exceptions: Round pipe penetrations less than 18 inches in diameter and square penetrations less than 4 inches square.
 - 2. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.

3.06 FLASHING AND ACCESSORIES INSTALLATION

- A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.
- B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
 - 1. Follow roofing manufacturer's instructions.
 - 2. Remove protective plastic surface film immediately before installation.
 - 3. Install water block sealant under the membrane anchorage leg.
 - 4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
 - 5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
 - 6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
 - 7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.
- C. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.
- D. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at walls, curbs, parapets, skylights, and other vertical and sloped surfaces that roofing membrane abuts to; extend flashing at least 8 inches high above membrane surface.
 - 1. Use longest practical flashing pieces.
 - 2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
 - 3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
 - 4. Provide termination directly to the vertical substrate as shown on roof drawings.
- E. Roof Drains:
 - 1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.
 - 2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch of membrane to extend inside clamping ring past drain bolts.

3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
 4. Apply sealant on top of drain bowl where clamping ring seats below the membrane
 5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.
- F. Flashing at Penetrations: Flash penetrations passing through membrane; make flashing seals directly to penetration.
1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
 2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches deep, with at least 1 inch clearance from penetration, sloped to shed water.

3.07 FINISHING AND WALKWAY INSTALLATION

- A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.
1. Use specified walkway pads unless otherwise indicated.
- B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1 inch and maximum of 3 inches from each other to allow for drainage.
1. If installation of walkway pads over field fabricated splices or within 6 inches of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches on either side.
 2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

3.08 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements for additional requirements.
- B. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).
- C. Perform corrections necessary for issuance of warranty.

3.09 CLEANING

- A. Clean contaminants generated by roofing work from building and surrounding areas including bitumen, adhesives, sealants, and coatings.
- B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.
- C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.10 PROTECTION

- A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION

SECTION 07.62.00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, and scuppers.
- B. Sealants for joints within sheet metal fabrications.
- C. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS

- A. Section 04.20.00 - Unit Masonry: Metal flashings embedded in masonry.
- B. Section 06.10.00 - Rough Carpentry: Wood nailers for sheet metal work.
- C. Section 07.31.13 - Asphalt Shingles: Non-metallic flashings associated with shingle roofing.
- D. Section 07.54.23 - Thermoplastic-Polyolefin Roofing (TPO).
- E. Section 07.71.00 - Roof Specialties: Manufactured copings, flashings, and expansion joint covers.
- F. Section 07.71.23 - Manufactured Gutters and Downspouts.
- G. Section 07.72.00 - Roof Accessories: Manufactured metal roof curbs.
- H. Section 07.92.00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.
- C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.
- D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- H. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.
- I. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).
- J. CDA A4050 - Copper in Architecture - Handbook; current edition.
- K. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit two samples 6x6 inch in size illustrating metal finish color.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gauge, (0.0239 inch) thick base metal.
- B. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gauge, 0.032 inch thick; plain finish shop pre-coated with modified silicone coating.
 - 1. Acrylic Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
 - 2. Color: As selected by Architect from manufacturer's standard colors; to match storefront.

2.02 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.03 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Plastic Cement: ASTM D4586/D4586M, Type I.
- F. Reglets: Recessed type, Aluminum.
 - 1. Product: Z Reveal manufactured by Fry Reglet.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.

- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

- A. Comply with drawing details.
- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07.71.00
ROOF SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured roof specialties, including copings, fascias, and gravel stops.
- B. Factory fabricated cornices.

1.02 RELATED REQUIREMENTS

- A. Section 07.72.00 - Roof Accessories: Manufactured curbs, roof hatches, and snow guards.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2017.
- C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- D. NRCA (RM) - The NRCA Roofing Manual; 2017.
- E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
- D. Samples: Submit two appropriately sized samples of coping and gravel stop.

PART 2 PRODUCTS

2.01 COMPONENTS

- A. Roof Edge Flashings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
 - 1. Configuration: Fascia, cant, and edge securement for roof membrane.
 - 2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.
 - 3. Exposed Face Height: As indicated on drawings.
 - 4. Material: Formed steel sheet, galvanized, 24 gauge, 0.024 inch thick, minimum.
- B. Copings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
 - 1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness, and finish as cap; concealed stainless steel fasteners.
 - 2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
 - 3. Wall Width: As indicated on drawings.
 - 4. Outside Face Height: As indicated on drawings.
 - 5. Inside Face Height: As indicated on drawings.
 - 6. Material: Formed aluminum sheet, 0.040 inch thick, minimum.
 - 7. Finish: Anodized natural (clear).
- C. Factory Fabricated Cornices: Factory fabricated, assembled, and finished sheet metal architectural details, including profiles, returns, mitered corners, end caps, rakes, gables, etc; finished unit mechanically fastened to structural support.

1. Material: Aluminum sheet, ASTM B209, alloy 3003 or 5005.
2. Sheet Thickness: 0.04 inch.
3. Section Length: 10 feet, maximum, between joints.
4. Joint Splice Plates: Same material as cornice sections, 6 inch wide, minimum, and formed to match inside surface of cornice profile.
5. Aluminum Finish: Manufacturer's standard factory applied PVDF coating.

2.02 FINISHES

- A. Clear Anodized Finish: AAMA 611 AA-M12C22A41 Class I clear anodic coating not less than 0.7 mils thick.

2.03 ACCESSORIES

- A. Sealant for Joints in Linear Components: As recommended by component manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.
 1. Refer to Section 07.72.00 for information on roofing related accessories.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Seal joints within components when required by component manufacturer.
- C. Anchor components securely.
- D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.
- E. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.
- F. Coordinate installation of flashing flanges into reglets.

END OF SECTION

SECTION 07.71.23
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pre-finished aluminum gutters and downspouts, including leaf guards.
- B. Precast concrete splash pads.
- C. Cast iron downspout boots.

1.02 RELATED REQUIREMENTS

- A. Section 07.62.00 - Sheet Metal Flashing and Trim.

1.03 REFERENCE STANDARDS

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.
- C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.
- D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Comply with SMACNA (ASMM) for sizing components for rainfall intensity determined by a storm occurrence of 1 in 5 years.
- B. Comply with applicable code for size and method of rain water discharge.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on prefabricated components.
- C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.
- D. Samples: Submit two samples, 6 inch long illustrating component design, finish, color, and configuration.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.
- B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Pre-Finished Aluminum Sheet: ASTM B209 (ASTM B209M); 0.032 inch thick.
 - 1. Finish: Plain, shop pre-coated with modified silicone coating.
 - 2. Color: As selected from manufacturer's standard colors.
- B. Protective Backing Paint: Zinc molybdate alkyd.

2.02 COMPONENTS

- A. Gutters: SMACNA rectangular style profile.

- B. Downspouts: SMACNA Rectangular profile.
- C. Leaf Guards: Premanufactured, pre-finished aluminum leaf guards, matching the gutters, which allow the ready flow of water into the gutter while preventing leaves and other similar wind-blown materials from entering the gutter.
- D. Anchors and Supports: Profiled to suit gutters and downspouts.
 - 1. Anchoring Devices: In accordance with CDA requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.
- E. Fasteners: Stainless steel, with soft neoprene washers.

2.03 ACCESSORIES

- A. Splash Pads: Precast concrete type, size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.
- B. Downspout Boots: Cast iron; ASTM A48.
 - 1. Manufacturer: J.R. Hoe, Zurn, or Neenah.
 - 2. Model No: Angular outlet type, size per Drawings.

2.04 FABRICATION

- A. Form gutters and downspouts of profiles and size indicated.
- B. Fabricate with required connection pieces.
- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- D. Hem exposed edges of metal.
- E. Fabricate gutter and downspout accessories; seal watertight.

2.05 FINISHES

- A. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

- A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

- A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
- B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- C. Slope gutters 1/8 inch per foot.
- D. Connect downspouts to downspout boots at 24 inches above grade. Grout connection watertight.
- E. Connect downspouts to storm sewer system. Grout connection watertight.
- F. Set rooftop splash pans under downspouts.

END OF SECTION

SECTION 07.72.00
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Curbs.
- B. Equipment rails.
- C. Roof penetrations mounting curbs.
- D. Roof hatches.

1.02 RELATED REQUIREMENTS

- A. Section 05.31.00 - Steel Decking.
- B. Section 07.62.00 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.
- C. Section 07.71.00 - Roof Specialties: Other manufactured roof items.
- D. Section 07.71.23 - Manufactured Gutters and Downspouts.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1910.23 - Ladders; current edition.
- B. 29 CFR 1910.29 - Fall Protection Systems and Falling Object Protection - Criteria and Practices; Current Edition.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- F. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.
- J. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Maintenance requirements.
- C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
 - 1. Non-penetrating Rooftop Supports: Submit design calculations for loadings and spacings.
 - 2. Submit shop drawings sealed and signed by a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- D. Warranty Documentation:

1. Submit manufacturer warranty.
2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

1.06 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 ROOF CURBS

- A. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
 1. Roof Curb Mounting Substrate: Curb substrate consists of standing seam metal roof panel system.
 2. Sheet Metal Material:
 3. Galvanized Steel: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33; G60 coating designation; 18 gauge, 0.048 inch thick.
 - a. Finish: Factory primed.
 4. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing system at 1:1 slope; minimum cant height 4 inches.
 5. Fabricate curb bottom and mounting flanges for installation directly on metal roof panel system to match slope and configuration of system.
 - a. Extend side flange to next adjacent roof panel seam and comply with seam configurations and seal connection, providing at least 6 inch clearance between curb and metal roof panel flange allowing water to properly flow past curb.
 - b. Where side of curb aligns with metal roof panel flange, attach fasteners on upper slope of flange to curb connection allowing water to flow past below fasteners, and seal connection.
 - c. Maintain at least 12 inch clearance from curb, and lap upper curb flange on underside of down sloping metal roof panel, and seal connection.
 - d. Lap lower curb flange overtop of down sloping metal roof panel and seal connection.
 6. Provide layouts and configurations indicated on drawings.
- B. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.
 1. Provide preservative treated wood nailers along top of curb.
 2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
 3. Height Above Finished Roof Surface: 8 inches, minimum.
- C. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
 1. Height Above Finished Roof Surface: 8 inches, minimum.
- D. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches square unless otherwise indicated.

2.02 ROOF HATCHES AND VENTS, MANUAL AND AUTOMATIC OPERATION

- A. Roof Hatch Manufacturers:

1. Bilco Company; Type TB (various types and special size): www.bilco.com/#sle.
- B. Roof Hatches: Factory-assembled steel frame and cover, complete with operating and release hardware.
 1. Style: Provide flat metal covers unless otherwise indicated.
 2. Mounting: Provide frames and curbs suitable for mounting on corrugated metal roof deck.
 3. Size: As indicated on drawings; single-leaf style unless indicated as double-leaf.
 4. For Ladder Access: Single leaf; 36 x 48 inches.
- C. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
 1. Material: Galvanized steel, 14 gauge, 0.0747 inch thick.
 2. Finish: Factory prime paint.
 3. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.
 4. Curb Height: 12 inches from surface of roof deck, minimum.
- D. Metal Covers: Flush, insulated, hollow metal construction.
 1. Capable of supporting 40 psf live load.
 2. Material: Galvanized steel; outer cover 14 gauge, 0.0747 inch thick, liner 22 gauge, 0.03 inch thick.
 3. Finish: Factory prime paint.
 4. Insulation: Manufacturer's standard 1 inch rigid glass fiber.
 5. Gasket: Neoprene, continuous around cover perimeter.
- E. Safety Railing System: Roof hatch manufacturer's standard accessory safety rail system mounted directly to curb.
 1. Railing: Comply with 29 CFR 1910.23 for ladder safety, with a safety factor of two.
 2. Self-Closing Gate: Comply with 29 CFR 1910.29 for safe egress and fall protection through hatch opening.
 3. Posts and Rails: Galvanized steel tubing.
 4. Gate: Same material as railing; automatic closing with latch.
 5. Finish: Manufacturer's standard, factory applied finish.
 6. Gate Hinges and Post Guides: ASTM B221 (ASTM B221M), 6063 alloy, T5 temper aluminum.
 7. Mounting Brackets: Hot dipped galvanized steel, 1/4 inch thick, minimum.
 8. Fasteners: Stainless steel, Type 316.
 9. Manufacturers:
 - a. BILCO Company; Bil-Guard 2.0: www.bilco.com/#sle.
- F. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
 1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
 2. Hinges: Heavy duty pintle type.
 3. Hold open arm with vinyl-coated handle for manual release.
 4. Latch: Upon closing, engage latch automatically and reset manual release.
 5. Manual Release: Pull handle on interior.
 6. Locking: Padlock hasp on interior.

2.03 NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES

- A. Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly.
 1. Design Loadings and Configurations: As required by applicable codes.
 2. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
4. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.
5. Manufacturers:
 - a. Metal Roof Innovations, Ltd. S-5! Attachment Solutions; S-5! Utility System: www.s-5.com/#sle.
 - b. PHP Systems/Design: www.phpsd.com/#sle.
 - c. Portals Plus: www.portalsplus.com/#sle.
- B. Pipe Supports: Provide attachment fixtures complying with MSS SP-58 and as indicated.
 1. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

- A. Clean installed work to like-new condition.

3.05 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07.84.00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

- A. Section 07.05.53 - Fire and Smoke Assembly Identification.
- B. Section 09.21.16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2016a.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a.
- C. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011).
- D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops; 2014b.
- E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2010a (Reapproved 2015).
- F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015b.
- G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013.
- H. ITS (DIR) - Directory of Listed Products; current edition.
- I. FM (AG) - FM Approval Guide; current edition.
- J. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.
- K. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- L. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

1.06 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
 - 2. Hilti, Inc: www.us.hilti.com/#sle.

2.02 MATERIALS

- A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- B. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
- B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
- C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
- D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.04 FIRESTOPPING FOR FLOOR-TO-FLOOR, FLOOR-TO-WALL, HEAD-OF-WALL, AND WALL-TO-WALL JOINTS

- A. Gypsum Board Walls:
 - 1. Wall-to-Wall Joints That Have Movement Capabilities (Dynamic-D):
 - a. 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
 - 2. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Cut to Fit Ribs:
 - a. 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.
 - 3. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Not Cut to Fit:
 - a. 1 Hour Construction: UL System HW-D-0042; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
 - b. 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

2.05 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

- A. Blank Openings:
 - 1. 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
- B. Penetrations By:
 - 1. Uninsulated Metallic Pipe, Conduit, and Tubing:
 - a. 1 Hour Construction: UL System W-L-1506; Hilti CFS-D Firestop Cable Disc.
 - 2. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
 - a. 1 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
 - 3. Electrical Cables Not In Conduit:
 - a. 1 Hour Construction: UL System W-L-3414; Hilti CFS-D Firestop Cable Disc.
 - 4. Insulated Pipes:
 - a. 1 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
 - 5. HVAC Ducts, Insulated:
 - a. 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.04 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07.92.00
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.
- D. Owner-provided field quality control.

1.02 RELATED REQUIREMENTS

- A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.
- B. Section 07.25.00 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders.
- C. Section 07.84.00 - Firestopping: Firestopping sealants.
- D. Section 08.71.00 - Door Hardware: Setting exterior door thresholds in sealant.
- E. Section 08.80.00 - Glazing: Glazing sealants and accessories.
- F. Section 09.21.16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- G. Section 09.30.00 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015.
- B. ASTM C834 - Standard Specification for Latex Sealants; 2014.
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).
- G. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).
- H. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2013.
- I. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2015a).
- J. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2016a.
- K. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.

2. List of backing materials approved for use with the specific product.
 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 4. Substrates the product should not be used on.
 5. Substrates for which use of primer is required.
 6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 7. Sample product warranty.
 8. Certification by manufacturer indicating that product complies with specification requirements.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
- F. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
- G. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
- H. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.
- I. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.
- J. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of each referenced document covering installation requirements on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
1. Identification of testing agency.
 2. Name(s) of sealant manufacturers' field representatives who will be observing
 3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
 - a. Test date.
 - b. Copy of test method documents.
 - c. Age of sealant upon date of testing.
 - d. Test results, modeled after the sample form in the test method document.
 - e. Indicate use of photographic record of test.
- D. Owner will employ an independent testing agency to perform the field quality control inspection and testing as referenced in PART 3 of this section and as follows, to prepare and submit the field quality control plan and log, and to provide recommendations of remedies in the case of failure.
- E. Field Quality Control Plan:
1. Visual inspection of entire length of sealant joints.
 2. Non-destructive field adhesion testing of sealant joints, except interior acrylic latex sealants.

3. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.
- F. Field Adhesion Test Procedures:
 1. Allow sealants to fully cure as recommended by manufacturer before testing.
 2. Have a copy of the test method document available during tests.
 3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
 4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
 5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
 6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.
- G. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
- H. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
 1. Sample: At least 18 inches long.
 2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
 3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.
- I. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or other applicable method as recommended by manufacturer.

1.06 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
 1. Pecora Corporation: www.pecora.com/#sle.
 2. Sika Corporation: www.usa-sika.com/#sle.
 3. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
- B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
 1. Pecora Corporation: www.pecora.com/#sle.
 2. Sika Corporation: www.usa-sika.com/#sle.
 3. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. Other joints indicated below.
 3. Do not seal the following types of joints.
 - a. Intentional weepholes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.
- B. Exterior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
- C. Interior Joints: Use non-sag acrylic emulsion latex sealant, unless otherwise indicated.
- D. Interior Wet Areas: Silicone sealant; Bathrooms, restrooms, and kitchens; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.
- E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.03 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products with levels of volatile organic compound (VOC) content as indicated in Section 01.61.16.

2.04 NONSAG JOINT SEALANTS

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent Plus and minus ____ percent, minimum.
 2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 5. Color: To be selected by Architect from manufacturer's standard range.
 6. Cure Type: _____.
 7. Manufacturers:
 - a. Pecora Corporation: www.pecora.com.
 - b. Sika Corporation: www.usa-sika.com.
 - c. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com/#sle.
 - d. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Silicone Sealant: ASTM C920, Grade NS, Use T; single-component, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
1. Movement Capability: Plus 100 percent and minus 50 percent, minimum.
 2. Color: Dark Gray.
 3. Manufacturers:
 - a. Pecora Corporation; Pecora 301 NS (Non-Sag): www.pecora.com/#sle.

- b. Tremco Commercial Sealants & Waterproofing; Spectrem 800:
www.tremcosealants.com/#sle.
- C. Polymer Sealant: ASTM C920; single component, cured sealant is paintable and mold/mildew resistant, low odor and VOC, and ultraviolet (UV) resistant.
 - 1. Color: White.
- D. Polyurethane Sealant: ASTM C920, Grade NS, Uses M, G, and A; single component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 25 percent Plus and minus ____ percent, minimum.
 - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: To be selected by Architect from manufacturer's standard range.
 - 4. Service Temperature Range: Minus 40 to 180 degrees F.
 - 5. Manufacturers:
 - a. Pecora Corporation: www.pecora.com.
 - b. Sika Corporation: www.usa-sika.com.
 - c. Tremco Commercial Sealants & Waterproofing; Dymonic 100:
www.tremcosealants.com/#sle.
 - d. Substitutions: See Section 01.60.00 - Product Requirements.
- E. Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: Match adjacent finished surfaces.
 - 4. Service Temperature Range: Minus 40 to 180 degrees F.
- F. Acrylic Emulsion Latex: Water-based; ASTM C834, Type OP, Grade NF single component, non-staining, non-bleeding, non-sagging, paintable; not intended for exterior use.
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Grade: ASTM C834; Grade Minus 18 Degrees C (0 Degrees F).
 - 3. Manufacturers:
 - a. Hilti, Inc; CP 506 Smoke and Acoustical Sealant: www.us.hilti.com/#sle.
 - b. Hilti, Inc; CP 572 Smoke and Acoustical Spray Sealant: www.us.hilti.com/#sle.
 - c. Pecora Corporation: www.pecora.com.
 - d. Tremco Commercial Sealants & Waterproofing; Tremflex 834:
www.tremcosealants.com/#sle.
 - e. Substitutions: See Section 01.60.00 - Product Requirements.
- G. Acrylic Latex Sealant: ASTM C834; for use as acoustical sealant and in firestopping systems for expansion joints and through penetrations.
 - 1. Fire Rated System: Complies with UL 263 and ASTM E119 with UL fire resistance classifications.
 - 2. Manufacturers:
 - a. Pecora Corporation; AC-20 FTR (Fire and Temperature Rated):
www.pecora.com/#sle.

2.05 SELF-LEVELING SEALANTS

- A. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: Gray.
 - 4. Tensile Strength: 200 to 250 psi in accordance with ASTM D412.
 - 5. Manufacturers:
 - a. Pecora Corporation; DynaTrol II-SG (Slope Grade): www.pecora.com/#sle.

- b. Tremco Commercial Sealants & Waterproofing; THC-901:
www.tremcosealants.com/#sle.
- B. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: Gray.
 - 4. Service Temperature Range: Minus 40 to 180 degrees F.
 - 5. Manufacturers:
 - a. Sika Corporation; Sikaflex-1c SL: www.usa-sika.com/#sle.
 - b. W. R. MEADOWS, Inc; POURTHANE SL: www.wrmeadows.com/#sle.

2.06 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 - 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
 - 2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
 - 3. Open Cell: 40 to 50 percent larger in diameter than joint width.
 - 4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- D. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.
- D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
 - 1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
 - 2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
 - 3. Arrange for sealant manufacturer's technical representative to be present during tests.
 - 4. Record each test on Preinstallation Adhesion Test Log as indicated.
 - 5. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
 - 6. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

- A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

3.05 POST-OCCUPANCY

- A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION

SECTION 08.11.13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.
- E. Hollow metal borrowed lites glazing frames.
- F. Accessories, including glazing, louvers, and matching panels.

1.02 RELATED REQUIREMENTS

- A. Section 08.71.00 - Door Hardware.
- B. Section 08.80.00 - Glazing: Glass for doors and borrowed lites.
- C. Section 09.21.16 - Gypsum Board Assemblies.
- D. Section 09.91.13 - Exterior Painting: Field painting.
- E. Section 09.91.23 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. HMMA: Hollow Metal Manufacturers Association.
- C. NAAMM: National Association of Architectural Metal Manufacturers.
- D. NFPA: National Fire Protection Association.
- E. SDI: Steel Door Institute.

1.04 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2007 (R2011).
- C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- D. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2003 (R2009).
- E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
- F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- G. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- I. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.
- J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2015.
- K. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.

- L. ASTM C476 - Standard Specification for Grout for Masonry; 2016.
- M. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- N. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- O. ASTM E336 - Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings; 2020.
- P. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.
- Q. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.
- R. ITS (DIR) - Directory of Listed Products; current edition.
- S. NAAMM HMMA 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames; 2012.
- T. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- U. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- V. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
- W. NAAMM HMMA 850 - Fire-Protection and Smoke Control Rated Hollow Metal Door and Frame Products; 2014.
- X. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames; 2013.
- Y. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.
- Z. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- AA. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.
- AB. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.
- AC. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- AD. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- AE. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: <https://steeldoors.org/sdi-certified/#sle>.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five (5) years of documented experience.

- C. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Curries, an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
 - 3. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
 - 4. Steelcraft, an Allegion brand: www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 4. Door Edge Profile: Manufacturers standard for application indicated.
 - 5. Typical Door Face Sheets: Flush.
 - 6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
 - 7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
 - 8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - a. Based on SDI Standards: Provide at least A40/ZF120 (galvanized) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvanized) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.

- e. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
- 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
- 3. Door Thermal Resistance: R-Value of 6.0 minimum, for installed thickness of polystyrene.
- 4. Door Thickness: 1-3/4 inches, nominal.
- 5. Top Closures: Flush with top of faces and edges.
- 6. Door Face Sheets: Flush.
- 7. Weatherstripping: Refer to Section 08.71.00.
- C. Interior Doors, Non-Fire Rated:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
 - 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 - 3. Door Thickness: 1-3/4 inches, nominal.
 - 4. Door Finish: Factory primed and field finished.
- D. Fire-Rated Doors:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
 - 2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
 - 3. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
 - 4. Provide units listed and labeled by UL (DIR) or ITS (DIR).
 - a. Attach fire rating label to each fire rated unit.
 - 5. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
 - 6. Door Thickness: 1-3/4 inches, nominal.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Exterior Door Frames: Full profile/continuously welded type.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvanized) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 - 2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
 - 3. Weatherstripping: Separate, see Section 08.71.00.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch, maximum, above floor at 45 degree angle.
 - 2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
- E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- F. Mullions for Pairs of Doors: Fixed, except where removable is indicated, with profile similar to jambs.

- G. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- H. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- I. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
- J. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

- A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 - 1. Size: As indicated on drawings.
 - 2. Frame Material: 18 gauge, 0.0478 inch, galvanized steel.
 - 3. Metal Finish: Beige polyester powder coating.
 - 4. Glazing: 1/4 inch thick, tempered glass, in compliance with requirements of authorities having jurisdiction.
- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. Astragals and Edges for Double Doors: Pairs of door astragals, and door edge sealing and protection devices.
 - 1. UL listed products in compliance with requirements of authorities having jurisdiction.
 - 2. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
 - 3. Astragal Type: Split, two parts, and with automatic locking, cutouts for other door hardware, and sealing gasket.
 - 4. Edge Type: Beveled edge
 - 5. Material: Aluminum.
 - 6. Metal Finish: Beige powder coating.
- D. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- E. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Install door hardware as specified in Section 08.71.00.
 - 1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
- F. Comply with glazing installation requirements of Section 08.80.00.
- G. Touch up damaged factory finishes.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 08.14.16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 08.11.13 - Hollow Metal Doors and Frames.
- B. Section 08.71.00 - Door Hardware.
- C. Section 08.80.00 - Glazing.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- C. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- D. ASTM E413 - Classification for Rating Sound Insulation; 2016.
- E. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.
- F. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- G. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.
- H. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- I. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
 - 1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
 - 2. Include certification program label.
- D. Samples: Submit two samples of door veneer, 8 by 10 inches in size illustrating wood grain, stain color, and sheen.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Specimen warranty.
- I. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than 15 years of documented experience.
 - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than 5 years of documented experience.
- C. Quality Certification:
 - 1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
 - 2. Provide labels or certificates indicating that installed work will comply with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 3. Provide designated labels on shop drawings as required by certification program.
 - 4. Provide designated labels on installed products as required by certification program.
 - 5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Masonite Architectural; Aspiro Select Wood Veneer Doors: www.architectural.masonite.com/#sle.
 - 2. Oregon Door; Architectural Series: www.oregondoor.com/#sle.
 - 3. VT Industries, Inc: www.vtindustries.com/#sle.

2.02 DOORS AND PANELS

- A. Doors: See drawings for locations and additional requirements.
 - 1. Quality Standard: Custom Grade, Standard Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
 - 2. Wood Veneer Faced Doors: 7-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: White birch, veneer grade in accordance with quality standard indicated, quarter cut, with book match between leaves of veneer, center balance match of spliced veneer leaves assembled on door or panel face; color as selected by Architect.
 - 1. Vertical Edges: Any option allowed by quality standard for grade.
 - 2. "Running Match" each pair of doors and doors in close proximity to each other.
- B. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge for hardware reinforcement.
 - 2. Provide solid blocking for other throughbolted hardware.
- C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 12, Polyurethane, Water-based.
 - b. Stain: As selected by Architect.
 - c. Sheen: Satin.
- B. Factory finish doors in accordance with approved sample.
- C. Seal door top and bottom edged with color sealer to match door facing.

2.07 ACCESSORIES

- A. Hollow Metal Door Frames: See Section 08.11.13.
- B. Glazed Openings:
 - 1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
- C. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 - 1. Size: As indicated on drawings.
 - 2. Frame Material: 18 gauge, 0.0478 inch, galvanized steel.
 - 3. Metal Finish: Beige polyester powder coating.
 - 4. Glazing: 1/4 inch thick, tempered glass, in compliance with requirements of authorities having jurisdiction.
- D. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- E. Astragals and Edges for Double Doors: Pairs of doors astragals, and door edge sealing and protection devices.
 - 1. UL listed products in compliance with requirements of authorities having jurisdiction.
 - 2. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
 - 3. Astragal Type: Split, two parts, and with automatic locking, cutouts for other door hardware, and sealing gasket.
 - 4. Edge Type: Beveled edge

- 5. Material: Aluminum.
- 6. Metal Finish: Beige powder coating.
- F. Door Hardware: See Section 08.71.00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

3.05 SCHEDULE

- A. See Door and Frame Schedule provided in the Drawings.

END OF SECTION

SECTION 08.31.00
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall mounted access units.
- B. Ceiling mounted access units.

1.02 RELATED REQUIREMENTS

- A. Section 08.71.00 - Door Hardware: Mortise cylinder and core hardware.
- B. Section 09.91.23 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. FM (AG) - FM Approval Guide; current edition.
- C. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Manufacturer's Installation Instructions: Indicate installation requirements.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.
- G. Project Record Documents: Record actual locations of each access unit.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units with Return Air Grille:
 - 1. Panel Material: Aluminum extrusions with gypsum board inlay.
 - 2. Size: 12 by 12 inches.
 - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
 - 5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
- B. Wall-Mounted Units in Wet Areas:
 - 1. Panel Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
 - 2. Size: 12 by 12 inches.
 - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
 - 5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

- C. Fire-Rated Wall-Mounted Units:
 - 1. Wall Fire-Rating: As indicated on drawings.
 - 2. Panel Material: Steel.
 - 3. Size: 12 by 12 inches.
 - 4. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.

2.02 WALL AND CEILING MOUNTED ACCESS UNITS

- A. Manufacturers:
 - 1. ACUDOR Products Inc: www.acudor.com/#sle.
 - 2. Karp Associates, Inc: www.karpinc.com/#sle.
 - 3. Milcor, Inc: www.milcorinc.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08.43.13
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.
- C. Weatherstripping.

1.02 RELATED REQUIREMENTS

- A. Section 07.25.00 - Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.
- B. Section 07.92.00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Section 08.71.00 - Door Hardware: Hardware items other than specified in this section.
- D. Section 08.80.00 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.
- C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- E. AAMA 612 - Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum; 2015.
- F. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- G. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.
- H. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.
- I. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- J. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- K. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- L. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- M. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- N. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- O. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

- P. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).
- Q. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.
- R. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2014a.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Samples: Submit two samples 2 x 6 inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.
- E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- F. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- G. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- H. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- I. Designer's Qualification Statement.
- J. Manufacturer's Qualification Statement.
- K. Installer's Qualification Statement.
- L. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least 10 years of documented experience.
 - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
 - a. Insulating Glass Certification Council (IGCC).
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least 7 years of documented experience.
 - 1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.
 - a. North American Contractor Certification (NACC) for glazing contractors.
 - b. Equivalent independent third-party ANSI accredited certification.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Kawneer.
- B. Other Acceptable - Aluminum-Framed Storefronts Manufacturers:
 - 1. Oldcastle BuildingEnvelope: www.oldcastlebe.com/#sle.
 - 2. Pittco Architectural Metals Inc: www.pittcometals.com/#sle.
 - 3. Tubelite, Inc: www.tubeliteinc.com/#sle.

2.02 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

- A. Front-Set Style, Thermally-Broken:
 - 1. Basis of Design: Pittco Architectural Metals Inc; TMS 114T UF Storefront: www.pittcometals.com/#sle.
 - 2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.

2.03 BASIS OF DESIGN -- SWINGING DOORS

- A. Medium Stile, Insulating Glazing, Thermally-Broken:
 - 1. Basis of Design: Pittco Architectural Metals Inc; Medium Stile Thermal Entrance: www.pittcometals.com/#sle.

2.04 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Glazing Rabbet: For 1 inch insulating glazing.
 - 2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
 - 3. Finish: Class I color anodized.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - 4. Finish Color: Dark bronze.
 - 5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - 6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - 7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 11. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
 12. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.
- B. Performance Requirements
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Design Wind Loads: Comply with requirements of ASCE 7.
 - b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
 2. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
 3. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
 4. Overall U-value Including Glazing: 0.38 Btu/(hr sq ft deg F), maximum.

2.05 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
 2. Glazing Stops: Flush.
- B. Glazing: As specified in Section 08.80.00.
- C. Swing Doors: Glazed aluminum.
1. Thickness: 1-3/4 inches.
 2. Top Rail: 4 inches wide.
 3. Vertical Stiles: 4-1/2 inches wide.
 4. Bottom Rail: 10 inches wide.
 5. Glazing Stops: Beveled.
 6. Finish: Same as storefront.

2.06 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Concealed Flashings: Sheet aluminum, 26 gauge, 0.017 inch minimum thickness.
- D. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- E. Sealant for Setting Thresholds: Non-curing butyl type.
- F. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.07 FINISHES

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils thick.
- B. Color: As selected by Architect from manufacturer's standard range.

2.08 HARDWARE

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Other Door Hardware: Storefront manufacturer's standard type to suit application.
 - 1. Finish on Hand-Contacted Items: Polished chrome.
 - 2. For each door, include butt hinges, pivots, push handle, pull handle, exit device, narrow stile handle latch, and closer.
 - 3.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Set thresholds in bed of sealant and secure.
- J. Install hardware using templates provided.
 - 1. See Section 08.71.00 for hardware installation requirements.
- K. Install glass and infill panels in accordance with Section 08.80.00, using glazing method required to achieve performance criteria.
- L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

- A. Provide services of storefront manufacturer's field representative to observe for proper installation of system and submit report.
- B. See Section 01.40.00 - Quality Requirements, for general testing and inspection requirements.
- C. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
 - 1. Perform a minimum of two tests in each designated area as indicated on drawings.
 - 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

- D. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08.54.13
FIBERGLASS WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Factory fabricated fiberglass windows with fixed and operating sash.
- B. Glazed by factory; including infill panels.
- C. Operating hardware.
- D. Insect screens.

1.02 RELATED REQUIREMENTS

- A. Section 07.25.00 - Weather Barriers: Sealing frames to weather barrier installed on adjacent construction.
- B. Section 07.92.00 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.03 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.
- B. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products; 2012.
- C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- F. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- G. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).
- H. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2010).
- I. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.
- J. ASTM E1332 - Standard Classification for Rating Outdoor-Indoor Sound Attenuation; 2016.
- K. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2014a.
- L. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2007 (Reapproved 2016).
- M. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact; 2014.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide component dimensions, anchors, fasteners, glass, and internal drainage details.
- C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, installation requirements.
- D. Samples: Submit two color-selected, 2 x 6 inch in size, illustrating window frame section.
- E. Submit two samples of operating hardware.
- F. Manufacturer's Certificate: Certify that products of this section meet or exceed specified requirements.
- G. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
 - 1. Evidence of AAMA Certification.
 - 2. Evidence of WDMA Certification.
 - 3. Evidence of CSA Certification.
 - 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
- H. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.
- I. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- J. Manufacturer's Qualification Statement.
- K. Installer's Qualification Statement.
- L. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 10 years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 7 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
- B. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F.
- B. Maintain this minimum temperature during and after installation of sealants.

1.09 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a ten year period after Date of Substantial Completion.
- C. Provide ten year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same. Include coverage for degradation of color finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fiberglass Windows:
 - 1. Pella Corporation; Pella Impervia Windows: www.pellacommercial.com/#sle.

2.02 WINDOW UNITS

- A. Fiberglass Windows: Hollow, tubular, multi-layer fiber reinforced material; factory fabricated; with vision glass, related flashings, anchorage and attachment devices.
 - 1. Configuration: As indicated on drawings .
 - 2. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 - 3. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - 4. Thermal Movement: Design to accommodate thermal movement caused by 100 degrees F temperature change without buckling stress on glass, joint seal failure, damaging loads on structural elements, damaging loads on fasteners, reduction in performance or other detrimental effects.

2.03 PERFORMANCE REQUIREMENTS

- A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
 - 1. Performance Class (PC): R.
- B. Design Pressure (DP): In accordance with applicable codes.
- C. Deflection: Limit member deflection to 1/200 of the longer dimension with full recovery of glazing materials.
- D. Wind-Borne-Debris Resistance: Identical full-size glazed assembly without auxiliary protection, tested by independent agency and passed in accordance with ASTM E1996 for Wind Zone 3 - Enhanced Protection for Large and Small Missile impact and pressure cycling at design wind pressure.
- E. Overall Thermal Transmittance (U-value): 0.35, maximum, including glazing, measured on window sizes required for this project.
- F. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 12.11 pounds per square foot.
- G. Air Leakage: 0.3 cfm/sq ft maximum leakage when tested at 1.57 psf pressure difference in accordance with ASTM E283/E283M.
- H. Acoustic Performance: Minimum outdoor-indoor transmission class (OITC) rating of 34, when tested in accordance with ASTM E90 and ASTM E1332.
- I. Forced Entry Resistance for Window Type A: Comply with ASTM F588 for measured performance of Grade 10 in accordance with requirements.

2.04 COMPONENTS

- A. Frames: 1-3/4 inch wide by 4 inch deep profile; flush glass stops of screw fastened type.
 - 1. Type: Nailing flange (for new windows).
 - 2. Frame Corners: Mitered and joined with nylon corner locks.
- B. Sills: 6 inch nominal thickness, extruded aluminum; sloped for positive wash; fit under sash to 1/2 inch beyond wall face; one piece full width of opening.
- C. Insect Screen Frame: Rolled aluminum frame of rectangular sections; fit with adjustable hardware; nominal size similar to operable glazed unit.
- D. Insect Screens: Woven aluminum mesh; 14/18 mesh size.
- E. Operable Sash Weather Stripping: Wool pile; permanently resilient, profiled to effect weather seal.
- F. Fasteners: Stainless steel.
- G. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.05 GLASS AND GLAZING MATERIALS

- A. Manufacturer's standard 1" insulating glass, selected for project location needs.

2.06 HARDWARE

- A. Casement and Awning Sash: Zinc die-cast steel worm-gear operator with Painted finish.
 - 1. Operator Linkage, Hinge Slide, and Hinge Arms: 300 series stainless steel.
 - 2. Casement and Awning Sash Lock: Folding arm crank.
- B. Window Opening Control Devices (WOCD): Provide operable window sash hardware that limits openings to only allow passage of 4 inch diameter rigid sphere or less, and are easily releasable to fully open without use of keys, tools, or special knowledge.

2.07 FABRICATION

- A. Fabricate framing, mullions and sash members with fusion welded corners and joints, in a rigid jig. Supplement frame sections with internal reinforcement where required for structural rigidity.
- B. Form sills and stools in one piece. Slope sills for wash.
- C. Form snap-in glass stops, closure molds, weather stops, and flashings for tight fit into window frame section.
- D. Form weather stop flange to perimeter of unit.
- E. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- F. Arrange fasteners to be concealed from view.
- G. Permit internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.
- H. Assemble insect screen frame, miter and reinforced frame corners. Fit mesh taut into frame and secure. Fit frame with four spring loaded steel pin retainers.
- I. Double weatherstrip operable units.
- J. Factory glaze window units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

3.02 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Install windows in accordance with ASTM E2112.
- C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- D. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- E. Install sill, stool, and apron.
- F. Set sill members and sill flashing in continuous bead of sealant.
- G. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- H. Install operating hardware.

3.03 TOLERANCES

- A. Maximum Variation from Level or Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

3.04 FIELD QUALITY CONTROL

- A. Provide services of fiberglass window manufacturer's field representative to observe for proper installation of system and submit report.
- B. See Section 01.40.00 - Quality Requirements, for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- C. Provide field testing of installed fiberglass windows by independent laboratory in accordance with AAMA 502 and AAMA/WDMA/CSA 101/I.S.2/A440 during construction process and before installation of interior finishes.
 - 1. Field test for water penetration in accordance with ASTM E1105 using Procedure B - cyclic static air pressure difference; test pressure shall not be less than 1.9 psf.
 - 2. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 6.27 psf.
- D. Repair or replace fenestration components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

- A. Adjust hardware for smooth operation and secure weathertight closure.

3.06 CLEANING

- A. See Section 01.74.19 - Construction Waste Management and Disposal, for additional requirements.
- B. Remove protective material from pre-finished surfaces.
- C. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.
- D. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION

SECTION 08.71.00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for wood, aluminum, and hollow metal doors.
- B. Hardware for fire-rated doors.
- C. Electrically operated and controlled hardware.
- D. Lock cylinders for doors that hardware is specified in other sections.
- E. Thresholds.
- F. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

- A. Section 07.92.00 - Joint Sealants: Sealants for setting exterior door thresholds.
- B. Section 08.06.71 - Door Hardware Schedule: Schedule of door hardware sets.
- C. Section 08.11.13 - Hollow Metal Doors and Frames.
- D. Section 08.14.16 - Flush Wood Doors.
- E. Section 08.43.13 - Aluminum-Framed Storefronts: Door hardware, except as noted in section.
- F. Section 28.10.00 - Access Control: Electronic access control devices. ????
- G. Section 28.31.11 - Digital, Addressable Fire-Alarm System

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. BHMA (CPD) - Certified Products Directory; 2016.
- C. BHMA A156.1 - American National Standard for Butts and Hinges; 2013.
- D. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; 2011.
- E. BHMA A156.3 - American National Standard for Exit Devices; 2014.
- F. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.
- G. BHMA A156.5 - American National Standard for Cylinders and Input Devices for Locks; 2014.
- H. BHMA A156.6 - American National Standard for Architectural Door Trim; 2010.
- I. BHMA A156.7 - American National Standard for Template Hinge Dimensions; 2014.
- J. BHMA A156.12 - American National Standard for Interconnected Locks; 2013.
- K. BHMA A156.13 - American National Standard for Mortise Locks & Latches Series 1000; 2012.
- L. BHMA A156.15 - American National Standard for Release Devices - Closer Holder, Electromagnetic and Electromechanical; 2011.
- M. BHMA A156.16 - American National Standard for Auxiliary Hardware; 2013.
- N. BHMA A156.17 - American National Standard for Self Closing Hinges & Pivots; 2014.
- O. BHMA A156.18 - American National Standard for Materials and Finishes; 2012.
- P. BHMA A156.21 - American National Standard for Thresholds; 2014.
- Q. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2012.
- R. BHMA A156.25 - American National Standard for Electrified Locking Devices; 2013.
- S. BHMA A156.26 - American National Standard for Continuous Hinges; 2012.
- T. BHMA A156.28 - American National Standard for Recommended Practices for Mechanical Keying Systems; 2013.

- U. BHMA A156.30 - American National Standard for High Security Cylinders; 2014.
- V. BHMA A156.31 - American National Standard for Electric Strikes and Frame Mounted Actuators; 2013.
- W. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.
- X. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.
- Y. DHI (H&S) - Sequence and Format for the Hardware Schedule; 1996.
- Z. DHI (KSN) - Keying Systems and Nomenclature; 1989.
- AA. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.
- AB. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.
- AC. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.
- AD. ITS (DIR) - Directory of Listed Products; current edition.
- AE. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- AF. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- AG. NFPA 101 - Life Safety Code; 2015.
- AH. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.
- AI. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- AJ. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- AK. UL 437 - Standard for Key Locks; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- C. Pre-installation Meeting: Convene a pre-installation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
 - 1. Architect.
 - 2. Installer's Architectural Hardware Consultant (AHC).
 - 3. Hardware Installer.
 - 4. Owner's Security Consultant.
- D. Keying Requirements Meeting:
 - 1. Schedule meeting at project site prior to Contractor occupancy.
 - 2. Attendance Required:
 - a. Contractor.
 - b. Owner.
 - c. Architect.
 - d. Installer's Architectural Hardware Consultant (AHC).
 - e. Hardware Installer.
 - f. Owner's Security Consultant.
 - 3. Agenda:
 - a. Establish keying requirements.
 - b. Verify locksets and locking hardware are functionally correct for project requirements.
 - c. Verify that keying and programming complies with project requirements.
 - d. Establish keying submittal schedule and update requirements.

4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
 - a. Access control requirements.
 - b. Key control system requirements.
 - c. Schematic diagram of preliminary key system.
 - d. Flow of traffic and extent of security required.
5. Record meeting notes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
6. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
 2. List groups and suffixes in proper sequence.
 3. Provide complete description for each door listed.
 4. Provide manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
 5. Include account of abbreviations and symbols used in schedule.
- D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
 2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
 3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.
- E. Samples for Verification:
 1. Submit minimum size of 2 by 4 inch for sheet samples, and minimum length of 4 inch for other products.
 2. Submit one (1) sample of latchset and lockset illustrating style, color, and finish.
 3. Return full-size samples to Contractor.
 4. Submit product description with samples.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
 1. Submit manufacturer's parts lists and templates.
- H. Keying Schedule:
 1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- I. Manufacturer's Qualification Statement.
- J. Installer's Qualification Statement.
- K. Supplier's Qualification Statement.

- L. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- M. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- N. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01.60.00 - Product Requirements, for additional provisions.
 - 2. Lock Cylinders: Two for each master keyed group.
 - 3. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

- A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.
- D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
- B. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
 - 1. Closers: Five years, minimum.
 - 2. Exit Devices: Three years, minimum.
 - 3. Locksets and Cylinders: Three years, minimum.
 - 4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of federal, state, and local codes.
 - 2. Accessibility: ADA Standards and ICC A117.1.
 - 3. Applicable provisions of NFPA 101.
 - 4. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
 - 5. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR) or ITS (DIR) as suitable for application indicated.
 - 6. Listed and certified compliant with specified standards by BHMA (CPD).
 - 7. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
 - 8. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.

9. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.
- D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
 1. Refer to Section 28.10.00 for additional access control system requirements.
- E. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. Refer to Section 08.06.71 for listing of hardware sets.
- F. Fasteners:
 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - a. Aluminum fasteners are not permitted.
 - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
 2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
 - a. Self-drilling (Tek) type screws are not permitted.
 3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
 4. Provide wall grip inserts for hollow wall construction.
 5. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.
 6. Fire-Rated Applications: Comply with NFPA 80.
 - a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
 - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.
 7. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides - all are to be considered as concealed fastener locations.

2.02 HINGES

- A. Manufacturers:
 1. McKinney; an Assa Abloy Group company: www.assaabloydss.com.
 2. Hager Companies: www.hagerco.com.
 3. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Hinges: Comply with BHMA A156.1, Grade 1.
 1. Self Closing Hinges: Comply with BHMA A156.17.
 2. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
 - a. Provide hinge width required to clear surrounding trim.
 3. Continuous Hinges: Comply with BHMA A156.26.
 4. Provide hinges on every swinging door.
 5. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
 6. Provide ball-bearing hinges at each door with closer.
 7. Provide non-removable pins on exterior outswinging doors.
 8. Provide non-removable pins on interior outswinging doors at all locations.
 9. Provide power transfer hinges where electrified hardware is mounted in door leaf.
 10. Provide following quantity of butt hinges for each door:
 - a. Doors up to 60 inches High: Two hinges.
 - b. Doors From 60 inches High up to 90 inches High: Three hinges.
 - c. Doors 90 inches High up to 120 inches High: Four hinges.
 - d. Doors over 120 inches High: One additional hinge per each additional 30 inches in height.

2.03 FLUSH BOLTS

- A. Manufacturers:
 - 1. McKinney, an Assa Abloy Group company: www.assaabloydss.com.
 - 2. Hager Companies: www.hagerco.com.
 - 3. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Flush Bolts: Comply with BHMA A156.16, Grade 1.
 - 1. Flush Bolt Throw: 3/4 inch, minimum.
 - 2. Provides extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
 - a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
 - 3. Provide dustproof floor strike for bolt into floor, except at metal thresholds.
 - 4. Manual Flush Bolts: Provide lever extensions for top bolt at over-sized doors.
 - 5. Self-Latching Flush Bolts: Automatically latch upon closing of door; manually retracted; located on inactive leaf of pair of doors.
 - 6. Automatic Flush Bolts: Automatically latch upon closing of door; automatic retraction of bolts when active leaf is opened; located on inactive leaf of pair of doors.

2.04 EXIT DEVICES

- A. Manufacturers:
 - 1. Von Duprin, an Allegion brand: www.allegion.com/us.
 - 2. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Exit Devices: Comply with BHMA A156.3, Grade 1.
 - 1. Lever design to match lockset trim.
 - 2. Provide cylinder with cylinder dogging or locking trim.
 - 3. Provide exit devices properly sized for door width and height.
 - 4. Provide strike as recommended by manufacturer for application indicated.
 - 5. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

2.05 LOCK CYLINDERS

- A. Manufacturers:
 - 1. Schlage, an Allegion brand: www.allegion.com/us.
 - 2. Substitutions: See Section 01.60.00 – Product Requirements.
- B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
 - 1. Provide standard, conventional, type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
 - 2. Provide cylinders from same manufacturer as locking device.
 - 3. Provide cams and/or tailpieces as required for locking devices.
 - 4. Within specific Door Sections, when provisions for lock cylinder are being referenced to this Section, provide specified lock cylinder and keyed to building keying system, unless otherwise indicated.

2.06 CYLINDRICAL LOCKS

- A. Manufacturers:
 - 1. Schlage, an Allegion brand: www.allegion.com/us.
 - 2. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
 - 1. Bored Hole: 2-1/8 inch diameter.
 - 2. Latchbolt Throw: 1/2 inch, minimum.
 - 3. Backset: 2-3/4 inch unless otherwise indicated.
 - 4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
 - a. Finish: To match lock or latch.
 - b. Flat-Lip Strikes: Provide for locks with three piece antifriction latchbolts as

recommended by manufacturer.

5. Provide a lock for each door, unless otherwise indicated that lock is not required.
6. Provide an office lockset for swinging door where hardware set is not indicated.

2.07 MORTISE LOCKS

- A. Manufacturers:
 1. Schlage, an Allegion brand: www.allegion.com/us.
- B. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
 1. Latchbolt Throw: 3/4 inch, minimum.
 2. Deadbolt Throw: 1 inch, minimum.
 3. Backset: 2-3/4 inch unless otherwise indicated.
 4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
 - a. Flat-Lip Strikes: Provide for locks with three piece antifriction latchbolts as recommended by manufacturer.
 - b. Finish: To match lock or latch.

2.08 PUSH AND PULL PLATES

- A. Manufacturers:
 1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
 2. Hager Companies: www.hagerco.com.
 3. Trimco: www.trimcohardware.com/#sle.
 4. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Door Pulls and Push Plates: Comply with BHMA A156.6.
 1. Pull Type: Straight, unless otherwise indicated.
 2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
 - a. Edges: Beveled, unless otherwise indicated.
 3. Material: Aluminum, unless otherwise indicated.
 4. Provide door pulls and push plates on doors without a lockset, latchset, exit device, or auxiliary lock unless otherwise indicated.
 5. On solid doors, provide matching door pull and push plate on opposite faces.
 6. On glazed storefront doors, provide matching door pulls/push plates on both faces unless otherwise indicated.

2.09 CLOSERS

- A. Manufacturers; Surface Mounted:
 1. LCN, an Allegion brand: www.allegion.com/us.
 2. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Closers: Comply with BHMA A156.4, Grade 1.
 1. Type: Surface mounted to door.
 2. Provide door closer on each exterior door.
 3. Provide door closer on each fire-rated and smoke-rated door.
 - a. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.
 4. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.
 5. At corridor entry doors, mount closer on room side of door.
 6. At outswinging exterior doors, mount closer on interior side of door.

2.10 PROTECTION PLATES

- C. Manufacturers:
 1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
 2. Hager Companies: www.hagerco.com.
 3. Ives, an Allegion brand: www.allegion.com/us.
 4. Trimco: www.trimcohardware.com/#sle.
 5. Substitutions: See Section 01.60.00 - Product Requirements.
- D. Protection Plates: Comply with BHMA A156.6.
- E. Metal Properties: Aluminum.

1. Metal, Standard Duty: Thickness 0.05 inch, minimum.
- F. Edges: Square, on four sides unless otherwise indicated.
- G. Fasteners: Countersunk screw fasteners.
- H. Provide clear anti-microbial coating that is silver ion-based.
- I. Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
 1. Size: 8 inch high by 2 inch less door width (LDW) on push side of door.

2.11 FLOOR STOPS

- A. Manufacturers:
 1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
 2. Hager Companies: www.hagerco.com.
 3. Trimco: www.trimcohardware.com/#sle.
 4. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
 1. Provide floor stops when wall surface is not available; be cautious not to create a tripping hazard.
 2. Type: Manual hold-open, with pencil floor stop.
 3. Material: Aluminum housing with rubber insert.

2.12 WALL STOPS

- A. Manufacturers:
 1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
 2. Hager Companies: www.hagerco.com.
 3. Trimco: www.trimcohardware.com/#sle.
 4. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
 1. Provide wall stops to prevent damage to wall surface upon opening door.
 2. Type: Bumper, concave, wall stop.
 3. Material: Aluminum housing with rubber insert.

2.13 ASTRAGALS

- A. Manufacturers:
 1. Pemko; an Assa Abloy Group company: www.assaabloydss.com/#sle.
 2. National Guard Products, Inc: www.ngpinc.com/#sle.
 3. Zero International, Inc: www.zerointernational.com/#sle.
- B. Astragals: Comply with BHMA A156.22.
 1. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
 2. Type: Split, two parts, and with sealing gasket.
 3. Material: Aluminum, with neoprene weatherstripping.
 4. Provide non-corroding fasteners at exterior locations.

2.14 THRESHOLDS

- A. Manufacturers:
 1. Pemko; an Assa Abloy Group company: www.assaabloydss.com.
 2. National Guard Products, Inc: www.ngpinc.com.
 3. Zero International, Inc: www.zerointernational.com.
 4. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Thresholds: Comply with BHMA A156.21.
 1. Provide threshold at interior doors for transition between two different floor types, unless otherwise indicated.
 2. Provide threshold at each exterior door, unless otherwise indicated.
 3. Type: Ramped, accessible with maximum 1:12 slope.

4. Material: Aluminum.
5. Threshold Surface: Fluted horizontal grooves across full width.
6. Field cut threshold to profile of frame and width of door sill for tight fit.
7. Provide non-corroding fasteners at exterior locations.

2.15 WEATHERSTRIPPING AND GASKETING

- A. Manufacturers:
 1. Pemko; an Assa Abloy Group company: www.assaabloydss.com.
 2. National Guard Products, Inc: www.ngpinc.com.
 3. Zero International, Inc: www.zerointernational.com.
 4. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
 1. Head and Jamb Type: Adjustable.
 2. Door Sweep Type: Encased in retainer.
 3. Material: Aluminum, with neoprene weatherstripping.
 4. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated; .
 5. Provide door bottom sweep on each exterior door, unless otherwise indicated.

2.16 SILENCERS

- A. Manufacturers:
 1. Ives, an Allegion brand: www.allegion.com/us/#sle.
- B. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
 1. Single Door: Provide three on strike jamb of frame.
 2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
 3. Material: Rubber, gray color.

2.17 WIRELESS ACCESS MANAGEMENT SYSTEMS

1. Wireless Access Management Systems: Provided by access control provider.
2. Door Locking Hardware: Provide applicable cylindrical locksets, panic hardware, or mortise locksets in compliance with project access control requirements.

2.18 KEY CONTROL SYSTEMS

- A. Key Control Systems: Comply with guidelines of BHMA A156.28.
 1. Provide keying information in compliance with DHI (KSN) standards.
 2. Keying: Grand master keyed.
 3. Include construction keying.
 4. Supply keys in following quantities:
 - a. 1 each Grand Master keys.
 - b. 6 each Construction Master keys.
 - c. 15 each Construction keys.
 - d. 6 each Master keys per Master key group.
 5. Key Management System: For each keyed lock on project, provide one set of consecutively numbered duplicate key tags with hanging hole and snap catch.
 6. Security Key Tags: For each keyed lock on project, provide one set of matching key tags for permanent attachment to one key of each set.
 7. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
 8. Deliver keys with identifying tags to Owner by security shipment direct from hardware supplier.
 9. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."

2.19 KEY CABINET

- A. Manufacturers:
 1. Knox Company: www.knoxbox.com/#sle.

- B. Key Cabinet: Sheet steel construction, piano hinged door with key lock; BHMA A156.28.
 - 1. Mounting: Wall-mounted.
 - 2. Capacity: Actual quantity of keys, plus 25 percent additional capacity.
 - 3. Size key hooks to hold 6 keys each.
 - 4. Finish: Baked enamel, manufacturer's standard color.
 - 5. Key cabinet lock to building keying system.

2.20 FIRE DEPARTMENT LOCK BOX

- A. Manufacturers:
 - 1. Knox Company; Knox-Box Rapid Entry System, 3200 Series: www.knoxbox.com.
 - 2. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Fire Department Lock Box:
 - 1. Heavy-duty, surface mounted, solid stainless-steel box with hinged door and interior gasket seal; single drill resistant lock with dust covers and tamper alarm.
 - 2. Capacity: Holds 10 keys.
 - 3. Finish: Manufacturer's standard black.

2.21 FINISHES

- A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
 - 1. Primary Finish: 613; dark oxidized satin bronze, oil rubbed, with bronze base material (former US equivalent US10B); BHMA A156.18.
 - 2. Secondary Finish: Same as Primary Finish, unless noted otherwise; BHMA A156.18.
 - a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.
 - 3. Exceptions:
 - a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
 - b. Hinges for Fire-Rated Doors: Steel base material with plated finish, in compliance with NFPA 80.
 - c. Door Closer Covers and Arms: Color as selected by Architect from manufacturer's standard colors unless otherwise indicated.
 - d. Aluminum Surface Trim and Gasket Housings: Anodized to match door panel finish, not other hardware, unless otherwise indicated.
 - e. Hardware for Aluminum Storefront Doors: Finished to match door panel finish, except at hand contact surfaces provide stainless steel with satin finish, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
- C. Use templates provided by hardware item manufacturer.
- D. Do not install surface mounted items until application of finishes to substrate are fully completed.
- E. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
 - 1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
 - 2. For Aluminum-Framed Storefront Doors and Frames: Refer to Section 08.43.13.

3. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
4. Mounting heights in compliance with ADA Standards:
 - a. Locksets: 40-5/16 inch.
 - b. Push Plates/Pull Bars: 42 inch.
 - c. Deadlocks (Deadbolts): 48 inch.
 - d. Exit Devices: 40-5/16 inch.
- F. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.
 1. Refer to Section 07.92.00 for additional requirements.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Section 01.40.00 - Quality Requirements.
- B. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

- A. Adjust work under provisions of Section 01.70.00 - Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.
- D. See Section 01.74.19 - Construction Waste Management and Disposal, for additional requirements.

3.06 PROTECTION

- A. Protect finished Work under provisions of Section 01.70.00 - Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

3.07 SCHEDULE

Set No. 1

Each to have:

Aluminum doors complete with all required hardware except:

- | | | |
|---|----------|---------------------|
| 1 | Cylinder | Schlage as required |
|---|----------|---------------------|

Where required, wireless exit device trim, wireless locksets, controller, logic, software, by access control provider.

Set No. 2

Each to have:

- | | | |
|---|---------------------------|----------------------------|
| 3 | Ea. Butts | BB1191 |
| 1 | Exit Device | 99EO |
| 1 | Wireless Exit Device Trim | By access control provider |
| 1 | Cylinder | Schlage as required |
| 1 | Door Closer | 4111-S-H-CUSH |
| 1 | Kick Plate | 193S |
| 1 | Threshold | 425 |
| 1 | Door Sweep | 200NA |
| 1 | Set Weatherstrip | 127NA – Head & Jambs |

Wireless exit device trim, controller, logic, software, by access control provider.

Set No. 3

Each to have:

3	Ea. Butts	BB1191
1	Exit Device	99EO
1	Wireless Exit Device Trim	By access control provider
1	Cylinder	Schlage as required
1	Door Closer	4111-S-CUSH
1	Kick Plate	193S
1	Threshold	425
1	Door Sweep	200NA
1	Set Weatherstrip	127NA – Head & Jambs

Wireless exit device trim, controller, logic, software, by access control provider.

Set No. 4

Each to have:

1	Continuous Hinge	780-112-HD
1	Wireless Lever Lock	By access control provider
1	Cylinder	Schlage as required
1	Door Closer	4111-S-H-CUSH
1	Kick Plate	193S – 30" High
1	Threshold	425HD (0.244" Thick)
1	Door Sweep	200NA
1	Set Weatherstrip	127NA – Head & Jambs

Wireless Lever Lock, controller, logic, software, by access control provider.

Set No. 5

Each to have:

3	Ea. Butts	BB1191
1	Exit Device	99NL
1	Cylinder	Schlage as required
1	Door Closer	4111-S-CUSH
1	Kick Plate	193S
1	Threshold	425
1	Door Sweep	200NA
1	Set Weatherstrip	127NA – Head & Jambs

Set No. 6

Each to have:

3	Ea. Butts	BB1279
1	Lever Storeroom	ND96PD – RHO
1	Door Stop & Holder	495
3	Silencers	SR64

Set No. 7

Each to have:

3	Ea. Butts	BB1191
1	Lever Storeroom	ND96PD – RHO
1	Door Closer	4111-S-H-CUSH
1	Set Weatherstrip	127NA – Head, Jambs and Sill (4 Sided)

Set No. 8

Each to have:

3	Ea. Butts	BB1279
1	Wireless Lever Lock	By access control provider
1	Cylinder	Schlage as required
1	Door Closer	4011/4111-EDA
1	Kick Plate	193S
1	Door Stops	236W
1	Set Fire Seal	5050-Head & Jambs

Wireless Lever Lock, controller, logic, software, by access control provider.

Set No. 9

Each to have:

3	Ea. Butts	BB1279
1	Exit Device	99EO-F
1	Wireless Exit Device Trim	By access control provider
1	Cylinder	Schlage as required
1	Door Closer	4011
1	Kick Plate	193S
1	Door Stop	236W
1	Set Fire Seal	9850 – Head & Jambs

Wireless exit device trim, controller, logic, software, by access control provider.

Set No. 10

Each to have:

3	Ea. Butts	BB1279
1	Lever Storeroom	ND96PD – RHO
1	Door Closer	4111-EDA/4011
1	Door Stop	236W
1	Set Fire Seal	5050 – Head & Jambs (At 20 Min Doors)
1	Set Fire Seal	9850 – Head & Jambs (At 1 Hour Doors)

Set No. 11

Each to have:

3	Ea. Butts	BB1279
1	Lever Office	ND92PD – RHO
1	Door Closer	4011
1	Kick Plate	193S
1	Door Stop	236W
1	Set Fire Seal	5050 – Head & Jambs (At 20 Min Doors)
1	Set Fire Seal	9850 – Head & Jambs (At 1 Hour Doors)

Set No. 12

Each to have:

3	Ea. Butts	BB1279
1	Lever Privacy	L9496P – 06/B
1	Door Closer	4011
1	Door Closer	4111-S-CUSH (At Doors 209, 210)
1	Kick Plate	193S
1	Door Stop	236W
1	Set Fire Seal	5050 – Head & Jambs (At 20 Min Doors)

Set No. 13

Each to have:

3	Ea. Butts	BB1279
1	Lever Passage	ND10S – RHO
1	Door Closer	4011
1	Kick Plate	193S
1	Door Stop	236W
1	Set Fire Seal	5050 – Head & Jambs (At 20 Min Doors)
1	Set Fire Seal	9850 – Head & Jambs (At 1 Hour Doors)

Set No. 14

Each to have:

6	Ea. Butts	BB1168
1	Mullion	9954
2	Exit Devices	99L-F-06
2	Cylinders	Schlage as required
2	Door Closers	4111-EDA
2	Kick Plates	193S
2	Door Stops	236W
1	Set Fire Seal	5050 – Head & Jambs
1	Set Fire Seal	9550 – Head & Jambs

Set No. 15

Each to have:

3	Ea. Butts	BB1279
1	Exit Device	99L-F-06 Lever
1	Cylinder	Schlage as required
1	Door Closer	4111-EDA
1	Kick Plate	193S
1	Door Stop	236W
1	Set Fire Seal	5050 – Head & Jambs

Set No. 16

Each to have:

3	Ea. Butts	BB1279
1	Exit Device	99NL-F
1	Cylinder	Schlage as required
1	Door Closer	4111-EDA
1	Door Stop	236W
1	Set Fire Seal	9850 – Head & Jambs

Set No. 17

Each to have:

3	Ea. Butts	BB1279
1	Lever Office	ND92PD – RHO
1	Door Stop	236W
3	Silencers	SR64

Set No. 18

Each to have:

6	Ea. Butts	BB1279
2	Flush Bolts	282D
1	Dust Proof Strike	280X
1	Lever Office	ND92PD – RHO
2	Door Stops	236W
2	Silencers	SR64

Set No. 19

Each to have:

2	Ea. Butts	BB1279
1	Lever Passage	ND10S – RHO
1	Door Stop	236W At Doors Swinging Into Walls
1	Door Stop	250W At Doors Swinging into Cabinets.
2	Silencers	SR64

Set No. 20

Each to have:

3	Ea. Butts	BB1191
1	Lever Storeroom	L9080P – 06/B
1	Overhead Holder	GJ70H Series
1	Threshold	425
1	Door Sweep	200NA
1	Set Weatherstrip	127NA – Head & Jambs

END OF SECTION

SECTION 08.80.00
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.
- C. Plastic films.
- D. Glazing compounds.

1.02 RELATED REQUIREMENTS

- A. Section 07.25.00 - Weather Barriers.
- B. Section 07.92.00 - Joint Sealants: Sealants for other than glazing purposes.
- C. Section 08.11.13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- D. Section 08.14.16 - Flush Wood Doors: Glazed lites in doors.
- E. Section 08.43.13 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.
- F. Section 08.54.13 - Fiberglass Windows: Glazing provided by window manufacturer.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.
- C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.
- F. ASTM C1036 - Standard Specification for Flat Glass; 2016.
- G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- H. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.
- J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
- L. GANA (GM) - GANA Glazing Manual; 2009.
- M. GANA (SM) - GANA Sealant Manual; 2008.
- N. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.
- O. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2004).
- P. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.
- Q. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.
- R. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data on Insulating Glass Unit and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 6 by 6 inch in size of glass units.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years of documented experience.
 - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Float Glass Manufacturers:
 - 1. AGC Glass North America, Inc: www.agcglass.com/#sle.
 - 2. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
 - 3. Guardian Glass, LLC: www.guardianglass.com/#sle.
 - 4. Pilkington North America Inc: www.pilkington.com/na/#sle.
 - 5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Design Pressure: Calculated in accordance with ASCE 7.
 - 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.

3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7.
 4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 5. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
1. In conjunction with vapor retarder and joint sealer materials described in other sections.
 2. To maintain a continuous vapor retarder and air barrier throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 2. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
 3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

2.04 INSULATING GLASS UNITS

- A. Manufacturers:
1. AGC Glass North America, Inc: www.agcglass.com/#sle.
 2. Guardian Glass, LLC: www.guardianglass.com/#sle.
 3. Pilkington North America Inc: www.pilkington.com/na/#sle.
 4. Viracon, Apogee Enterprises, Inc: www.viracon.com/#sle.
 5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
- B. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
- C. Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Metal Edge Spacers: Aluminum, bent and soldered corners.
 4. Spacer Color: Black.
 5. Edge Seal:
 - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
 6. Color: Black.
 7. Purge interpane space with dry air, hermetically sealed.
- D. Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 - b. Coating: Low-E (passive type), on #2 surface.

4. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.27, nominal.
7. Visible Light Transmittance (VLT): 75 percent, nominal.
8. Solar Heat Gain Coefficient (SHGC): 0.40, nominal.

2.05 GLAZING UNITS

- A. Monolithic Interior Vision Glazing:
 1. Applications: Interior glazing unless otherwise indicated.
 2. Glass Type: Annealed float glass.
 3. Tint: Clear.
 4. Thickness: 1/4 inch, nominal.
 5. Glazing Method: Dry glazing method, gasket glazing.
- B. Wired Glass: Flat glass with embedded wire mesh.
 1. Applications: Locations as indicated on drawings.
 2. Form: Form 1 - Wired glass, polished both sides; ASTM C1036.
 3. Mesh: M1 - Diamond; ASTM C1036.
 4. Pattern and Finish: P1 - Linear, F1 - Patterned one side; ASTM C1036.
 5. Tint: Clear, Class 1.
 6. Glass Type: Annealed.
 7. Thickness: 1/4 inch, nominal.
 8. Glazing Method: Wet glazing method, compound and compound.
 9. Manufacturers:
 - a. GGI - General Glass International; Wire Glass: www.generalglass.com/#sle.
 - b. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite I-W: www.safti.com/#sle.

2.06 GLAZING COMPOUNDS

- A. Type GC-2 - Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.
- B. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.07 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Continuous by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
- D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
- E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- E. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - WET GLAZING METHOD (COMPOUND AND COMPOUND)

- A. Application - Interior Glazed: Set glazing infills from the interior of the building.
- B. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch centers, kept 1/4 inch below sight line.
- C. Locate and secure glazing pane using glazers' clips.
- D. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.06 INSTALLATION - WET/DRY GLAZING METHOD (PREFORMED TAPE AND SEALANT)

- A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.
- B. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.
- C. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- D. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

- E. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.
- F. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch below sight lines.
 - 1. Place glazing tape on glazing pane of unit with tape flush with sight line.
- G. Fill gap between glazing and stop with silicone type sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.
- H. Apply cap bead of silicone type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.07 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements for additional requirements.
- B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- C. Monitor and report installation procedures and unacceptable conditions.

3.08 CLEANING

- A. See Section 01.74.19 - Construction Waste Management and Disposal, for additional requirements.
- B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- C. Remove nonpermanent labels immediately after glazing installation is complete.
- D. Clean glass and adjacent surfaces after sealants are fully cured.
- E. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.09 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 09.05.61

COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
 - 1. Resilient tile and sheet.
 - 2. Broadloom carpet.
 - 3. Carpet tile.
 - 4. Thin-set ceramic and porcelain tile.
- B. Preparation of new concrete floor slabs for installation of floor coverings.
- C. Testing of concrete floor slabs for moisture and alkalinity (pH).
- D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
 - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- E. Patching compound.
- F. Remedial floor coatings.

1.02 RELATED REQUIREMENTS

- A. Section 01.40.00 - Quality Requirements: Additional requirements relating to testing agencies and testing.
- B. Section 01.74.19 - Construction Waste Management and Disposal: Handling of existing floor coverings removed.
- C. Section 03.30.00 - Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.
- D. Section 03.30.00 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

1.03 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2016a.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 2020.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.
- E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.05 SUBMITTALS

- A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.

2. Manufacturer's required bond/compatibility test procedure.
- B. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
 1. Manufacturer's qualification statement.
 2. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
 3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
 4. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.
- C. Testing Agency's Report:
 1. Description of areas tested; include floor plans and photographs if helpful.
 2. Summary of conditions encountered.
 3. Moisture and alkalinity (pH) test reports.
 4. Copies of specified test methods.
 5. Recommendations for remediation of unsatisfactory surfaces.
 6. Submit report to Architect.
 7. Submit report not more than two business days after conclusion of testing.
- D. Adhesive Bond and Compatibility Test Report.
- E. Floor Moisture Testing Technician Certificate: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician- Grade I certificate.

1.06 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.
- C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- D. Contractor's Responsibility Relating to Independent Agency Testing:
 1. Provide access for and cooperate with testing agency.
 2. Confirm date of start of testing at least 10 days prior to actual start.
 3. Allow at least 4 business days on site for testing agency activities.
 4. Achieve and maintain specified ambient conditions.
 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.
- E. Floor Moisture Testing Technician Qualifications: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician Certification- Grade I.
- F. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
 - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 - 2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
 - 3. Products:
 - a. H.B. Fuller Construction Products, Inc; TEC Feather Edge Skim Coat: www.tecspecialty.com/#sle.
 - b. USG Corporation; Durock Brand Advanced Skim Coat Floor Patch: www.usg.com/#sle.
- B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.
- C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
 - 1. Thickness: 1/8 inch, maximum.
 - 2. Products:
 - a. ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com/#sle.
 - b. H.B. Fuller Construction Products, Inc; TEC LiquiDam with TEC Level Set 200 SLU: www.tecspecialty.com/#sle.
 - c. LATICRETE International, Inc; LATICRETE SUPERCAP Moisture Vapor Control with LATICRETE SUPERCAP Underlayment: www.laticrete.com/#sle.
 - d. Sika Corporation; Sikafloor Moisture Tolerance Epoxy Primer and Sikafloor Self-Leveling Moisture Tolerant Resurfacer: www.sikafloorusa.com/#sle.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
 - 1. Preliminary cleaning.
 - 2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
 - 3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.

5. Specified remediation, if required.
 6. Patching, smoothing, and leveling, as required.
 7. Other preparation specified.
 8. Adhesive bond and compatibility test.
 9. Protection.
- B. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
 2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
 3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

3.03 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

3.04 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

3.05 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
 - 1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
 - 2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
 - 3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.
- C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.06 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

3.07 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

3.08 APPLICATION OF REMEDIAL FLOOR COATING

- A. Comply with requirements and recommendations of coating manufacturer.

3.09 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 09.21.16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal hat and furring channel wall framing.
- C. Acoustic insulation.
- D. Gypsum sheathing.
- E. Cementitious backing board.
- F. Gypsum wallboard.
- G. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 06.10.00 - Rough Carpentry: Building framing and sheathing.
- C. Section 06.10.00 - Rough Carpentry: Wood blocking product and execution requirements.
- D. Section 07.21.00 - Thermal Insulation: Exterior wall insulation.
- E. Section 07.25.00 - Weather Barriers: Water-resistive barrier over sheathing.
- F. Section 07.84.00 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- G. Section 07.92.00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2018).
- B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).
- C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
- F. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
- G. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2014).
- H. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2009).
- I. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.
- J. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2017.
- K. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2017.
- L. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2016.
- M. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

- N. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.
- O. ASTM C1325 - Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units; 2017.
- P. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014a.
- Q. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.
- R. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.
- S. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- T. GA-216 - Application and Finishing of Gypsum Board; 2016.
- U. GA-600 - Fire Resistance Design Manual; 2015.
- V. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
 - 1. Fire Rated Partitions: UL listed assembly No. as listed on drawings; 1 hour rating.
 - 2. Head of Fire Rated Partitions: UL listed assembly No. as listed on drawings; 1 hour rating.
 - 3. Fire-Resistance-Rated Ceilings: One (1) hour fire rating.
 - 4. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
 - 1. ClarkDietrich: www.clarkdietrich.com/#sle.
 - 2. Jaimes Industries: www.jaimesind.com/#sle.
 - 3. Marino: www.marinoware.com/#sle.
- B. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
 - 1. Studs: C-shaped with knurled or embossed faces.
 - 2. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
 - 3. Resilient Furring Channels: Single or double leg configuration; 1/2 inch channel depth.
- C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.

1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
 2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
- D. Preformed Top Track Firestop Seal:
1. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.

2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
1. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
 2. National Gypsum Company: www.nationalgypsum.com/#sle.
 3. USG Corporation: www.usg.com/#sle.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
 4. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 5. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
- C. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas including countertops, sinks and laundry room.
 2. Application: Horizontal surfaces behind tile in wet areas including showers.
 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 4. Showers: ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 1/2 inch.
 5. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
 - a. Regular Type: Thickness 5/8 inch.
 - b. Products:
 - 1) CertainTeed Corporation; Diamondback 5/8" Type X Tile Backer: www.certainteed.com/#sle.
 - 2) Georgia-Pacific Gypsum; DensShield Tile Backer: www.gpgypsum.com/#sle.
- D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
1. Application: Vertical surfaces behind thinset tile, except in wet areas.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Type X Thickness: 5/8 inch.
 4. Edges: Tapered.
 5. Products:
 - a. Georgia-Pacific Gypsum; DensArmor Plus: www.gpgypsum.com/#sle.
- E. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.

2. Thickness: 1/2 inch.
3. Edges: Tapered.
4. Products:
 - a. USG Corporation; 1/2 Inch Sheetrock Brand UltraLight Panels: www.usg.com/#sle.
- F. Exterior Sheathing Board: As specified in Section 06.10.00.
- G. Exterior Soffit Board: As specified in Section 07.46.46 - Fiber-Cement Siding.

2.04 GYPSUM WALLBOARD ACCESSORIES

- A. Water-Resistive Barrier: As specified in Section 07.25.00.
- B. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 1. Corner Beads: Low profile, for 90 degree outside corners.
 - a. Products:
 - 1) CertainTeed Corporation; No-Coat Drywall Corner: www.certainteed.com/#sle.
 - 2) ClarkDietrich; Strait-Flex Big-Stick: www.clarkdietrich.com/#sle.
 - 3) Phillips Manufacturing Co; Everlast Corner Bead: www.phillipsmfg.com/#sle.
 2. Architectural Reveal Beads:
 - a. Reveal Depth: 1/2 inch.
 - b. Reveal Width: 1/2 inch.
 - c. Shapes: As indicated on drawings.
 - d. Products:
 - 1) Phillips Manufacturing Co; J-400 Reveal Trim: www.phillipsmfg.com/#sle.
 - 2) Trim-Tex, Inc; ____: www.trim-tex.com/#sle.
- C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
 3. Joint Compound: Drying type, vinyl-based, ready-mixed.
 - a. Products:
 - 1) CertainTeed Corporation; Extreme All-Purpose Joint Compound: www.certainteed.com/#sle.
 4. Joint Compound: Setting type, field-mixed.
- D. Finishing Compound: Surface coat and primer, takes the place of skim coating.
 1. Products:
 - a. CertainTeed Corporation; Quick Prep Plus Interior Prep Coat: www.certainteed.com/#sle.
- E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- F. Nails for Attachment to Wood Members: ASTM C514.
- G. Adhesive for Attachment to Wood, ASTM C557:
 1. Products:
 - a. Franklin International, Inc; Titebond PROvantage Professional Drywall Adhesive: www.titebond.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
 - 1. Level ceiling system to a tolerance of 1/1200.
- C. Studs: Space studs at 16 inches on center.
 - 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 - 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
 - 3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
- F. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.
- G. Blocking: Install wood blocking for support of:
 - 1. Framed openings.
 - 2. Wall-mounted cabinets.
 - 3. Plumbing fixtures.
 - 4. Toilet accessories.
 - 5. Wall-mounted door hardware.

3.03 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- F. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108/A118/A136.1 and manufacturer's instructions.
- G. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For nonrated assemblies, install as follows:
 - 1. Single-Layer Applications: Screw attachment.
 - 2. Double-Layer Application: Install base layer using screws or nails. Install face layer using adhesive.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
 - 2. At exterior soffits, not more than 30 feet apart in both directions.

- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.
- D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

3.05 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
 - 2. Taping, filling, and sanding are not required at base layer of double-layer applications.
- E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.06 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09.30.00
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Cementitious backer board as tile substrate.
- D. Coated glass mat backer board as tile substrate.
- E. Stone thresholds.
- F. Ceramic trim.
- G. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

- A. Section 07.92.00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 09.05.61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

- A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.
- B. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- C. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).
- D. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.
- E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
- F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).
- H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).
- I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).
- J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).
- K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).
- L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).

- N. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2017.
- O. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar; 2012 (Revised).
- P. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2013 (Revised).
- Q. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).
- R. ANSI A118.5 - American National Standard Specifications for Chemical Resistant Furan Mortars and Grouts for Tile Installation; 1999 (Reaffirmed 2010).
- S. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2010 (Revised).
- T. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).
- U. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).
- V. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.
- W. ANSI A118.11 - American National Standard Specifications for EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- X. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014.
- Y. ANSI A118.13 - American National Standard Specifications for Bonded Sound Reduction Membranes for Thin-Set Ceramic Tile Installation; 2014.
- Z. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.
- AA. ANSI A136.1 - American National Standard for Organic Adhesives for Installation of Ceramic Tile; 2008 (Reaffirmed 2013).
- AB. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.
- AC. ANSI A137.2 - American National Standard Specifications for Glass Tile; 2013.
- AD. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.
- AE. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2016e1.
- AF. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.
- AG. ASTM E492 - Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine; 2009 (Reapproved 2016).
- AH. ASTM E2179 - Standard Test Method for Laboratory Measurement of the Effectiveness of Floor Coverings in Reducing Impact Sound Transmission Through Concrete Floors; 2003 (Reapproved 2016).
- AI. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- AJ. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2016.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Master Grade Certificate: Submit for each type of tile, signed by the tile manufacturer and tile installer.
- G. Installer's Qualification Statement:
 - 1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.
- H. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- B. Installer Qualifications:
 - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 MOCK-UP

- A. See Section 01.40.00 - Quality Requirements, for general requirements for mock-up.
- B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
 - 1. Minimum size of mock-up is 48" x 48".
 - 2. Approved mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

- A. Refer to A901 for product selections.
- B. Glazed Wall Tile: ANSI A137.1, standard grade.
 - 1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
 - 2. Size: As indicated on drawings.
 - 3. Edges: Cushioned.
 - 4. Surface Finish: High gloss.
 - 5. Color(s): As indicated on drawings.
 - 6. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile.
- C. Quarry Tile: ANSI A137.1, standard grade.
 - 1. Moisture Absorption: Over 3.0 but not more than 5.0 percent as tested in accordance with ASTM C373.

2. Size: As indicated on drawings.
 3. Thickness: 1/2 inch, nominal.
 4. Edges: Cushioned.
 5. Surface Finish: Unglazed.
 6. Color(s): As indicated on drawings.
 7. Trim Units: Matching bullnose, cove, cove base, and window sill or step nosing shapes in sizes coordinated with field tile.
- D. Porcelain Tile: ANSI A137.1, standard grade.
1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
 2. Size: As indicated on drawings.
 3. Thickness: 3/8 inch.
 4. Edges: Cushioned.
 5. Surface Finish: Unglazed.
 6. Color(s): To be selected by Architect from manufacturer's full range.
 7. Trim Units: Matching bullnose, double bullnose, cove base, and cove shapes in sizes coordinated with field tile.

2.02 TRIM AND ACCESSORIES

- A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
1. Applications:
 - a. Open Edges: Bullnose.
 - b. Inside Corners: Jointed.
 - c. Floor to Wall Joints: Cove base.
 2. Manufacturers: Same as for tile.
- B. Non-Ceramic Trim: Dark bronze anodized aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
1. Applications:
 - a. Transition between floor finishes of different heights.
 - b. Thresholds at door openings.
 2. Manufacturers:
 - a. Schluter-Systems: www.schluter.com/#sle.
- C. Thresholds: 2 inches wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.
1. Thickness: 3/8 inch.
 2. Material: Marble, honed finish.
 3. Applications:
 - a. At doorways where tile terminates.
 - b. At open edges of floor tile where adjacent finish is a different height.

2.03 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.
- B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
1. Applications: Use this type of bond coat where indicated, and where no other type of bond coat is indicated.
 2. Products:
 - a. TEC: 392 Super Flex Ultra-Premium Thin Set Mortar.
- C. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated.
 2. Products:
 - a. TEC: 386 Fast-Set Ultimate Large Tile Mortar.
- D. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.
1. Products:

- a. TEC: 3N1 Fast Set Performance Mortar.

2.04 GROUTS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
 - 1. TEC: 550 Power Grout; tecspecialty.com.
- C. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
 - 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 - 3. Color(s): As selected by Architect from manufacturer's full line.

2.05 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
 - 1. Applications: Between tile, plumbing fixtures, and at inside corners.
 - 2. Color(s): As selected by Architect from manufacturer's full line.
 - 3.
- B. Grout Release: Temporary, water-soluble pre-grout coating.

2.06 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
 - 1. Crack Resistance: No failure at 1/8 inch gap, minimum.
 - 2. Fluid or Trowel Applied Type:
 - a. Material: Synthetic rubber or Acrylic.
 - b. Thickness: 20 mils, maximum.
 - c. Products:
 - 1) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
 - 2) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
- B. Waterproofing Membrane at Showers and Tiled Tubs: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
 - 1. Fluid or Trowel Applied Type:
 - a. Material: Synthetic rubber.
 - b. Material: Acrylic.
 - c. Thickness: 25 mils, minimum, dry film thickness.
 - d. Products:
 - 1) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.
 - 2) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
- C. Underlayment at Floors: Specifically designed for bonding to thin-set setting mortar; not primarily a waterproofing material and having the following characteristics:
 - 1. Sound Reduction: Comply with ANSI A118.13, bonded membrane, ASTM E492, and ASTM E2179.
 - 2. Crack Resistance: No failure at 1/16 inch gap, minimum; comply with ANSI A118.12.
 - 3. Water Resistance: Comply with ANSI A118.10, bonded waterproofing.
 - 4. Uncoupling Function: Allow for separation between membrane and the mortar adhering tile to the membrane when subjected to excessive substrate movement.
 - 5. Type: Fluid or Trowel Applied.
 - a. Products:
 - 1) LATICRETE International, Inc; LATICRETE 125 Sound and Crack Adhesive: www.laticrete.com/#sle.

- D. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
- E. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
- F. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
 - 1. Test in accordance with Section 09.05.61.
 - 2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
 - 3. Follow moisture and alkalinity remediation procedures in Section 09.05.61.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Install thresholds where indicated.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control and expansion joints free of mortar, grout, and adhesive.
- J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

- L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with epoxy grout, unless otherwise indicated.
 - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
 - 2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
 - 3. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F115.

3.05 INSTALLATION - SHOWERS AND BATHTUB WALLS

- A. At bathtub walls install in accordance with TCNA (HB) Method B412, over cementitious backer units with waterproofing membrane.
- B. Grout with standard grout as specified above.

3.06 INSTALLATION - WALL TILE

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
- B. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

3.07 CLEANING

- A. Clean tile and grout surfaces.

3.08 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09.51.00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.
- C. Acoustical sealant.

1.02 RELATED REQUIREMENTS

- A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 05.31.00 - Steel Decking: Placement of special anchors or inserts for suspension system.
- C. Section 08.31.00 - Access Doors and Panels: Access panels.
- D. Section 21.10.00 - Water-Based Fire Suppression System.
- E. Section 26.51.19 - LED Interior Lighting: Light fixtures in ceiling system.

1.03 REFERENCE STANDARDS

- A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2009a.
- B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.
- C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2016.
- E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.
- F. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.
- E. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and perimeter molding.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Manufacturer's Qualification Statement.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01.60.00 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
 - 1. VOC Content: As specified in Section 01.61.16.
- B. Acoustical Panels, Type ACT-1: Painted mineral fiber, with the following characteristics:
 - 1. Classification: ASTM E1264 Type III.
 - 2. Size: 24 by 24 inches.
 - 3. Thickness: 3/4 inch.
 - 4. Panel Edge: Reveal.
 - 5. Tile Edge: Beveled.
 - a. Joint: Kerfed and rabbeted.
 - 6. Color: White.
 - 7. Suspension System Type 1 - Narrow 9/16" Grid: Exposed grid.
 - 8. Products:
 - a. Armstrong World Industries, Inc; Dune:, #1775 www.armstrongceilings.com/#sle.
- C. Acoustical Panels, Type ACT-2: Mineral fiber with membrane-faced overlay, with the following characteristics:
 - 1. Application(s): Classrooms and associated spaces.
 - 2. Classification: ASTM E1264 Type IV.
 - 3. Size: 24 by 48 inch.
 - 4. Thickness: 3/4 inch.
 - 5. Panel Edge: Square.
 - 6. Suspension System Type 2 - Standard 15/16": Exposed grid.
 - 7. Products:
 - a. Armstrong World Industries, Inc; School Zone Fine Fissured AirAssure, #1357: www.armstrongceilings.com/#sle.
- D. Acoustical Panels, Type ACT-3: Mineral fiber with membrane-faced overlay, with the following characteristics:
 - 1. Classification: ASTM E1264 Type IV.
 - 2. Size: 24 by 48 inch.
 - 3. Thickness: 3/4 inch.
 - 4. Panel Edge: Square.
 - 5. Suspension System Type 2 - 15/16" Standard: Exposed grid.
 - 6. Products:
 - a. Armstrong: Ceramaguard Fine Fissured, #608.

- E. Acoustical Panels, Type ACT-4: Mineral fiber with scrubbable finish, with the following characteristics:
 - 1. Classification: ASTM E1264 Type IX.
 - 2. Size: 24 by 48 inch.
 - 3. Thickness: 3/4 inch.
 - 4. Panel Edge: Square.
 - 5. Color: White.
 - 6. Suspension System Type 3 - Clean Room: Exposed grid.
 - 7. Products:
 - a. Armstrong: Ceramaguard Unperforated, #605.

2.03 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
- B. Exposed Suspension System, Type 1: Hot-dipped galvanized steel grid with aluminum cap.
 - 1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 2. Profile: Tee; 9/16 inch face width.
 - 3. Finish: Baked enamel.
 - 4. Color: White.
 - 5. Products:
 - a. Armstrong - Interldue 9/16".
- C. Exposed Suspension System, Type 2: Hot-dipped galvanized steel grid and cap.
 - 1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 2. Profile: Tee; 15/16 inch face width.
 - 3. Finish: Baked enamel.
 - 4. Color: White.
 - 5. Products:
 - a. Prelude 15/16".
- D. Exposed Suspension System, Type 3: Hot-dipped galvanized steel grid and cap; factory-applied closed-cell foam gaskets.
 - 1. Application(s): Kitchen.
 - 2. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 3. Profile: Tee; 1-1/2 inch face width.
 - 4. Finish: Baked enamel.
 - 5. Products:
 - a. Armstrong: 15/16" Clean Room.

2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Perimeter Moldings: Same metal and finish as grid.
- E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Install in bed of acoustical sealant.
 - 2. Use longest practical lengths.
 - 3. Overlap and rivet corners.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Lay directional patterned units with pattern parallel to longest room axis.
- D. Fit border trim neatly against abutting surfaces.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.
 - 3. Double cut and field paint exposed reveal edges.
- G. Where round obstructions occur, provide preformed closures to match perimeter molding.
- H. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.
- I. Install hold-down clips on panels within 20 ft of an exterior door.

3.05 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09.65.00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Resilient base.
- C. Resilient stair accessories.
- D. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 03.30.00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.
- C. Section 09.05.61 - Common Work Results for Flooring Preparation: Cleaning and preparation of new floor slabs.
- D. Section 09.05.61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2015.
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2014).
- D. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).
- E. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015.
- F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- E. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.
- F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- G. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.
- J. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01.60.00 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: 50 square feet of each type and color.

3. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

1.07 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 SHEET FLOORING

2.02 TILE FLOORING

- A. Vinyl Composition Tile - Type LVT-1, LVT-2: Homogeneous, with color extending throughout thickness.
 1. Manufacturers:
 - a. Mannington, Amtico Signature, Abstract.
 2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 4. Size: 9 by 48 inch.
 5. Thickness: 0.125 inch.
 6. Pattern: VCT-1 & VCT-2 - Ashlar; VCT 3 - Aspekt, Small 3.
 7. Color: As indicated on drawings.

2.03 STAIR COVERING

- A. Stair Treads: Rubber; full width and depth of stair tread in one piece; tapered thickness.
 1. Manufacturers:
 - a. Johnsonite, a Tarkett Company; Color Splash: www.johnsonite.com/#sle.
 - b. Roppe Corporation; Rubber Stair Treads: www.roppe.com/#sle.
 2. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 4. Nominal Thickness: 0.1875 inch.
 5. Nosing: Round.
 6. Striping: 2 inch wide contrasting color abrasive strips.
 7. Texture: Smooth.
 8. Color: As indicated on drawings.
- B. Stair Risers: Full height and width of tread in one piece, matching treads in material and color.

1. Manufacturers:
 - a. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - b. Roppe Corporation: www.roppe.com/#sle.
2. Thickness: 0.080 inch.

2.04 RESILIENT BASE

- A. Resilient Base - Type RB-1: ASTM F1861, Type TS rubber, vulcanized thermosetStyle B, Cove; style as scheduled.
 1. Manufacturers:
 - a. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 3. Height: 4 inch.
 4. Thickness: 0.125 inch.
 5. Finish: Satin.
 6. Length: Roll.
 7. Color: To be selected by Architect from manufacturer's full range.
 8. Accessories: Premolded external corners and internal corners.

2.05 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Adhesive for Vinyl Flooring:
 1. Manufacturers:
 - a. H.B. Fuller Construction Products, Inc; TEC Flexera Premium Universal Adhesive: www.tecspecialty.com/#sle.
- D. Moldings, Transition and Edge Strips: Same material as flooring.
 1. Manufacturers:
 - a. Burke Flooring; Mercer Vinyl Mouldings: www.burkeflooring.com/#sle.
- E. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 1. Test in accordance with Section 09.05.61.
 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
 3. Follow moisture and alkalinity remediation procedures in Section 09.05.61.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- C. Prohibit traffic until filler is fully cured.
- D. Clean substrate.

- E. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
 - 1. Spread only enough adhesive to permit installation of materials before initial set.
 - 2. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 26.05.26 for grounding and bonding to building grounding system.
 - 3. Fit joints and butt seams tightly.
 - 4. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 - 1. Resilient Strips: Attach to substrate using adhesive.
- F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- G. Install flooring in recessed floor access covers, maintaining floor pattern.

3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.
- C. Install plank tile with a random offset of at least 6 inches from adjacent rows.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.06 INSTALLATION - STAIR COVERINGS

- A. Install stair coverings in one piece for full width and depth of tread.
- B. Adhere over entire surface. Fit accurately and securely.

3.07 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.08 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09.91.13
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Steel handrails.
 - 2. Dumpster enclosure steel framing.
 - 3. Other steel items exposed to view.
 - 4. Exposed surfaces of steel lintels and ledge angles.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
 - 6. Marble, granite, slate, and other natural stones.
 - 7. Floors, unless specifically indicated.
 - 8. Ceramic and other types of tiles.
 - 9. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
 - 10. Exterior insulation and finish system (EIFS).
 - 11. Glass.
 - 12. Concrete masonry units in utility, mechanical, and electrical spaces.
 - 13. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 05.50.00 - Metal Fabrications: Shop-primed items.
- C. Section 09.91.23 - Interior Painting.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2015.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.
- E. SSPC-SP 1 - Solvent Cleaning; 2015.
- F. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
- G. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. Manufacturer's installation instructions.
 - 3. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, submit each color in each sheen available.
 - 3. Allow 30 days for approval process, after receipt of complete samples by Architect.
 - 4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01.60.00 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. PPG Paints: www.ppgpaints.com/#sle.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
- B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Volatile Organic Compound (VOC) Content: Comply with Section 01.61.16.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- E. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Selection to be made by Architect after award of contract.
 - 2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including primed metal.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Exterior Light Industrial Coating, Water Based; MPI #161, 163, or 164.
 - a. Products:
 - 1) PPG Paints Pitt-Tech Plus DTM Industrial Enamel, 4216 HP Series, Semi-Gloss.
 - 3. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint E-Pav - Pavement Marking Paint:
 - 1. White: One coat, with reflective particles.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 - 1. Anti-Corrosive Alkyd Primer for Metal; MPI #79.
 - a. Products:
 - 1) PPG Paints Multiprime Multi-Purpose Primer, 4160 Series. (MPI #79)

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 2.
- G. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- H. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance.
- E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09.91.23
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints, stains, and other coatings.
- C. Materials for backpriming woodwork.
- D. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
- E. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
 - 6. Marble, granite, slate, and other natural stones.
 - 7. Floors, unless specifically indicated.
 - 8. Ceramic and other tiles.
 - 9. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
 - 10. Glass.
 - 11. Concrete masonry units in utility, mechanical, and electrical spaces.
 - 12. Acoustical materials, unless specifically indicated.
 - 13. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 05.50.00 - Metal Fabrications: Shop-primed items.
- C. Section 05.51.00 - Metal Stairs: Shop-primed items.
- D. Section 07.05.53 - Fire and Smoke Assembly Identification: Fire-rated wall identifications, painted.
- E. Section 09.91.13 - Exterior Painting.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.
- B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2005 (Reapproved 2012).
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2015.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.
- E. SSPC-SP 1 - Solvent Cleaning; 2015.
- F. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

- G. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
- H. SSPC-SP 13 - Surface Preparation of Concrete; (Reaffirmed 2015); 2003.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 3. Manufacturer's installation instructions.
 - 4. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, submit each color in each sheen available.
 - 3. Allow 30 days for approval process, after receipt of complete samples by Architect.
 - 4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01.60.00 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

- C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. PPG Paints: www.ppgpaints.com/#sle.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content: Comply with Section 01.61.16.
- C. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- D. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Selection to be made by Architect after award of contract.
 - 2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
 - 3. Extend colors to surface edges; colors may change at any edge as directed by Architect.
 - 4. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the color coding scheme indicated.

2.03 PAINT SYSTEMS - INTERIOR

- A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, wood, shop primed steel, and galvanized steel.
 - 1. Two top coats and one coat primer.
 - 2. Eggshell: MPI gloss level 3; use this sheen for hard ceilings.
 - 3. Satin: MPI gloss level 4; use this sheen for items subject to frequent touching by occupants, including door frames and railings.
 - 4. Primer(s): As recommended by manufacturer of top coats.
 - a. Gypsum Board: Interior Latex Primer Sealer.
 - b. Concrete: Alkali Resistant Water Based Primer.
 - c. Concrete Masonry: Latex Block Filler; heavy coat squeegeed into pores.
 - d. Wood: Latex Primer for Interior Wood.
 - e. Steel -- Shop Primer: Quick Dry Alkyd Primer for Metal.

- f. Galvanized Steel: Water Based Galvanized Primer.
- 5. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, or 141.
 - a. Products:
 - 1) PPG Paints Manor Hall Interior Latex, 82-3410 Series, Satin. (MPI #139)
 - 2) PPG Paints Manor Hall Interior Latex, 82-3510 Series, Semi-Gloss. (MPI #141)
- 6. Top Coat Sheen:
 - a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
 - b. Eggshell: MPI gloss level 3; use this sheen at all locations.
 - c. Satin: MPI gloss level 4; use this sheen for items subject to frequent touching by occupants, including door frames and railings.
- 7. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
 - 1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
 - 2. Two top coats and one coat primer.
 - 3. Satin: MPI gloss level 4; use this sheen at all locations.
 - 4. Primer(s): As recommended by manufacturer of top coats.
 - 5. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.
 - a. Products:
 - 1) PPG Paints Aquapon WB EP Two-Component Waterborne Epoxy Coating, 98E-1/98E-100 Series, Semi-Gloss. (MPI #215)
- C. Medium Duty Vertical and Overhead: Including gypsum board, concrete, concrete masonry units, shop primed steel, and galvanized steel.
 - 1. Two top coats and one coat primer.
 - 2. Eggshell: MPI gloss level 3; use this sheen at hard ceilings.
 - 3. Satin: MPI gloss level 4; use this sheen at all locations not called for elsewhere.
 - 4. Primer(s): As recommended by manufacturer of top coats.
 - a. Gypsum Board: MPI #50, Interior Latex Primer Sealer.
 - b. Concrete: Same as top coats.
 - c. Concrete: MPI #3, Alkali Resistant Water Based Primer.
 - d. Concrete Masonry: MPI #4, Latex Block Filler; heavy coat squeegeed into pores.
 - e. Plaster: MPI #50, Interior Latex Primer Sealer.
 - 5. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, or 141.
 - a. Products:
 - 1) PPG Paints Manor Hall Interior Latex, 82-3410 Series, Satin. (MPI #139)
 - 2) PPG Paints Manor Hall Interior Latex, 82-3510 Series, Semi-Gloss. (MPI #141)

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 - 1. Alkali Resistant Water Based Primer; MPI #3.
 - a. Products:
 - 1) PPG Paints Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI. (MPI #3)
 - 2. Interior/Exterior Latex Block Filler; MPI #4.
 - a. Products:
 - 1) PPG Paints Speedhide Masonry Hi Fill Latex Block Filler, 6-15XI. (MPI #4)
 - 3. Interior Latex Primer Sealer; MPI #50.
 - a. Products:
 - 1) PPG Paints Speedhide Zero Interior Latex Sealer, 6-4900XI. (MPI #50)
 - 4. Interior Drywall Primer Sealer.
 - a. Products:
 - 1) PPG Paints Speedhide Zero Interior Latex Sealer, 6-4900XI.

5. Interior Rust-Inhibitive Water Based Primer; MPI #107.
 - a. Products:
 - 1) PPG Paints Pitt-Tech Plus Interior/Exterior DTM Waterborne Acrylic Primer/Finish, 4020 PF Series.
6. Interior Water Based Primer for Galvanized Metal; MPI #134.
 - a. Products:
 - 1) PPG Paints Pitt-Tech Plus Interior/Exterior DTM Waterborne Acrylic Primer/Finish, 4020 PF Series. (MPI #134)
7. Stain Blocking Primer, Water Based; MPI #137.
 - a. Products:
 - 1) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #137)
8. Latex Primer for Interior Wood; MPI #39.
 - a. Products:
 - 1) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #39)

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 2. Clean concrete according to ASTM D4258. Allow to dry.
 3. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- G. Masonry:
1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 2. Prepare surface as recommended by top coat manufacturer.
- H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- I. Galvanized Surfaces:
1. Prepare surface according to SSPC-SP 2.
- J. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- K. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- L. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.
- M. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions.
- B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 10.14.00
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Room and door signs.
- B. Interior directional and informational signs.
- C. Building identification signs.

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.
- D. UL 1994 - Luminous Egress Path Marking Systems; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Verification Samples: Submit samples showing colors specified.
- G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01.60.00 - Product Requirements, for additional provisions.
 - 2. Curved Sign Media Suction Cups: One for each 100 signs; for removing media.

1.04 QUALITY ASSURANCE

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Flat Signs:
 - 1. Best Sign Systems, Inc: www.bestsigns.com/#sle.
- B. Curved Signs:
 - 1. FASTSIGNS: www.fastsigns.com/#sle.
- C. Dimensional Letter Signs:
 - 1. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com/#sle.

2.02 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs:
 - 1. Sign Type: Curved signs with engraved panel media as specified.
 - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
 - 3. Character Height: 1 inch.
 - 4. Sign Height: 2 inches, unless otherwise indicated.
 - 5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
 - 6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
 - 7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
 - 8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
- C. Interior Directional and Informational Signs:
 - 1. Sign Type: Curved signs with engraved panel media as specified.
 - 2. Allow for 20 signs 4 inches high by 16 inches long.
- D. Building Identification Signs:
 - 1. Use individual metal letters.
 - 2. Mount on outside wall in location indicated on drawings.

2.03 SIGN TYPES

- A. Radius / Curved Signs: One-piece, curved extruded aluminum media holder securing flat, flexible sign media by curved lip on two sides; other two sides closed by end caps; concealed mounting attachment.
 - 1. Sizes: As indicated on drawings.
 - 2. Finish: Natural (clear) anodized.
 - 3. Sign Orientation: Curved in horizontal section.
 - 4. End Caps: Aluminum with finish matching frame and stainless steel screw attachment.
 - 5. Wall Mounting of One-Sided Signs: Mechanical anchorage, with predrilled holes, and set in clear silicone sealant.
- B. Color and Font: Unless otherwise indicated:
 - 1. Character Font: Helvetica, Arial, or other sans serif font.
 - 2. Character Case: Upper case only.
 - 3. Background Color: Clear.
 - 4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
 - 1. Total Thickness: 1/16 inch.

2.05 DIMENSIONAL LETTERS

- A. Metal Letters:
 - 1. Metal: Aluminum casting.
 - 2. Metal Thickness: 1/8 inch minimum.
 - 3. Text and Typeface:
 - a. Character Font: Helvetica, Arial, or other sans serif font.
 - b. Character Case: Upper case only.
 - 4. Finish: Brushed, satin.
 - 5. Mounting: Concealed screws.

2.06 ACCESSORIES

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10.26.00
WALL AND CORNER PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.

1.02 RELATED REQUIREMENTS

- A. Section 06.10.00 - Rough Carpentry: Blocking for wall and corner guard anchors.
- B. Section 08.71.00 - Door Hardware: Standard protection plates and trim.

1.03 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010.
- B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2020.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- D. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2014.
- E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.
- D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit two sections of corner guards, 24 inches long.
- E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Protect work from UV light damage.
- D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.
- E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.06 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Corner Guards:
 - 1. Construction Specialties, Inc; Heavy Duty Corner Guards: www.c-sgroup.com/#sle.

2.02 PERFORMANCE CRITERIA

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
- B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
- C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

- A. Corner Guards - Surface Mounted:
 - 1. Material: High impact vinyl with full height extruded aluminum retainer.
 - 2. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
 - 3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - 4. Width of Wings: 2 inches.
 - 5. Corner: Square.
 - 6. Color: As selected from manufacturer's standard colors.
 - 7. Projection From Wall to Outside of Guard: 1/2 inch.
 - 8. Length: One piece.
- B. See Section 06.10.00 for wood blocking for wall and corner guard anchors.

2.04 FABRICATION

- A. Fabricate components with tight joints, corners and seams.
- B. Pre-drill holes for attachment.
- C. Form end trim closure by capping and finishing smooth.

2.05 SOURCE QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements, for additional requirements.
- B. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.
- C. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner guard 4 inches above finished floor to 48 inches high.

3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch.

- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

- A. See Section 01.74.19 - Construction Waste Management and Disposal, for additional requirements.
- B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 10.28.00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Commercial shower and bath accessories.
- C. Under-lavatory pipe supply covers.
- D. Grab bars.
- E. Diaper changing stations.
- F. Laundry room accessories.
- G. Janitor closet accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06.10.00 - Rough Carpentry: Concealed supports for accessories, including in-wall wood blocking for support of wall-mounted accessories.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- E. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.
- F. ASTM C1036 - Standard Specification for Flat Glass; 2016.
- G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- H. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).
- I. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004 (Reapproved 2016).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Samples: Submit one sample of each accessory, illustrating color and finish.
- D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:

1. Georgia-Pacific Professional: www.blue-connect.com/#sle.
- B. Under-Lavatory Pipe Supply Covers:
 1. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
- C. Diaper Changing Stations:
 1. American Specialties, Inc: www.americanspecialties.com/#sle.
 2. Koala Kare Products: www.koalabear.com/#sle.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 1. Grind welded joints smooth.
 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Keys: Provide two keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- F. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- G. Adhesive: Two component epoxy type, waterproof.
- H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

- A. Stainless Steel: No. 4 brushed finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
- D. Powder-Coated Steel: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat, and two finish coats of powder coat enamel.
- E. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
- F. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- G. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. Basis of design and items called out are manufactured by Georgia Pacific. Products by other manufacturers will be considered, if identical in general appearance and performance characteristics.
- B. Toilet Tissue Dispenser (TT-D): GPC56784A: Double roll, surface mounted bracket type, black transparent plastic.
- C. Paper Towel Dispenser: Electric, roll paper type.
 1. Cover: Opaque black plastic.
 2. Paper Discharge: Touchless automatic.
 3. Capacity: 10 " diameter roll.
 4. Mounting: Surface mounted.
 5. Power: Battery operated.
 6. Products:

- a. Georgia-Pacific Professional; GP enMotion Stainless Recessed Automated Touchless Towel Dispenser: www.blue-connect.com/#sle.
- D. Automated Soap Dispenser: Liquid soap dispenser, wall-mounted, with black plastic cover and window to gauge soap level, tumbler lock.
 - 1. Products:
 - a. Georgia-Pacific Professional; GP enMotion Automated Touchless Soap and Sanitizer Dispenser, Black; www.gppro.com
- E. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
 - 1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
 - 2. Size: As indicated on drawings.
 - 3. Fixed Framed Mirrors (MR-2): B-165.
 - 4. Fixed Tilt Mirrors (MR-1): B-292: Minimum 3 inches tilt from top to bottom.
 - 5. Products:
 - a. Bobrick.
- F. Mirrors: Framed, Wall Hung: Asymmetrical Wall Hung, similar to Edgewood, Model B08CDJK79W, but must be tempered glazing.
- G. Grab Bars: Stainless steel, smooth surface.
 - 1. Standard Duty Grab Bars (GBH36, GBH42, & GBV18):
 - a. Push/Pull Point Load: 250 pound-force, minimum.
 - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
 - c. Finish: Peened satin.
 - d. Length and Configuration: As indicated on drawings.
- H. Sanitary Napkin Disposal (SND): Powder-coated steel, surface-mounted, self-closing lid, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle, black finish.
 - 1. Products:
 - a. Golden Group International, Model: TD1000.
- I. Coat Hook (CH): Kohler, K-27363: Cast metal, black, surface-mounted, satin finish.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

- A. Shower Curtain Rod: Brass tube, 1 inch outside diameter, 0.04 inch wall thickness, black satin-finished, with 3 inch outside diameter, minimum 0.04 inch thick black satin-finished stainless steel flanges, for concealed mounting.
 - 1. Products:
 - a. Signature Hardware.
- B. Folding Shower Seat: Wall-mounted surface; welded tubular seat frame, structural support members, swing-down legs, hinges, and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand seat.
 - 1. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of white color.
 - 2. Size: ADA Standards compliant.
 - 3. Products:
 - a. Bradley: Model 9569.

2.06 DIAPER CHANGING STATIONS

- A. Diaper Changing Station (CS): Koala Kare KB110-SSWM: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
 - 1. Material: Polyethylene.
 - 2. Mounting: Semi-Recessed.
 - 3. Color: As selected.
 - 4. Minimum Rated Load: 250 pounds.

2.07 UTILITY ROOM ACCESSORIES

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
 - 1. Drying rod: Stainless steel, 1/4 inch diameter.
 - 2. Hooks: Three, 0.06 inch stainless steel rag hooks at shelf front.
 - 3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
 - 4. Length: 36 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections (if required) are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.
- E. See Section 06.10.00 - Rough Carpentry for installation of blocking in walls and ceilings.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, and as indicated on Drawings.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 10.44.00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06.10.00 - Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 09.91.23 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a.
- B. FM (AG) - FM Approval Guide; current edition.
- C. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.
- D. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features.
- C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Ansul, a Tyco Business: www.ansul.com/#sle.
 - 2. JL Industries, Inc; Cosmic: www.jlindustries.com.
 - 3. Potter-Roemer: www.potterroemer.com/#sle.
 - 4. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.
 - 5. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Fire Extinguisher Cabinets and Accessories:
 - 1. JL Industries, Inc; Ambassador Series: www.jlindustries.com.
 - 2. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
 - 3. Potter-Roemer: www.potterroemer.com/#sle.
 - 4. Substitutions: See Section 01.60.00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Stored Pressure Operated: Deep Drawn.
 - 2. Class: A:B:C type.
 - 3. Size: 10 pound.
 - 4. Finish: Baked polyester powder coat, color as selected.
 - 5. Temperature range: Minus 40 degrees F to 120 degrees F.
- C. Dry Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
 - 1. Class: K type.
 - 2. Size: 1.6 gallons.
 - 3. Temperature range: Minus 20 degrees F to 120 degrees F.
- D. FE-36 Clean Agent Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
 - 1. Class: A:B:C type.
 - 2. Size: 10 pound.
 - 3. Finish: Baked polyester powder coat, color as selected.
 - 4. Temperature Range: Minus 40 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

- A. Cabinet Configuration: Recessed type.
 - 1. Size to accommodate accessories.
 - 2. Projected Trim: Returned to wall surface, with 1/2 inch projection, and 1-1/2 inch wide face.
 - 3. Door: 1/2 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide roller type catch.
 - 4. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
- B. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.
- C. Door Glazing: Float glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.
- D. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- E. Fabrication: Weld, fill, and grind components smooth.
- F. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.
- G. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets and on wall brackets.

3.03 MAINTENANCE

- A. See Section 01.70.00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

- B. Provide a separate maintenance contract for the service and maintenance of all extinguishers for 1 years from Date of Substantial Completion.

END OF SECTION

SECTION 10.56.17
WALL MOUNTED SHELVING STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Steel shelf standards, brackets, and accessories.
- B. See drawings for locations and configurations.

1.02 RELATED REQUIREMENTS

- A. Section 06.10.00 - Rough Carpentry: Wood blocking in walls for attachment of standards.
- B. Section 06.20.00 - Finish Carpentry: Wood shelves with hardwood nosings.

1.03 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products under cover and elevated above grade.
- B. Store products in manufacturer's unopened packaging until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Shelf Standards and Brackets:
 - 1. Knappe & Vogt Manufacturing Company; 85™/185™ Series: www.knappeandvogt.com/#sle.

2.02 COMPONENTS

- A. Steel Shelf Standards, Brackets, and Accessories:
 - 1. Extra-Duty Shelf Standards and Brackets: Double-slotted channel standards for brackets adjustable in 1 inch increments along entire length of standard, drilled and countersunk for screws.
 - a. Product: KV 85/187.
 - b. Load Capacity: Recommended by manufacturer for loading of 300 to 680 pounds per pair of standards.
 - c. Material: Steel.
 - d. Lengths: As indicated on drawings.
 - e. Finish: Powder-coated, white; provide screws with matching heads.
 - f. Brackets: Double tab type, locking into slots; size to suit shelves; same finish as standards.
 - g. Bracket Quantity: Provide one bracket for each 12 inches of standard length.
 - 2. Shelf Standard Accessories:
 - a. Provide brackets flanged brackets; fasten to shelf underside with screws.
- B. Fasteners: Screws as recommended by manufacturer for intended application or as otherwise required by project conditions. Finish of exposed to view fasteners to match finish of standards and other components.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.

- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mount standards or brackets to solid backing capable of supporting intended loads.
- C. Install brackets and accessories.
- D. Review installation of standards and brackets for compliance with Drawings requirements.
- E. Shelving installation, whether by this sub-contractor or the millwork sub-contractor, may now occur.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 10.73.16.13
METAL CANOPIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Column and building-supported, shop fabricated metal canopies.

1.02 RELATED REQUIREMENTS

- A. Section 03.30.00 - Cast-in-Place Concrete: Concrete footings.
- B. Section 07.71.23 - Manufactured Gutters and Downspouts.
- C. Section 09.91.13 - Exterior Painting: Finish coating.

1.03 REFERENCE STANDARDS

- A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.
- B. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.
- E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
- F. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2018.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- H. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).
- I. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process; 2019.
- J. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2020.
- K. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014a.
- L. ASTM E2950 - Standard Specification for Metal Canopy Systems; 2020.
- M. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2017.
- N. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.
- O. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit product data sheets, including material descriptions and finishes, and preparation instructions and recommendations.
- C. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing profiles, sections of components, finishes, and fastening details.
- D. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

- E. Designer's Qualification Statement.
- F. Manufacturer's Qualification Statement.
- G. Erector's Qualification Statement.
- H. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
 - 1. Comply with applicable code for submission of design calculations as required for acquiring permits.
- B. Perform work in accordance with AISC 303.
- C. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
- D. Erector Qualifications: Company specializing in performing the work of this section.
 - 1. Not less than 5 years of documented experience and approved by canopy manufacturer.
- E. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site ready for erection.
- B. Package using methods that prevent damage during shipping and storage on site.
- C. Store materials under cover and elevated above grade.

1.07 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
- B. Metal Canopies: Correct defective work within a two year period after Date of Substantial Completion.
- C. Finish Warranty: Provide manufacturer's one year warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Canopies:
 - 1. Austin Mohawk, Inc: www.austinmohawk.com/#sle.
 - 2. Duo-Gard: www.duo-gard.com.
 - 3. Madison Industries: www.madisonind.com.

2.02 METAL CANOPIES

- A. Shop Fabricated Metal Canopy
 - 1. Pre-engineered system complying with ASTM E2950.
 - 2. Design and fabricate metal canopy system to resist wind, snow, live, and seismic loads without failure, damage, or permanent deflection in accordance with ASCE 7:
 - a. Loads: In compliance with local building codes.
 - 3. Thermal Movement: Design canopy system to accommodate thermal movement caused by ambient temperature range of 120 degrees F and surface temperature range of 180 degrees F without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects on assembly components.

- B. Configuration: Column layout, canopy clearance, fascia profile, and roof covering design as indicated on drawings.

2.03 COMPONENTS

- A. Structural Steel Framing:
1. Columns: ASTM A500/A500M, Grade B, rectangular tubing, sized to suit project design load requirements.
 2. Base and Top Plates: ASTM A36/A36M, with pre-drilled bolt holes.
 3. Beams: Wide flange, ASTM A572/A572M, Grade 50.
 4. Other Structural Steel Members: ASTM A36/A36M.
- B. Covering:
1. Sheet Metal Decking: Interlocking metal panels.
 - a. Panel Size: 16 inches wide by 3 inches deep; 20 gauge, 0.0359 inch thickness.
 - b. Material: ASTM A653/A653M, G40 galvanized according to ASTM A924/A924M.
 - c. Provide canopy manufacturer's standard clip type fasteners for attaching covering to structural beams.
- C. Fascia: Manufacturer's standard flat profile.
1. Material: Aluminum Composite Material (ACM) panel.
- D. Anchor Bolts: ASTM A307 or ASTM A572/A572M, formed with bent shank, assembled with template for casting into concrete.
1. Minimum exposed thread of 7 inches above footing and 23 inch minimum embedment.
 2. Provide nuts and washers as required for column leveling and plumbing.
- E. Concrete Footings: Refer to Section 03.30.00 for additional requirements.
- F. Exposed Gutters and Downspouts: Galvanized steel with baked enamel finish, color to match canopy covering, manufacturer's recommended size for canopy specified.
1. Refer to Section 07.71.23 for additional requirements.

2.04 SHOP FABRICATION

- A. Provide a complete system ready for erection at project site.
- B. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.
- C. Perform welding in accordance with AWS D1.1/D1.1M.
- D. Fabricate connections for bolt, nut, and washer connectors.

2.05 FINISHES

- A. Structural Steel Framing:
1. Shop Primer: Rust-inhibitive red oxide.
 2. Finish Coating: As specified in Section 09.91.13.
- B. Steel Decking: Polyester baked enamel finish; color as selected from manufacturer's standard range.
- C. Fascia: Fluoropolymer finish; custom color required.

2.06 ACCESSORIES

- A. Structural Bolts: ASTM F3125/F3125M, Grade A325, minimum 3/4 inch diameter.
- B. Trim, Closure Pieces, and Flashings: Same material, thickness and finish as sheet metal decking; factory-fabricated to required profiles.
1. Exposed Fasteners: Not permitted.
- C. Grout: ASTM C1107/C1107M; non-shrinking; premixed compound consisting of non-metallic aggregate, cement, water-reducing and plasticizing agents.
- D. Fasteners, Non-Structural: ASTM F593 stainless steel or ASTM A307 carbon steel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and site area for conditions that might prevent satisfactory installation.
- B. Verify that foundation, electrical utilities, and placed anchors are in correct position.
- C. Verify that bearing surfaces are ready to receive this work.
- D. Do not proceed with installation until all conditions are satisfactory.

3.02 INSTALLATION - FRAMING

- A. Erect framing in accordance with AISC 303.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation.
- C. Set column base plates with non-shrink grout to achieve full plate bearing.
- D. Fasten columns to anchor bolts.
- E. Do not field cut or alter structural members without approval.
- F. After erection, prime welds, abrasions, and surfaces not shop primed.

3.03 INSTALLATION - CANOPY COVERING

- A. Install in accordance with manufacturer's instructions.
- B. Fasten metal decking to steel support members, aligned level and plumb.
- C. Install fascia panels, trim, and flashing.
- D. Separate dissimilar metals using concealed bituminous paint.
- E. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

3.04 TOLERANCES

- A. Maximum Variation from Level: Plus/Minus 1/8 inch.

3.05 CLEANING

- A. Clean surfaces of dust and debris; follow manufacturer's cleaning instructions for the finish used.

3.06 PROTECTION

- A. Protect canopy after installation to prevent damage due to other work until Date of Substantial Completion.

END OF SECTION

SECTION 11.40.00 – FOOD SERVICE 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 OF WORK

- A. The work covered by this Section includes the following:
1. Furnishes all food service equipment shown, including all labor, materials, tools and equipment necessary for the complete installation of kitchen equipment and refrigeration in a first-class manner, including all work incidental thereto in accordance with the drawings and these specifications.
 2. Provide superintendent who, shall be devoted full time to this project during installation, shall be available to the other trades for verification of connection location, "etc." as needed, and shall direct, coordinate and supervise all work associated with this Section and inspects all equipment provided under this Section.
 3. Provide equipment with threaded outlets for type of connections as standardized by Food Service Equipment Manufacturers for other contractors to make final steam, plumbing, electric and ventilating connections.
 4. Provide all labor and material necessary to adequately insulate and seal any and all penetrations in Food Service Equipment. All penetrations are to be insulated and sealed properly to prevent condensation on inside of boxes.
 5. Erect the equipment at the site in full compliance with all current local, state and Federal rules, regulations and codes.
 6. Attend construction meetings and any other scheduled meetings as necessary to maintain coordination related to this Section.
 7. Provide coordination of Food Service Equipment shop drawings, submittal data and installation activities, as required and identified in Section 01.30.00 – Administrative Requirements.
 8. All labor is to be performed in the best and most workmanlike manner. The standards of the work required are of such grade as will bring first class results. Materials and/or workmanship not in compliance with the drawings and specifications or are improperly installed shall be removed and replaced with no change in contract price or other cost to the Owner.
 9. Cleans up all debris resulting from the work of this Section immediately upon completion of installation and removes same from premises.
 10. Field verify all measurements on-site (including shelving); verify the placement of pipes, sleeves, hood, pant-leg duct, drains, power, and walk-in wood breaker strip locations prior to the pouring of the floor slab or, if in an existing facility, prior to the installation of such services. Any modification necessary to the equipment because of the location of service connections must be brought to the attention of the Architect immediately for approval if the modifications require design changes. Measurements shown on drawings are approximate and are for estimating purposes only. Verify all electrical and mechanical requirements for all new, existing and future equipment with all appropriate trades, consultants, and engineers. Supplier of Food Service Equipment must examine roughed-in mechanical and electrical services. Notify the General Contractor in writing of unsatisfactory locations and dimensions of other work, and of unsatisfactory conditions for proper installation of Food Service Equipment. Do not proceed with fabrication or installation until unsatisfactory dimensions and conditions have been corrected. Any costs related to the failure of performing this function will not be borne by the Owner.
 11. Verify all plug types and lengths of all cord and plug sets on equipment for which it is supplied. All cord sets are to contain an equipment grounding conductor and be furnished with caps or plugs listed or recognized by Underwriter's Laboratories.

12. Confer with the General Contractor on all measurements, location and measurement of recesses and openings, verification of all connection requirements, etc.; coordinate with the General Contractor the scheduling and transfer of all pertinent information (measurements, drawings, connection data, etc.) to other trades who will be involved in the work associated with this Section.
 13. Items identified as **"Existing"** or **"Relocate"** are existing equipment to be reused. Remove identified items at a time prearranged with the Owner and warehouse the items (if required) while site is being prepared by other trades. Provide protection to prevent damage, injury or loss and maintains applicable insurance for all existing equipment stored. Existing equipment is cleaned according to the cleaning instructions included in this section. Refinishing and/or repairs for existing equipment are noted in the General Requirements and Itemized Specifications. Any damage during moving or warehousing shall be repaired at no cost to the Owner. Inspect and note in the presence of the Owner and/or their duly authorized representative any observable damage to existing equipment before removal. Owner shall be responsible for existing equipment not to be reused on the project.
 14. Verify all utility connections for existing equipment to be reused.
- B. Related Sections include the following:
1. Section 01.30.00 – Administrative Requirements for submittal preparation and coordination.
 2. Division 22 for Plumbing/Piping Work
 3. Division 23 for Ventilation Work requirements.
 4. Division 26 for Electrical requirements

1.03 DEFINITIONS

- A. The term "Complete Installation" means the delivery of all kitchen equipment and refrigeration, with transportation and trucking charged prepaid to the building site, removal from crates, assembled, set in place, leveled, ready for final connection, re-leveled, calibrated, started-up and adjusted, cleaned, demonstrated, with Owner Training complete. All equipment to be cleaned using cleaners approved by and as recommended by the manufacturers to a condition of sanitation ready and acceptable for intended food service use. Equipment is cleaned just prior to Owner's acceptance.
- B. Work denoted as "Furnished By Others" (F.B.O.) or "By Other Trades" in Part 3, Equipment Schedule, in this Section will be furnished and installed under other Sections.
- C. Any reference to "standard" in Part 3, Equipment Schedule, in this Section is to be supplied whether or not it is identified as standard by the manufacturer.

1.04 PERMITS AND LICENSES

- A. Pay all costs for permits, licenses, and fees, which are required for the work associated with this Section, and which may arise incidental to fulfilling of these specifications.

1.05 QUALITY ASSURANCE

- A. Qualifications:
1. Upon demand, provide evidence satisfactory to the Architect and Owner of having successfully completed Food Service Equipment projects of a size comparable to this one, and having sufficient experience in the work called for to assure completion of this project in a satisfactory manner. If requested, submit as a minimum the following information to the Architect within five days of receipt of request: Number of years in Food Service Equipment Industry; Key organizational personnel; Credit rating for this contract; Total amount of work under other contracts this date; Certificate of Licensing from State Licensing Board of General Contractors; past experience in the work called for to assure completion of the work in a satisfactory manner including names of projects, project contract amounts, scope of projects, names, addresses and telephone numbers of references of projects. If requested, submit evidence of sufficient financial resources for completion of this project.
- B. Custom Equipment Fabricators:
1. It is required that all fabricated equipment such as food serving units, tables, sinks, counter tops, etc., described in the following specifications, other than by name and catalog numbers, be

manufactured by an equipment fabricator who has the plant, personnel, and engineering facilities to properly design, detail and manufacture high quality food service equipment. All work in the above category shall be completed by one manufacturer with standard unit assembly and uniform design and finish.

1.06 SUBMITTALS

- A. Submittal booklets, electronic, shall contain the following information:
 - 1. Specification sheets for each item of manufactured standard equipment including illustrations, line drawings, rough-in information, service connections, power and fuel requirements, water and drainage requirements, options and accessories specified and similar information.
- B. Shop Drawings, electronic, are required for the following:
 - 1. All custom fabricated equipment including walk-in cooler/freezer, stainless steel fabrication and serving line units, dimensioned and drawn at a minimum scale of 3/4" to the foot, with necessary cross sections at a minimum scale of 1½" to the foot, showing complete detail for each item of specially fabricated equipment. Indicate name of manufacturer.
 - 2. Separate mechanical and electrical rough-in drawings with dimensions showing rough-in locations and final connections for each piece of equipment with each connection shown giving size, height and an explanation with each connection cross-referenced to the specification sheets or shop drawings. Rough-in shall be drawn at a minimum scale of ¼" to the foot. Above finished floor dimensions are required. All electrical connections are to be water tight or located at a height to prevent water from entering. Coordinate height of rough-ins so as not to interfere with the sealing of tables, over shelves and sinks to the walls, etc., as well as at heights for the convenience of the operator. Verify heights required and coordinate with the other trades as required..
 - 3. Service connections located under the exhaust hood must be located to provide the capture space as shown on the enlarged kitchen plan. Space between the backs of the equipment or between the backs of the equipment and wall must be maintained as shown when locating the service connection under the hood. For serving line units, location of floor drains and electrical outlets must be coordinated with the location of drains and cord and plugs on the units.
 - 4. All convenience outlets and convenience drains are included on the electrical and mechanical rough-in dimensioned drawings.
 - 5. Dedicated electrical service for computer is required in the manager's office. See electrical, mechanical and plumbing drawings for numbers and locations.
 - 6. Exposed conduit, surface mounted disconnects, surface mounted panel boxes and surface mounted equipment control panels are not permitted unless indicated otherwise or with the permission of the Architect.
 - 7. Provide dimensioned details, sections or elevations for all wall openings for equipment such as pass-thrus, dish machine, chutes, etc.; for all wall or floor recesses for equipment such as walk-in cooler/freezer, floor troughs, wash down system junction boxes and remote stations, waste system control panels, etc. All cross sections, elevations and details are to be drawn at a minimum scale of 1½" to the foot.
 - 8. Provide a dimensioned food service equipment layout separate from the dimensioned electrical and mechanical rough-in drawings showing the placement of all equipment, including the ventilation hood. An itemized equipment schedule is to be included.
 - 9. Provide an electrical and mechanical schedule identified by Item number and description showing the exact electrical and mechanical characteristics required for each item, including comments concerning final connections and interconnections. Power/fuel requirements, water/drainage requirements and similar information are to be included.
 - 10. All drawings are to be based upon the food service equipment layout and itemized specifications. Drawings will include accurately dimensioned layouts and locations for all masonry bases, if required or called for, and will include accurately dimensioned details and locations of any special wall openings that are required for equipment extending through walls.
 - 11. All rough-in connections located in walls are to be dimensioned to avoid any cove tile, stainless steel bases, shelves, table, counter tops, and backsplashes.
- C. Submittal requirements are as specified in Division 1 Section "Submittal Procedures"

1.07 MATERIAL AND WORKMANSHIP

- A. Unless otherwise specified or shown on drawings, all material is to be new, of best quality, perfect and without flaws, and delivered upon completion in an undamaged condition.
- B. All workmanship is required to be the best of its respective kind. All labor to be performed in a thorough workmanlike manner by qualified, efficient and skilled mechanics.
- C. Equipment will be inspected after delivery and any equipment found not to be in accordance with specifications, drawings and/or approved shop drawings will be rejected and shall be replaced with the approved equipment, with associated cost borne by the Contractor. Any defects found during inspection must be remedied to the satisfaction of the Owner and Architect.

1.08 STANDARDS

- A. All equipment shall be constructed in strict compliance with the standards of the National Sanitation Foundation (NSF) and in full compliance with the Public Health Regulations of the State in which installation is made. Each piece of equipment must bear "Seal of Approval" label of the National Sanitation Foundation, if applicable.
- B. Dish machines must conform to the latest adopted standards, and electrical and gas cooking and warming equipment must conform to the latest adopted standards, as established by the National Sanitation Foundation, Ann Arbor, Michigan.
- C. ANSI Standards: Comply with applicable ANSI standards for electric powered and gas burning appliances, for piping to compressed gas cylinders, and for plumbing fittings including vacuum breakers and air gaps to prevent back siphonage in water piping.
- D. NFPA Codes: Comply with the latest adopted NFPA Codes, "National Electrical Code", "Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment", and "National Fuel Gas Code".
- E. ASME Boiler Code: Construct steam generating and closed steam heated equipment to comply with the latest adopted ASME Boiler and Pressure Vessel Codes.
- F. All electrical equipment is U.L. Approved and Listed.
- G. All gas equipment is AGA Approved and Listed.

1.09 COMPLIANCE WITH LAWS AND CODE REGULATIONS

- A. Nothing in the Contract Documents shall be construed to conflict with any local, state or federal laws or regulations governing the installation or any part of the work to be performed under this Contract, and all requirements shall be in accordance therewith, without any additional cost to the Owner.

1.10 INSPECTION OF WORK

- A. The Owner, Architect, or their duly authorized representative shall have free access to the work covered by these specifications for the purpose of observation, in the shop, in storage and at the job site, of the work for conformance with the Contract Documents. Nonconforming work and/or equipment shall be corrected when identified.

1.11 WORK BY OTHER TRADES

- A. The work to be provided under other Sections includes roughing-in to points indicated on the mechanical, plumbing and electrical plans, final connections from rough-in point to various pieces of Food Service Equipment requiring such connections, final connection between various pieces of equipment or within pieces of equipment as required, and the supplying of all necessary materials, tools and labor for this work.
- B. Electrical Work performed under Division 26 includes the following:
 - 1. Interior wiring and/or control wiring in walk-in cooling equipment, wiring for lights in walk-in cooler/freezer units, sink heaters and ice cream makers.
 - 2. Electrical connections to compressors, blower coils, controls, lights, etc.

3. Install all conduit and wiring for rough-in, final and inter-connections and makes all final connections within, between, and to Food Service Equipment.
 4. Wiring for lights in walk-in refrigeration equipment shall be run through conduit installed on the ceiling inside the boxes and not on the top of the boxes. See Installation Instructions, this Section for description of fasteners and use of mastic.
 5. Provide any sleeves required for power, controls or alarms.
 6. Furnish and install all disconnect switches, safety cut-outs, control panels, fuse boxes, or other electrical controls, fittings, and connections.
 7. Install motor starters and switches, which are furnished with Food Service Equipment.
 8. Install all cord and plugs, which are furnished loose with Food Service Equipment.
 9. Coordinate the installation of electrical components for Food Service Equipment so as to be in compliance with related local codes and regulations.
 10. Note that all electrical work related to this Section shall be in compliance with the requirements for WET LOCATION unless otherwise noted.
- C. Plumbing/Piping Work performed under Division 22 includes the following:
1. Provide rough-in and make all final connections including all materials and labor for gas, water and waste within, between and to the Food Service Equipment.
 2. Install all faucets, lever waste drains, hose reels with mixing valves and gas pressure regulators, which are furnished with Food Service Equipment.
 3. Plumbing connections to compressors, blower coils.
 4. Provide any sleeves required for installation of refrigeration tubing or other piping.
 5. Piping extensions from fixtures to floor drains and floor sinks for walk-in refrigeration.
 6. Flush all lines free of foreign matter before connecting fixtures.
 7. Provides water supply piping, traps, check valves, water pressure reducing valves, vacuum breakers, tail pieces and fittings, waste piping, floor drains, gas pressure regulators, shut-off valves, and all other necessary fittings.
 8. Provide back flow prevention devices required by regulatory codes and/or the Public Health Department, and install any back-flow prevention devices supplied by the Food Service Equipment
 9. Provide half drain covers on floor drains or floor sinks for free-flowing drain connections where required to prevent water from splashing on surrounding floor and/or equipment.
- D. Ventilation Work performed under Division 23 includes the following:
1. Furnishes and installs necessary ventilation facilities of sufficient capacity to operate the equipment.
 2. Furnishes and installs required vent ducts and transitions, and exhaust hood fans, and connects to equipment.
 3. Note the ventilator shown in drawings is approximated size of ventilator capture area only.
- E. General Work performed under Divisions 3 through 9
1. Provide a finished floor that is level unless noted otherwise in the Itemized Specifications or on the enlarged Food Service Equipment drawing. Floors are not pitched to drains because of the extensive use of mobile equipment. Leveling of the floor surface in the serving area, under Pass-Thru Refrigerated and Heated Cabinets, under the hood and in the walk-in Cooler/Freezer recess is critical. Equipment in the serving area are equipped with casters and cannot be leveled except by the floor and will not lock together if the floor is not level.
 2. Provides all openings and penetrations in walls, ceilings, roofs, etc., for the food service equipment as required and finishes such openings as specified on the Construction Documents

PART 2 PRODUCTS

2.01 EQUIPMENT MANUFACTURERS

- A. Manufacturers: The equipment specified in Part 3, Equipment Schedule, shall be construed as a basis-of-design product and as such sets forth not only quality, standard/optional features but also equipment connection requirements. Acceptable equipment manufacturers shall be listed on a per equipment item basis. Due to the variations of equipment connection requirements from

manufacturer to manufacturer the Food Service Equipment Contractor shall be responsible for the following when providing a listed acceptable equipment manufacturer other than the basis-of-design product.

1. Food Service Contractor shall make the General Contractor aware of any differences in connection requirements, including but not limited to the following:
 - a. Electrical amperage.
 - b. Waste connections and volume.
 - c. Water (hot and cold) connections and volume.
 - d. Exhaust connections and volume.
2. The Food Service Contractor shall provide, at no additional cost to the Owner, any equipment characteristic considered as a standard on the basis-of-design product but considered as an optional characteristic on the listed acceptable equipment manufacturer.

2.02 FABRICATED EQUIPMENT

- A. The material used in manufacturing equipment shall be as hereafter specified. Material that is not definitely specified shall be of the best quality used for its specified or intended purposes. All materials shall be new and free from all defects and imperfections. All fabricated equipment in this specification shall be custom built by a fabricator who has a complete factory with suitable equipment, personnel, and engineering facilities to properly design, detail, and manufacture the highest quality of food service equipment. All fabricated equipment shall conform to the current standards of the National Sanitation Foundation (NSF), Ann Arbor, Michigan. All fabricated equipment shall bear the NSF seal applied before delivery to the job site.
- B. Where not defined in Itemized Specifications all General Specifications and Sections take precedent.
- C. Deviations or changes from the General Specifications for Fabricated Equipment are found in Itemized Specifications.
- D. Where units cannot be fully shop fabricated; fabrication shop shall complete fabrication work at project site.
- E. Food Service Equipment Contractor is required to make all field measurements and dimensions and deliver and install all fabricated equipment. Measurements are made wall to wall. Fabricator to allow 1/4" for fit.
- F. Electrical Specifications
 1. Motors up to and including 1/2 H.P. are wired to 110, 115, or 120 volts, single phase. Motors over 1/2 H.P. are wired for 208 or 220 volts, three phase, unless otherwise noted on Architect's plans or in the Itemized Specifications.
 2. Heating Elements having a connected load up to and including 1,000 watts are wired for 110 or 220 volts, single phase. Any heating element over 1,000 watts or any combination of heating elements within one fixture totaling more than 1,000 watts is wired for 208 or 220 volts, single phase, unless otherwise noted on Architect's plans or in the Itemized Specifications. All units are wired to a single master switch.
 3. Provide 480 volt, three phase power where called for in the Itemized Specifications or as noted on Electrical drawings.
- G. Switches and Controls
 1. The Food Service Equipment Contractor supplies for each motor driven appliance or electrically heated unit, a suitable control switch or starter of proper type in accordance with Underwriter's Code. Controls that are mounted on vertical surfaces of fabricated fixtures are set into recessed die stamped stainless steel cups or otherwise indented to prevent damage.
 2. All internal wiring for fabricated equipment items, including all electrical devices, wiring controls, switches, etc., built into or forming an integral part of these items are furnished and installed by Food Service Equipment Fabricator in his factory with all items wired completely to a junction box within the fixture ready for final connection to building lines. All receptacles are grounding type listed by Underwriters Laboratories and approved by National Electrical Code. A standard three-prong plug to fit "U" slot grounding type receptacles is provided for all equipment operating off a 110 or 120 volt single phase A.C. electrical outlet. A three-wire cord of suitable length is

provided for this equipment as well. All cord sets are to contain an equipment grounding conductor and be furnished with caps or plugs listed by Underwriter's Laboratories.

H. Faucets, Valves, and Fittings

1. Food Service Equipment Contractor furnishes all faucets and lever waste drains. Sinks are fitted with faucets as called for under each item or as separate item listed as faucets. All special faucets for kettles, pre-wash, etc., are listed under Itemized Specifications.
2. Faucets are properly tagged with item numbers and delivered to Plumbing Contractor on job for installation. Mounting of faucets to fixtures is responsibility of Plumbing Contractor. Lever waste drains are installed into bottom of sinks by Food Service Equipment Contractor.
3. Faucets and hose and spray units with a mixing valve shall be provided with internal spring checks to prevent cross flow of water. If mixing faucet is attached to hose and spray unit with back flow prevention device, the faucet may have to be modified with a spring check spindle and/or check valves provided to prevent cross flow of water. Back flow prevention devices must be compatible with base unit and meet Public Health Code. It is the responsibility of the Food Service Equipment Contractor to verify the Public Health requirements and supply back flow prevention devices accordingly.
4. All other fittings, such as stops, shut-offs, trap valves, etc., furnished and installed by Plumbing Contractor.
5. Openings for faucets and spray units are located by the Fabricator to prevent handles from hitting splash when in the fully open position.

I. Non-Corrodible Alloy

1. Non-Corrodible alloy, or stainless steel, specified hereafter are Type 304 stainless steel, having a standard analysis of 18% chrome and 8% nickel and .08% carbon steel.
2. All gauges, where specified, are United States Standard gauges. All exposed surfaces are given a #4 finish 180 grit. Where manufacturing process and welding disturb the original finish, it is carefully reground, polished and restored to match balance of surface. All gauges, not specified, are United States Type 304, 18-8, 14 gauge stainless steel.

J. Galvanized

1. Where galvanized iron is specified, tight coat galvanized Copper Bearing is furnished in largest possible sheets with as few joints as necessary. The sheets are of an approved grade, re-rolled for smoothness.
2. Paint with hammertone grey enamel which meets U.S.D.A. criteria unless specified otherwise. Underbracing is not painted with hammertone grey enamel.

K. Welding

1. All welding of stainless steel, whether specified or implied, is accomplished by the Heli-arc method using stainless steel rod of the same composition as the parts welded. Welds are ground smooth and polished to the original finish of the metal, with the grain uniform to the grain of the original sheet. The stainless steel welds are free of pits, flaws, discolorations, and peened to remove flux and impurities. Where the grinding and polishing have destroyed the grain, restore and blend to obliterate all traces of welding. Welds are ground back to the surface of the original metal and sealed. Acetylene welding will not be accepted. Solder will not be accepted. Shop seams and corners in stainless steel tops shall be welded, ground smooth and polished.
2. All welds of galvanized metal on dish tables and sinks shall be ground smooth and sandblasted and sprayed with molten zinc at 1200 Fahrenheit to a .004 thickness. Tinning of welds is not acceptable.

L. Pipe Stands and Frames

1. All pipe stands for work tables, open base tables, dish tables, sinks and drainboards are constructed of 1-5/8" O.D. stainless steel tubing (16 gauge, type 304) or as indicated in the Itemized Specifications. All stringers and cross bracing are of same material as legs. All joints between legs and cross braces are notched, welded and ground smoothly. Legs fitted at top with fully enclosed stainless steel gussets welded to angle underbracing and stud bolted to top. Legs are attached without the use of bolts and are spaced on maximum of 4' to 5' centers.

2. Crossrails are supplied between each leg. Legs anchored to closed gussets at top only and without crossrails are not acceptable. Constructed of 1-5/8" O.D. stainless steel tubing (16 gauge, type 304).
 3. All crossrails are 12" O. A. above floor, or as called for by local health authorities. Verify that height of crossrails does not interfere with service connections.
- M. Bracing
1. Bracing is 12 gauge 1" X 4" X 1" galvanized iron channels and 12 gauge 1½" X 1½" X 1/8" galvanized iron angles. See Table Top section for attachment. Amount of bracing provided is as required to reinforce to prevent noticeable deflection. Tops of work tables, dish tables, enclosed base tables, serving counters and drainboards are braced. Clear silicon caulking manufactured to with stand 400° F. temperature water is applied at seam between bracing and tops.
 2. Exposed underbracing is 14 gauge, type 304 stainless steel.
- N. Sound Deadening
1. Furnish sound deadening pads to break metal to metal contact between bracing and tops on all work tables, dish tables, sinks, drainboards, enclosed base tables and serving counters except where noted otherwise.
 2. Furnish sound deadening pads on underside of all sinks including pre-wash and disposal sinks, dish tables, drainboards, and underside of all tables between bracing.
 3. Double walled sliding and swing doors are fitted with sound deadening insulation between the walls.
- O. Feet
1. All pipe legs are fitted with sanitary die stamped stainless steel bullet shaped feet, fully enclosed with a slightly rounded bottom to protect the floor. Top of these feet are fitted with a male threaded stem to fit into the end of pipe legs hereinabove specified and provide a total adjustment of 1". Stem is extra long so threads are not exposed. Bottom of pipe leg is finished off smoothly and overlap stem to provide sanitary fitting and prevent accumulation of grease or other debris at this joint.
 2. Cabinet type fixtures are mounted on 6" high die stamped sanitary one piece stainless steel legs and adjustable feet not less than 3" in diameter at top. Bottom adjusting member to telescope up into inside of upper member and match adjuster on open base units. Legs are fitted with a male threaded stem and have an adjustment of 1" on the 6" high legs. The upper part is stamped in a neat design with flared inverted shoulder, welded to stainless steel base plate designed for anchoring to channel braces below cabinet type fixtures.
- P. Table Tops (Metal)
1. Metal table tops are made of 14 gauge stainless steel. See Itemized Specifications for description of edge. Shop seams and corners are welded, ground smooth and polished. Working tops are reinforced on the underside with a framework of 12 gauge 1" x 4" x 1" galvanized iron channel and 1½" x 1½" x 1/8" galvanized iron angles as required. All horizontal and vertical cove corners on a ¼" or larger radius. Height of table top is 34".
 2. Tops are reinforced so there will be no noticeable deflections, with reinforcements stud welded to underside of top. Rivets or bolts used through the top are not accepted. Reinforced with 12 gauge 1" x 4" x 1" galvanized iron channel and 1½" x 1½" x 1/8" galvanized iron angles. Bracing is stud bolted to underside of top with cadmium plated lock nuts. Sound deadening pads are applied to break metal to metal contact between all bracing and underside of top.
 3. Field joints are provided in tops where necessary, located for practical construction and consistent with sizes convenient for shipping and accessibility into buildings. See section entitled "Field Joints" for description of these joints.
 4. See Itemized Specifications for description of edge.
- Q. Dish Table Tops
1. Tops of dish tables are constructed of 14 gauge stainless steel with all free edges turned up 3" and finished with 1½" diameter sanitary rolled rim. Sides and back adjacent to walls or higher fixtures are coved up 8", returned 2½" on a 45° angle, turned straight back 3/4" and straight down ½" along wall edges to an overall height of 10". Table is attached to wall with 12" stainless steel strips (Z clips). All interior horizontal and vertical corners are coved on a ¼" or larger

- radius. Outside radius of rolled rim corners is concentric with inside cove. Top is reinforced, braced and sound deadened the same as Table Top.
2. Dish Table Tops are mounted on tubular stainless steel legs and adjustable feet with connecting rails the same as specified for pipe stands and frames.
 3. Ends of splash are closed. Free corners of tops are spherical.
 4. Legs are fitted with adjustable stainless steel bullet feet as described under feet.
 5. Field joints are provided in tops where necessary, located for practical construction and consistent with sizes convenient for shipping and accessibility into buildings. See section entitled "Field Joints" for description.
- R. Drawers
1. Drawer housing is fully enclosed and is made entirely from 18 gauge 304 stainless steel including any reinforcements, 24" X 24" X 8", or as called for in Itemized Specifications.
 2. Internal drawer slide assembly is removable. Drawer slide assembly is stainless steel full extension drawer slides with stainless steel bearing wheels and screws: Standard-Keil 1452 series or Component Hardware Group Inc. S52 series.
 3. Drawer face is of 14 gauge stainless steel. Face equipped with an integral handle across the entire top of the drawer.
 4. Drawer pan is die drawn with fully coved corners from one piece of 18 gauge 304 stainless steel, 20" X 20" X 5" deep or as called for in the Itemized Specifications. Top edges to flange out 1½". Interior horizontal corners of the pan are rounded on a 1" radius and interior vertical corners of the pan on a 2" radius. The use of solder or other material to fill in these corners is not acceptable.
 5. Apply 1/8" mastic sealant between drawer flange and work surface.
 6. Tier of drawers is constructed in same manner as single drawer.
 7. Drawers over 5" deep provided with drain hole and cap in front.
 8. Each drawer mounted on a mobile unit contains (2) concealed magnetic latches with a minimum release tension of twenty pounds located at rear of drawer.
 9. Single drawer and top drawer in tier of drawers are fabricated with a trough protector (gutter) to prevent entry of moisture.
- S. Undershelves
1. The undershelves on open base tables are solid removable type of 16 gauge stainless steel.
 2. Shelf is made in removable sections with rolled down edges on sides which overlap pipe crossrails where they abut same.
 3. Abutting sections of shelves are turned down 1" straight.
 4. Shelves are notched to legs of table.
 5. Size of shelf is fabricated in sections for easy handling and for sending through dish machine.
- T. Elevated Shelves
1. Elevated shelves constructed of 14 gauge stainless steel.
 2. Shelf is mounted on 16 gauge 1-5/8" O.D. stainless steel tubular supports. Shelf is 12" wide unless stated otherwise; height is 18" and shelf is supported by cantilever supports mounted through the splash and into gusset welded to table bracing. Gusset fitted with set screw.
 3. Three supports are required for shelves four to eight feet in length. One additional support is required for each additional three feet over eight feet in length as a minimum.
 4. Front and sides have a marine edge. Back side is turned up 90° 2", returned ½" on a 45° angle, turned straight back 5/8", straight down 5/8" and hemmed. Shelf backsplash is capped at both ends. When elevated shelf is attached to a wall, 12" stainless steel "Z" clips and clear silicon caulking that will withstand 190° F. temperature water are used in order for shelf to be attached to wall. Elevated shelf on mobile units is never attached to wall regardless of location.
 5. A minimum of ½" of insulation is required to separate heat lamps and shelf when lamp is installed underneath shelf.
- U. Sinks
1. Sinks are of the size called for, constructed of 14 gauge stainless steel, type 304 (18-8), #4 finish. Backs, bottoms and fronts shall be formed of one continuous sheet with ends welded in place. Compartment sinks have double wall partitions of same material as sink.

2. Vertical and horizontal corners, including partition, are coved $\frac{1}{2}$ " or larger radius, electrically welded, ground smooth and polished.
3. Top edges of sinks at front and ends, except where fitted with integral type drainboards, are furnished with a $1\frac{1}{2}$ " die formed integral sanitary roll rim.
4. Across back of sinks, unless otherwise specified, there will be a 10" high backsplash at walls. When sink adjoins side walls, unless otherwise specified, there will be a 10" high sidesplash. Back and sides, where applicable, are coved up 8", returned $2\frac{1}{2}$ " on a 45° angle, turned straight back $\frac{3}{4}$ " and straight down $\frac{1}{2}$ " along wall edges to an overall height of 10". Sink attached to wall with 12" stainless steel strip (Z clips). Faucet holes are provided in backsplash 4" down from top. Faucet holes are centered over single compartment sinks and centered over partitions on multi-compartment sinks. Where roll terminates into backsplash the roll is fully welded and polished thereto. Ends of splash are fully enclosed, integrally welded, finished and polished and fully sealed by welding to meet NSF requirements unless specified otherwise. Sinks not adjacent to wall are equipped with backsplash that is fully enclosed, integrally welded, finished and polished and fully sealed by welding. Access openings are provided by the fabricator in the top and bottom of the enclosed backsplash for piping for faucets and vacuum breakers. Rubber grommets are supplied to seal between the piping and the edge of the openings to prevent corrosion between dissimilar metals.
5. Sinks are 37" high to top of roll, 34" AFF to deck and 14" deep from top of roll to bottom of compartment unless specified otherwise.
6. Bottom of each compartment is die-stamped with tapered grooves at least $\frac{1}{4}$ " deep at drain depression. Each compartment is provided with 2" lever type drain. Drain is fitted with rod lever for opening and closing drain. Each rod handle is suitably braced to bottom of sink with 16 gauge stainless steel bracket. All other components are nickel plated to match stainless steel. Drain is equipped with solid stainless steel handle assembly. Strainers are flat type made of stainless steel and snap-in. Drains have positive sealing action with heavy wall cast bronze body and self-centering face flanges.
7. Bodies are mounted on 1-5/8" O.D. tubing legs of 16 gauge stainless steel and fitted with stainless steel bullet type adjustable feet. Legs are mounted with 16 gauge stainless steel fully enclosed gussets fully welded to the sink bottom. See Pipe Stands and Frames and Feet sections.
8. Crossrails are 1-5/8" O.D. stainless steel tubing located 12" from floor; running front to back on legs forming a "H" frame unless specified otherwise. See Pipe Stands and Frames section. Locate crossrails to the front of the sink compartments. Coordinate height of crossrails and location of legs to avoid interference with sink heater controls.
9. All three-compartment sinks with drainboards longer than 27" to have six (6) legs unless specified otherwise. All three-compartment sinks with drainboards 27" or shorter to have four (4) legs mounted underneath sink body at corners. All drainboards longer than 27" require legs. If sink heater is specified for three-compartment sink with drainboards longer than 27", crossrail is located in front of drainboard adjacent to sink heater and rear of drainboard opposite of sink heater. If sink heater is not specified for three-compartment sink with drainboards longer than 27", crossrails are located at rear of drainboards.
10. In compartment with a sink heater, move the sink drain toward the side opposite the heater.
11. All three compartment sinks have 24" X 27" compartments with an overall width of $31\frac{1}{4}$ " unless specified otherwise. Compartment size must accommodate 18" X 26" sheet pans for total immersion.
12. Overall length and width is noted in the Itemized Specifications.
13. Bracing and sound deadening are the same as for table top.
14. Sound deadening pads are furnished on underside of sink compartments and drainboards.
15. Coordinate with Plumbing Contractor for location of faucet and vacuum breaker and provide knock-outs for same.
16. Provide rubber grommets for openings through which plumbing lines are routed to prevent dissimilar metal from touching. Label and deliver to Plumbing Contractor for installation.

V. Sink Inserts

1. Sink inserts are fabricated with no visible seams, size as called for, and constructed of 14 gauge stainless steel.
 2. Sinks are welded integral with counter tops with no lap between.
 3. Corners, partitions, bottoms and drains, sound deadening, etc., as specified under section entitled "Sinks".
- W. Sink Drainboards
1. Drainboards are constructed of same material as sinks and welded integral to same. Drainboards to have 1½" high rims with die formed integral rolled edges to match sink edges. Horizontal and vertical corners are coved on a ¼" or larger radius, electrically welded, ground and polished to a #4 finish. Solder filling of these corners is not acceptable. Drainboards are pitched to properly drain into sink. (Minimum pitch in top of drainboards is 1/8" per foot from end of drainboard to sink compartments).
 2. Across backs and ends against walls or high fixtures, drainboards have a 10" high backsplash and sidesplash, when applicable, to match splash of sink compartment. Backsplash and sidesplash, when applicable, are welded integral with splash of sink compartment with ends fully enclosed, integrally welded, finished and polished and fully sealed by welding. Attached to wall with 12" stainless steel "Z" clips. See description for exposed backsplashes and sidesplashes this Section for specifications for drainboards not attached to wall.
 3. Sink and drainboards are constructed so that the rolled rims on drainboards are continuous and at the same height of 34". Where drainboards are longer than 27" in length, they are supported on pipe legs of same material as used for sink legs and cross braced above the floor with pipe rail. See Pipe Stands and Frames section.
 4. Drainboard underbracing is 1½" x 1½" x 1/8" 14 gauge, type 304 stainless steel stud bolted to top. Sound deadening pads applied between angles and top and on underside between angles.
- X. Edges
1. Bull nose edge.
 2. Standard table edge.
 3. Flat turndown edge.
 4. Standard roll rim edge.
 5. Rolled table edge.
- Y. Back, Sidesplashes
1. Back and sidesplashes cove up per drawings and specifications, return 2½" on a 45° angle, turn straight back ¾" and turn straight down ½". If adjacent to wall and non-mobile, attach to wall with 12" stainless steel strip (Z clips).
 2. Sides of sidesplashes and ends of sidesplashes are fully enclosed, integrally welded, finished and polished and fully sealed by welding to the top to meet NSF requirements unless specified otherwise. Use of silicon cannot be used to seal sidesplash on the outside but is one continuous piece. Sidesplash adjacent to wall is coved up 8", returned 2½" on a 45° angle, turned straight back ¾" and turned straight down ½" to an overall height of 10" and attached to wall with 12" stainless steel strip (Z clips). End is fully enclosed, integrally welded, finished and polished and fully sealed by welding to the top.
 3. Ends of backsplash are fully enclosed, integrally welded, finished and polished and fully sealed by welding to the top to meet NSF requirements unless specified otherwise.
 4. Backsplash and sidesplashes for mobile equipment or equipment not adjacent to wall are fully enclosed, integrally welded, finished and polished and fully sealed by welding to the top and sides to meet NSF requirements unless specified otherwise. Use of silicon cannot be used to seal splashes on the outside but is one continuous piece. Access openings are required in fully enclosed backsplash by the fabricator through the top and bottom of the backsplash for equipment requiring piping for faucet and vacuum breaker. When applicable, removable 16 gauge, Type 304, 18-8 stainless steel enclosure panel (skirt) is supplied and installed at back of equipment below backsplash to cover exposed electrical and plumbing connections. Equipment attached to wall with "Z" clips does not have an enclosed backsplash but backsplash is turned down next to wall ½". End is fully enclosed, integrally welded, finished and polished and fully sealed by welding to the top.

5. All fully enclosed backsplashes and sidesplashes extend down to counter or table top or below in order to cover all underbracing.
 6. In instances where backsplashes and sidesplashes are attached to the walls and are not fully enclosed, exposed underbracing is 14 gauge, type 304 stainless steel.
- Z. Casters
1. All casters are 5" with brake unless specified otherwise.
- AA. Field Joints
1. Field joints are located for practical construction, consistent with sizes convenient for shipping and accessibility into building.
 2. Field joints in tops are carefully sheared so they can be tightly butted and joined together to form an integral unit to match balance of equipment.
 3. Field joints and butte joints are heli-arc welded, ground and polished smoothly. These joints are made by the approved fabricator.
- BB. Refrigeration Service
1. Refrigeration service includes start-up and all parts; service, parts, mileage, transportation and labor warranty for one year from the date of final acceptance by the Owner and a five year non-prorated compressor replacement warranty from the date of final acceptance by the Owner.
- CC. Painting
1. All fixtures, unless made of stainless steel, are finished with hammertone grey paint of the highest quality, air-dried and applied in accordance with the manufacturer's direction.
- DD. Joints, Finishes and Trim Strips
1. All equipment is formed of one piece of material wherever possible, with due regard to shipping and erection.
 2. All joints, where necessary, are homogeneously welded by electric fusion metal arc, using welding rod of same composition as material being welded, ground smooth and polished to an invisible joint to match adjoining surfaces.
- EE. Definition
1. "Fully" is defined as continuously. Stainless steel gussets are fully (continuously) welded.
- FF. Sealing
1. Any gaps or crevices such as the seam between under bracing and top are fully (continuously) sealed with sealant as described in this Section.
 2. Supply and install rubber grommets for all openings through which dissimilar metals pass such as piping for disposal vacuum breaker in soiled dish table.
- GG. Coordination
1. Provide copy of specification sheet or shop drawing for integral equipment such as dish machine, waste system, disposal, booster heater, etc. to fabricator for use in preparing submittal drawings.
- HH. Approved Fabricators
1. Fabricators which are pre-approved for construction of stainless steel custom fabrication (serving line equipment excluded) are:
 - a. **Advance Tabco**
 - b. **Atlanta Custom Fabricators, Douglasville, GA**
 - c. **Commercial Stainless Fabricators, Marietta, GA.**
 - d. **Low Temp Manufacturing, Jonesboro, GA.**
 - e. **Kalthoff, Knoxville, TN**
 - f. **Titan Stainless, Pageland, SC**

2.03 GENERAL MANUFACTURING NOTES FOR ALL EQUIPMENT

- A. Water inlets are located above positive water level to prevent syphoning of liquids into the water system. Wherever conditions require a water inlet placed below the water level, Food Service Equipment Contractor supplies suitable type of vacuum breaker or back flow prevention device for the fixture to form part of same to prevent siphoning; labels and delivers to Plumbing Contractor for

installation. Food Service Equipment supplier is required to furnish back flow prevention device as required by the Public Health Department for any piece of equipment supplied. It is noted that Public Health Departments usually require back flow prevention device on water inlet for Convection Combo type units. All back flow prevention devices must be acceptable to the Public Health Department.

- B. Food Service Equipment Contractor supplies all faucets, spray and hose units with mixing valves and cross flow prevention devices if supply through unit is hot and cold water and all hose and spray units with back flow prevention devices. Face for all spray units is stainless steel. See description of Faucets, Valves and Fittings this section. Parts are labeled and delivered to Plumbing Contractor for installation.
- C. Suitable pipe slots are provided through all undershelves to accommodate necessary service lines. These slots are proper size and are neatly made with turned up edges on all four sides to eliminate cutting or defacing of equipment on job. Cabinet bases are provided with an inner panel duct at ends or rear of cabinet to allow enclosed vertical and horizontal pipe space to conceal the vertical and horizontal piping.
- D. All hardware, including that used for refrigerators, is heavy-duty cast type and arranged for locking device. Mounting screws are stainless steel or non-corrosive. Hardware is specifically selected for the particular use to which each piece is intended. Mastic required between non-similar metals to prevent rusting.

PART 3 EXECUTION

3.01 EQUIPMENT DELIVERY

- A. Equipment is not to be delivered, removed from crates, set-in-place for final connections until as a minimum all painting has been completed; ceilings, hood and ventilation duct work are in place; floor is cleaned; and all rough-in connections are in place. Site must be ready for final connections

3.02 INSTALLATION

- A. Where there are gaps or spaces over 1/8" between walls and equipment, at tops of backsplashes, between adjoining pieces of equipment, etc., necessary trim strips are furnished for the proper finishing in installation. Necessary measurements for trim strips are taken during the time of installation in order to afford proper fit. Wall trim is made generally from 22 gauge Type 304, 18-8 stainless steel, broke to provide a tight fit. Trim is attached to backsplash (metal) with adhesive. Exposed fasteners may not be used to attach trim to metal backsplashes. In all other instances stainless steel fasteners may be used to attach trim to walls and equipment if equipment finish is stainless steel. Non-corrosive fasteners are required if equipment finish is not stainless steel. Fasteners supplied and installed by other contractors to attach conduit and other materials to the Food Service Equipment must meet the preceding specifications. Trim is sealed to wall and equipment with clear silicone caulking; see installation requirements this Section.
- B. Install closure plates and strips where required, of same material as equipment with joints coordinated with units of equipment. Joints are sealed with clear silicon caulking; see description of caulking types, this Section.
- C. Install insulation where indicated by industry standards and sealants and gaskets all around each unit and penetration or as required to make joints air-tight, waterproof, vermin-proof and sanitary for cleaning purposes. In general, clear silicon caulking is the sealant. In general, make sealed joints not less than 1/8" wide and stuff with backer rod to shape sealant bead properly, at 1/4" depth. Shape exposed surfaces of sealant slightly concave, with edges flush with faces of material at joint. Anchor gaskets mechanically or with adhesives to prevent displacement.
- D. Conduit seal-offs required for penetrations into walk-in cooler/freezer.
- E. Mastic is required between fasteners and equipment or trim and equipment when non-similar metals are used to prevent rusting through electrolysis. Rubber grommets are required where plumbing lines and connections penetrate splashes to prevent corrosion. Food Service Equipment Contractor supplies, labels and delivers rubber grommets to Plumbing Contractor for installation.

- F. All single or multiple compartment sinks and tables with single or multiple compartment sinks are attached to the wall with 12" stainless steel strips (Z clips) and sealed with clear silicon caulking if located adjacent to wall.
- G. Top shelf on all shelving and shelving/platform units unless noted otherwise is installed even with the top of the posts.
- H. Air curtain devices shall be adjusted to regulate the velocity and volume of air at the air outlet for the purpose intended.
- I. One hundred percent clear silicone caulking approved for use with food and rated to withstand temperatures up to 400° F. is used when caulking comes in contact with 190° F. water. General Electric sealant SCS 1000 and SCS 1200 and Component Hardware Silicone Sealer are the standards.
- J. Caulking required with glass, copper, mill finish aluminum, galvanized steel, many plastics, stone, concrete and masonry finishes and rated to withstand temperatures up to 400° F. is General Electric sealants, Silglaze N or Gesil N depending upon the cure time required and the color specified. These sealants are only used with non-food contact surfaces. Examples: Floor level, trim at dish room openings and pass-thru openings.
- K. Light fixtures over the door frames of walk-in refrigeration boxes are installed at a height sufficient to accommodate installation of strip curtains, if specified.
- L. All thermometers, timers, thermostats for all equipment is tested and calibrated to proper operating conditions.
- M. The equipment under the hood is positioned to allow for proper capture. Refer to drawings. Food Service Equipment Contractor is responsible for coordinating with all other contractors the proper locations of service connections under the hood to maintain floor space for equipment and the space in front of and behind or between the equipment under the hood as shown on the Food Service Equipment (Kitchen) Plan.
- N. Food Service Equipment Contractor is responsible for coordinating the placement of the hood to maintain working aisle spaces.
- O. If sprinkler heads are installed inside walk-in cooler/freezer box, Food Service Equipment Contractor is responsible for insulating and sealing penetrations properly to prevent condensation and ice formation.

3.03 QUALITY AND GUARANTEE

- A. All equipment is guaranteed by the Food Service Equipment Contractor to be free from defects in workmanship and/or material for a period of one (1) year from the date of substantial completion of same by the Architect and Owner. This guarantee covers replacement of defective material at Food Service Equipment Contractor's expense, including parts, mileage, service, transportation and labor, but it does not cover any cost whatsoever for replacement of parts or work made necessary by carelessness or misuse of equipment. All Refrigeration units have a five (5) year non-prorated replacement warranty on the compressor from the date of substantial completion of same by the Architect and Owner. Extended warranties are specified in the Itemized Equipment Specifications, this Section.

3.04 TESTING AND START-UP INSTRUCTIONS

- A. After all utility connections to equipment have been made by other contractors, Food Service Equipment Contractor starts-up, adjusts, levels and calibrates all equipment. Calibrate all thermometers, timers, and thermostats. After start-up and adjustment Food Service Equipment Contractor conducts final test of equipment before requesting first inspection by Architect and his Food Service Equipment Consultant.
- B. Delay start-ups of food service equipment until service lines have been tested, balanced, and adjusted for pressure, voltage and similar considerations, and until water and steam lines have been cleaned and treated for sanitation by other Contractors.

- C. Test each item of operational equipment to demonstrate that it is operating properly, and that controls and safety devices are functioning. Repair or replace equipment which is found defective in its operation, including units which are below capacity or operating with excessive noise or vibration.
- D. Walk-in Cooler/Freezer refrigeration systems to be run **five consecutive** days prior to equipment demonstrations.

3.05 MANUALS FOR OWNER

- A. Food Service Equipment Contractor, upon completion of work, to deliver to the Architect's Food Service Consultant for review three (3) sets of Operation and Maintenance Manuals. Manuals to include the following information:
 - 1. Warranty statement indicating date of start-up for equipment.
 - 2. Names and addresses of manufacturers supplying the equipment.
 - 3. List of authorized service agencies including name, address and telephone number.
 - 4. Service information organized in a chart format including item description, manufacturer, model, electrical and mechanical characteristics, and serial number.
 - 5. Specification sheets on all items of equipment marked as supplied. Any variations from the original specifications to be noted.
 - 6. Operation and Instruction manuals for each item of equipment including information on the care of finished surfaces.
 - 7. As built shop drawings for all custom equipment.
 - 8. Floor plan, plumbing and electrical rough-in drawings and equipment schedule marked as built. Show any variations from the original drawings.
- B. Organize and assemble all information into three individual hardback vinyl loose-leaf binders properly identified and indexed by manufacturer. Binder to include two pocket folders for folded sheet information. Mark the appropriate identification on both the front and spine of each binder. Binder for site has identification as such on the front and spine.
- C. Organize drawing sheets into manageable sets, bind with durable paper cover sheets and print suitable titles, dates and other identification on cover of each set.
- D. Manuals are assembled and ready to use during demonstration and training.
- E. After review and approval of manuals by Food Service Equipment Consultant, manuals are transferred to Owner or Owner's representative.

3.06 GENERAL OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Food Service Equipment Contractor shall furnish qualified representatives to instruct and demonstrate to the Owner's Personnel, at project site, the proper operation, care and maintenance of all equipment involved including the care of finished surfaces. The dates and times of the demonstration shall be coordinated with the Owner's Personnel. Food items supplied by the Owner are prepared during training by the food service employees utilizing the equipment. Food Service Equipment Contractor identifies to the Owner the food items and supplies required for training at least one week before the scheduled training date. All equipment to be demonstrated must be fully operable before training; all final connections must be made and start-up and adjustment completed.
- B. It is noted that for the purposes of scheduling that all contractors must be completed with their work with-in the kitchen and or serving area prior to equipment demonstration and training.
- C. As part of this instruction, provide a review of the information assembled in the Operation and Maintenance Manuals and the following items which are not inclusive:
 - 1. Maintenance Manuals
 - 2. Operation Manuals
 - 3. Tools
 - 4. Spare parts and materials
 - 5. Lubricants
 - 6. Fuels
 - 7. Identification system
 - 8. Control sequences

9. Hazards
 10. Cleaning
- D. For operational equipment also demonstrate:
1. Start-up
 2. Shut-down
 3. Emergency operations
 4. Safety
 5. Effective energy utilization
- E. Review maintenance and operations in relation with applicable warranties.
- F. The Food Service Equipment Contractor shall provide a qualified representative to be on site during demonstration and training of all equipment.
- G. Provide one copy of an operation and maintenance video for each piece of equipment, if available. Videos become the property of the Owner.
- H. Submit written documentation, signed by the personnel receiving instruction, that training was received with the date it was given. Submit written documentation that keys were transmitted to Owner.

3.07 FINAL CLEANING

- A. General: Provide final cleaning of all equipment both inside and outside. Comply with manufacturers' instructions for cleaning operations. Final cleaning of the food service equipment by the Food Service Equipment Contractor is not scheduled until all contractors other than Food Service Equipment Contractor have completed their work. Food Service Equipment Contractor and General Contractor shall coordinate timing of the final cleaning to allow sufficient time for the Food Service Equipment Contractor to complete his final adjustments; to schedule inspection by the Architect and his Food Service Consultant; and to schedule training of the Food Service employees. The preceding must occur before training is scheduled and Owner occupies the kitchen.
- B. Remove protective coverings and labels which are not required as permanent labels.
- C. Clean glazed materials, including glass shelves and sneeze guards, to a polished condition, removing substances which are noticeable as vision-obscuring materials. Replace any broken glass.
- D. Clean exposed exterior and interior hard-surfaced finishes, including metals, painted surfaces, plastics, special coatings, and similar surfaces, to a dirt-free condition, free of dust, stains, films and similar noticeable distracting substances. Restore reflective surfaces to their original reflective condition.
- E. Replace work which cannot be successfully restored.
- F. Polish exposed metal surfaces and touch-up painted surfaces.
- G. Boil out fryers.
- H. Clean the interior and exterior of all the food service equipment to a condition of sanitation ready and acceptable for intended food service use.
- I. It is the sole responsibility of Food Service Equipment Contractor to protect all food service equipment with coverings, to maintain clean status of equipment between cleaning and occupancy. Protective coverings are removed immediately before Owner occupies the area.
- J. Cleaning is completed by General and Food Service Equipment Contractors before requesting first inspection by Architect and his Food Service Equipment Consultant.

3.08 PREREQUISITES TO SUBSTANTIAL COMPLETION

- A. Complete the requirements included in this Section.
- B. Submit Operation and Maintenance Manuals to Food Service Consultant for review.
- C. Submit Record Document for Architect/General Contractor.
- D. Deliver physical items such as unattached accessories to Owner.
- E. Transmit keys to Owner. Each key is labeled by description and Item Number.

- F. Complete start-up, adjustment, leveling and calibration of all equipment.
- G. Conduct final test of equipment.
- H. Complete final cleaning requirements.
- I. Complete operating and training requirements.
- J. Request first inspection by Architect and his Food Service Consultant.
- K. From receipt of written first inspection report prepared by Architect and his Food Service Consultant, Food Service Equipment Contractor has ninety days to complete corrections. Notification of receipt is made to Architect and his Food Service Consultant by Food Service Equipment Contractor. At the end of the ninety day period, if final inspection by Architect and his Food Service Consultant has not been scheduled by the Food Service Equipment Contractor, AIA procedures for correction of the deficiencies by others at the expense of the Food Service Equipment Contractor may be initiated.

3.09 PREREQUISITES TO FINAL ACCEPTANCE

- A. Submit to Architect copy of Architect's and his Food Service Consultant's first and/or prior inspection report of itemized work to be completed or corrected, stating that each item has been corrected or otherwise resolved for acceptance. At same time, request a final inspection by Architect and his Food Service Consultant.

3.10 RECORD DOCUMENT SUBMITTAL

- A. Record documents shall include the following:
 - 1. Provide one (1) set of as-built shop drawings including floor plan, dimensioned electrical and mechanical rough-in drawings and equipment schedule; as-built shop drawings showing elevations, cross-sections, and details of all custom equipment as provided with the submittals. Give particular attention to concealed work which would be difficult to measure and record at a later date. Note any deviations from the original drawings and specifications. Note related change order numbers where applicable.
- B. Submit directly to Architect and/or General Contractor as required.

3.11 EQUIPMENT SCHEDULE

ITEM 1 AIR CURTAIN Quantity: 1

Manufacturer: Mars

Model: STD242-1U

Electrical: 120/60/1

Description:

- 1. General Contractor to provide knock-out in door frame for wiring to micro switch for control wiring to be run in conduit concealed in wall above door. Food Service Equipment Contractor to coordinate with door supplier. See detail.
- 2. Air Curtain to be ordered with junction box on top of unit.

Options/Accessories:

- 1. Automatic door switch, plunger type for automatic on/off control.
- 2. Provide remote on/off throw toggle switch (99.033). Switch to be surface mounted at location as shown on drawings.
- 3. Color to be Pearl White.

ITEM 2 JAN SINK (By Other Trades) Quantity: 1

ITEM 3 SHELVING, CHEMICAL STORAGE Quantity: 1

Manufacturer: Amco

Acceptable Manufacturer: InterMetro

Model: Amco II Wire
(4) A1836PG
(4) P72PG

Description:

1. Units consist of four (4) shelves; bottom shelf is 8" from the floor. Provide equal spacing between shelves. The overall height is 72"

ITEM 4 3-COMP. SINK Quantity: 1

Manufacturer: Advance Tabco

Acceptable Manufacturers: Eagle or Custom, Reference 2.2 H.H. for list of Approved Fabricators.

T & S Brass & Bronze Works

Size: 97" Overall Length
Drain board Length - 18"

Model: 94-63-54-18RL

Description:

1. 14 gauge type 304 stainless steel with 11" high back splash.
2. 1-5/8" diameter tubular stainless steel.
3. Stainless steel gussets and channels.
4. Stainless steel 1" adjustable bullet feet.
5. NSF certified,

Installation:

1. Sink to be attached to wall at rear turn-up. Attach sink with stainless steel fasteners appropriate for wall type.

Options/Accessories:

1. Left side of 3-compartment sink to have 11" side splash.
2. Provide each sink compartment with a lever operated drain with overflow and lever drain support bracket.
3. Provide one (1) T & S Brass and Bronze Works Model #B-0230LN Swivel Base Faucet with #068X 18" swing nozzle. Faucet to include 1/2" IPS CC male inlets and #B-230-K installation kit.

ITEM 5 POT RACK, WALL MOUNTED Quantity: 1

Manufacturer: Advance Tabco

Acceptable Manufacturers: Eagle or Custom (reference 2.2, H.H. for list of Approved Fabricators).

Model: SW-84

Standard Features:

1. 2" x 1/4" flat stainless steel bar 84" in length, all welded construction
2. Provide eighteen (18) pot hooks.

Options/Accessories:

1. Install wall rack using stainless steel fasteners appropriate for wall type.

ITEM 6 STAINLESS STEEL WALL PANEL Quantity: 1

Manufacturer: Custom, reference 2.2 H.H. for list of Approved Fabricators

Description:

1. Provide and install Type 304, 18-8, 22 gauge stainless steel panels on walls as shown on drawings.
2. Attach panels to masonry partitions with mastic cement (liquid nail) and stainless steel fasteners appropriate for wall type.
3. Caulk around panel edges and butt joints with clear silicon sealant.
4. Reference drawing 10/FS300.

ITEM 7 SHELVING, POT & PAN DRYING Quantity: 2

Manufacturer: Amco

Acceptable Manufacturer: InterMetro

Model: Amco II Wire
(4) A2148PG
(4) P72PG
(4) AC2S, Casters

Description:

1. Units consist of four (4) shelves; bottom shelf is 8" from the floor. Provide equal spacing between shelves. The overall height is 72"

ITEM 8 HAND SINK Quantity: 3

Manufacturer: Advance Tabco

Acceptable Manufacturers: Eagle or Custom (reference 2.2 HH. for list of Approved Fabricators)

Model: 7-PS-66

Features:

1. Side splash shields.
2. Stainless steel basket drain.
3. Splash mounted gooseneck faucet with aerator.

Options/Accessories:

1. Chrome plated P-trap.
2. Wrist Handles in lieu of standard handles.

ITEM 9 WALL SHELF Quantity: 3

Manufacturer: Advance Tabco

Acceptable Manufacturers: Eagle or Custom Fabricated (reference 2.2 HH. for list of Approved Fabricators)

Model: WS-10-24

Size: 10" x 24"

Description:

1. Mount securely to wall above Hand Sink #28 as shown on plan approximately 60" AFF.
2. Mount with stainless steel fasteners, type appropriate for wall type.

ITEM 10 PAPER TOWEL DISPENSER (By Owner's Vendor) Quantity: 3

ITEM 11 PREP TABLE Quantity: 1

Manufacturer: Custom, reference 2.2 H.H. for list of Approved Fabricators.

T & S Brass and Bronze Works

Size: Length is 96" x 30" wide x 34" high.

Description:

1. Table is free-standing.
2. Top to be 14 gauge stainless steel, bull nose marine edges at free sides.
3. 8" back splash.
4. Provide one (1) 20" x 20" 14 ga. stainless steel sink, 14" deep with lever handle drain and rear connected overflow, provide 16 ga. stainless steel bracket to support drain handle.
5. One double stack of drawers, located as shown on the drawing. Top drawer is 20" x 20" x 5" deep and bottom drawer is 20" x 20" x 10" deep. Drawers enclosed in 18 ga. stainless steel cabinet secured to the underside of the table.
6. Double pan drawer fronts with full length, integral formed hand pull.
7. Provide 18 gauge stainless steel removable undershelf, location as shown on drawings.
8. See "Fabricated Equipment" and "General Manufacturing Notes for All Equipment" in this specification section.
9. Reference drawing elevation 2/FS300.

Options/Accessories:

1. Provide one (1) T & S Brass and Bronze Works Model #B-0230LN Swivel Base Faucet with 18" Double Joint Swing Nozzle. Faucet to include 1/2" IPS CC male inlets and #B-230-K installation kit.
2. Label faucet assembly and deliver to Plumbing Contractor for installation.

ITEM 12 WALL SHELF Quantity: 2

Manufacturer: Advance Tabco

Acceptable Manufacturers: Eagle or Custom Fabricated (reference 2.2 HH. for list of Approved Fabricators)

Model: WS-10-36, modified to 30"

Size: 10" x 30"

Description:

1. Mount securely to wall above Prep Table 11 as shown on plan approximately 60" AFF.
2. Mount with stainless steel fasteners, type appropriate for wall type.

ITEM 13 ICE MACHINE W/ BIN Quantity: 1

Manufacturer: Hoshizaki

Model: F-450MAJ-C with B300SF Bin.

Electrical: 120/60/1

Features:

1. Stainless steel exterior.
2. Stainless steel auger with greaseless bearings.

Options/Accessories:

1. B300SF Bin, stainless steel exterior finish and 6 " high stainless steel legs..
2. Supply cord and plug. Verify type, label and deliver to Electrical Contractor to install.
3. Start-up and adjust by authorized service agency.
4. H-9320-51 water filter.
 - a. Label and deliver filter to Plumbing Contractor for installation.
 - b. Mount to allow 3" clearance below filter cartridge.
 - c. Provide two (2) additional cartridges.
 - d. Provide San Jamar S19000 Saf-T-Ice ice scoop holder with 64 oz. scoop. Install ice scoop holder to bin with adhesive strips.

ITEM 14 REFRIGERATOR, REACH-IN Quantity: 1

Manufacturer: True

Model: T-23-HC

Electrical: 120/60/1

Description:

1. Exterior: Stainless steel front, anodized aluminum ends, back and top.
2. Interior: NSF approved, clear coated aluminum liner with stainless steel floor.
3. Bottom mounted condensing unit.
4. Door: Stainless steel exterior with white aluminum liner.
5. Door locks.
6. Interior lighting with safety shield.
7. Exterior temperature display.
8. 4" diameter castors with locks on front set.

Options/Accessories:

1. Door hinged as shown.
2. Full door bun tray rack holding up to 22. 18" x 26" sheet pans.

ITEM 15 WORK TABLE Quantity: 3

Manufacturer: Advance Tabco

Acceptable Manufacturers: Eagle or Custom, reference 2.2 H.H. for list of Approved Fabricators.

Size: 48" long x 30" wide x 35" high, with 5" back splash.

Model: KSS-304

Standard Features:

1. Stainless steel top, undershelf, and legs.

Options/Accessories:

1. TA 25 casters, brakes on all casters.
2. One (1), NS-2020 stainless steel drawer units. See drawings for draw unit locations.
3. PT-10S-48 over shelf; 10" deep x 48" long, splash mounted supports.

ITEM 16 SHELVING, GENERAL STORAGE Quantity: 1

Manufacturer: Amco

Acceptable Manufacturer: InterMetro

Model: Amco II Wire
(4) A2136PG
(4) P72PG

Description:

1. Units consist of four (4) shelves; bottom shelf is 8" from the floor. Provide equal spacing between shelves. The overall height is 72"

ITEM 17 SHELVING, GENERAL STORAGE Quantity: 1

Manufacturer: Amco

Acceptable Manufacturer: InterMetro

Model: Amco II Wire
(4) A2142PG
(4) P72PG

Description:

1. Units consist of four (4) shelves; bottom shelf is 8" from the floor. Provide equal spacing between shelves. The overall height is 72"

ITEM 18 SOILED DISHTABLE Quantity: 1

Manufacturer: Reference 2.2 HH. for list of Approved Fabricators

Model: Custom

Size: Size and shape as shown on the drawing, reference Architectural drawings for wall dimensions.

Description:

1. See "Fabricated Equipment" and "General Manufacturing Notes for All Equipment" in this specification section.
2. All stainless steel.
3. Table fabricated to fit specified dish machine at load end.
4. Where dish table abuts wall provide an integral 10" high splash with 2" return on a 45° slope. Ends are closed, welded, ground, and polished.
5. Table secured to wall with 12" long stainless steel "Z" clips mounted at 24" OC.
6. Table mounted on 1-5/8" OD stainless steel legs with similar cross bracing on a maximum of 72" centers. Legs are attached to fully enclosed stainless steel gussets welded to the under bracing and secured with setscrews.
7. Provide horizontal cross rails fully welded, ground and polished at joints. Cross rails must be positioned to avoid equipment under the tables. Move cross rail to the front when they interfere with rear plumbing utilities.
8. Where shown, soiled dish table shall be provided with an integrally welded 20" x 20" x 5" deep 14 ga. stainless steel pre-wash sink with all corners coved on a 3/4" radius. Sink to have die stamped drain star in the bottom and 1-1/2" removable basket drain. Pre-wash sink complete with removable 18" ga. stainless steel perforated scrap basket with 1-7/8" stainless steel legs and rack handle slides flush with the top of the sink.
9. As indicated in the General Requirements, Section 11400, measurements are made from wall to wall and

- an allowance not greater than 1/4" must be used for fit.
10. Reference Details.

ITEM 19 PRE-RINSE/ HOSE REEL Quantity: 1

Manufacturer: Fisher Manufacturing Company

Acceptable Manufacturer: T&S

Description:

1. 1801 Reel Rinse Control Unit.
2. 2985 Closed Reel Rinse, wall mounted, 30' hose with insulated hose handle and spray valve.
3. Label and deliver to Plumbing Contractor for installation.
4. All exposed pipes, elbows, and fittings to be chrome plated.
5. Note: During demonstration, adjust height of spray nozzle off working surface of soiled dish table per Owner's requirements.
6. Reference drawing detail 4/FS300.

Options/Accessories:

1. One (1) vacuum breaker #84867.
2. Four (4) wall brackets with rods #2902.

ITEM 20 STAINLESS STEEL WALL PANEL Quantity: 1

Manufacturer: Custom, reference 2.2 H.H. for list of Approved Fabricators

Description:

1. Provide and install Type 304, 18-8, 22 gauge stainless steel panels on walls as shown on drawings.
2. Attach panels to masonry partitions with mastic cement (liquid nail) and stainless steel fasteners appropriate for wall type.
3. Caulk around panel edges and butt joints with clear silicon sealant.
4. Reference drawing 3/FS300.

ITEM 21 DISH MACHINE Quantity: 1

Manufacturer: Hobart

Model: AM15 TALL

Electrical: 208-240/60/3

Description:

1. High temperature door-style dishwashing machine.
2. Automatic fill.
3. Door actuated start.
4. Automatic drain closure.
5. Vent fan control.
6. Delime cycle.
7. Service diagnostics.
8. Hot water sanitation.
9. 3/4" pressure regulator valve.

Options/Accessories:

1. 70 degree F rise electric booster heater.
2. Single point electric kit.
3. Drain water tempering kit.

4. Water hammer arrestor kit.
5. Dish Racks
 - (6) Cambro PR59314 racks, Carilisle or Vollrath equivalent.
 - (2) Hobart Bun Pan Racks
 - (2) Hobart open ended peg racks

ITEM 22 CONDENSATE HOOD (by other trades) Quantity: 1

ITEM 23 DISH RACK DOLLY Quantity: 2

Manufacturer: Advance Tabco

Acceptable Manufacturers: Eagle or Custom (reference 2.2 HH. for list of Approved Fabricators)

Model: GRD-1

Description:

1. 20-1/2"W x 20-1/2" D x 5-1/4" H, single stack welded aluminum frame.

ITEM 24 CLEAN DISHTABLE Quantity: 1

Manufacturer: Reference 2.2 HH. for list of Approved Fabricators

Model: Custom

Size: Size and shape as shown on the drawing, reference Architectural drawings for wall dimensions.

Description:

1. See "Fabricated Equipment" and "General Notes for All Equipment" in this specification section.
2. All stainless steel.
3. Table fabricated to fit specified dish machine at unload end.
4. Where dish table abuts wall provide an integral 10" high splash with 2" return on a 45° slope. Ends are closed, welded, ground, and polished.
5. Table secured to wall with 12" long stainless steel "Z" clips mounted at 24" OC.
6. Table mounted on 1-5/8" OD stainless steel legs with similar cross bracing on a maximum of 72" centers. Legs are attached to fully enclosed stainless steel gussets welded to the under bracing and secured with setscrews.
7. Provide horizontal cross rails fully welded, ground and polished at joints. Cross rails must be positioned to avoid equipment under the tables. Move cross rail to the front when they interfere with rear plumbing utilities.

ITEM 25 WALK-IN COOLER/ FREEZER Quantity: 1

Manufacturer: Thermo-Kool

Model: Walk-Ins are prefabricated, precision-formed and modular.

Electrical:

Cooler Condensing Unit: 208-230/60/3
Cooler Evaporator: 120/60/1
Freezer Condensing Unit: 208-230/60/3
Freezer Evaporator: 208-230/60/1

Refrigerant:

Cooler: Meet CFC reduction regulations
Freezer: Meet CFC reduction regulations

Size: Nominal 8'-6" high

Verify overall box dimensions with drawings, reference Architectural drawings for wall dimensions.

Door swings and positions must be as shown on the drawing.

All specifications apply to cooler and freezer unless indicated otherwise.

Panel Wall Construction:

Each panel shall consist of inner and outer metal pans, precision-formed on steel dies, and securely fastened to a tongue and grooved perimeter frame of high density urethane structural members. Perimeter frame to feature tongue and groove profile for positive alignment and sealing. Panels to be equipped with cam-action locking devices. The locking devices shall be operable from inside the walk-in and a wrench shall be supplied.

NSF listed section gaskets are foamed-in-place to the male side of all panels, on both interior and exterior. Gaskets are impervious to stains, greases, oils, mildew, etc. No wood or pressed board is used on panel perimeters, around door openings or for reinforcement. Provide panel sizes as required to meet size requirements. To insure exact alignment and maximum strength, corner panels shall be exact 90 degree angles and measure 12" in each horizontal exterior dimension. Doors shall be mounted in panels 46" wide. Insulation must be rigid urethane pour type, foamed-in-place with minimum of 4" thickness.

Panel Floor Construction:

Floor panels shall be similar to other panels and shall be made to withstand evenly distributed floor loads up to 600 pounds per square foot, when panel is full supported. All panels shall be connected one to another by placing the tongue of one panel into the groove of the adjoining panel, before actuating the cam-action locking device. The cam-action locking devices are to be actuated from inside the walk-in to permit erection against a wall or inside a room with close tolerances. Press-fit plug buttons shall be provided to seal wrench holes after erection is complete. Construction shall be as approved by the National Sanitation Foundation. Unit shall bear the NSF® Seal of Approval affixed to the interior of a door panel.

Floor is recessed. Coordinate recess depth so that the walk-in box flooring is no more than a ¼" above finished floor of the kitchen. Floor of walk-in cooler/freezer is not covered with kitchen finish floor system.

Common Wall Partition:

When specified or shown on drawing, walk-in shall be divided into compartments by use of insulated panels. Panels shall be constructed in accordance with specifications for all panels. Partitions in standard locations shall be foam tongue and groove construction secured in place by com-lock fasteners. All partition panels shall have foamed-in-place thermal breakers to prevent condensation and heat transfer between compartments of different temperatures.

Panel Finishes:

Metal finish of panels shall be as follows.

INTERIOR WALLS: are .040 stucco Aluminum.

INTERIOR CEILING: is .040 stucco Aluminum with white baked-on enamel finish.

INTERIOR FLOOR: 16-gauge stainless steel.

UNEXPOSED EXTERIOR WALLS, FLOOR AND CEILING: are 26 gauge stucco embossed Galvanized Steel.

EXPOSED EXTERIOR WALLS: including door section but excluding door are .040 stucco Aluminum.

DOOR: Interior and exterior is 20 gauge, Type 304 stainless steel, No. 3 finish.

Panel Insulation:

Insulation shall be 4" thick rigid urethane pour type foamed-in-place using HCFC blowing agent, with tenacious bond to inner and outer metal pans. The "K" factor (Thermal Conductivity) shall be no more than .125 B.T.U. per hour, per square foot, per inch thickness, per degree Fahrenheit. The "U" factor (Overall coefficient of heat transfer) shall not exceed .031 for 4" panels. Insulation shall be 97% closed cell to prevent moisture absorption. The "R" factor efficiency shall be 32 for 4" panels. Insulation shall be in compliance with ASTM D-1929 and shall provide a minimum self ignition temperature of 650 degrees F. Insulation shall be a listed urethane with a rating of no more than 25 for flame spread and 250 for smoke developed as per ASTM E-84.

Walk-In Door:

34" x 78" (Heavy Duty Type)

Door shall be flush-mounted, in fitting type with door panel construction the same as for other panels. Insulation shall be same thickness and type as used in other panels. Door and door section shall be listed by Underwriters Laboratories.

Door shall be hinged as shown on the drawing.

Door frame shall consist of heavy reinforced steel "U" channel around entire perimeter of opening, foamed in place to give support and rigidity to frame. An armored anti-sweat heater cable shall be run in a breaker strip located behind a removable heavy gauge stainless steel trim piece for easy access to heater cable. Heater cable shall be run under threshold consisting of a heavy reinforcement "U" channel, breaker strip and heavy gauge stainless steel threshold. Door shall be equipped with a one piece perimeter PVC accordion type removable gasket with magnetic core at the top and along the side perimeter of the door. Door to have adjustable vinyl wiper gasket for seal at threshold. Gasket to be easily replaceable and resistant to damage from oils, fats, water and detergents.

Hinges shall be cam-lift, heavy duty hinges consisting of a pressure die cast strap and flange with a brushed satin surface chrome finish. Bearing to be composed of cam and follower made of self-lubricating nylon (Zytel). Each hinge features a spring-assisted operation to facilitate closing. Three (3) hinges to be provided per door. Door hinges shall have positive "hold-open" feature allowing door to remain open unaided, when opened to 180 degree position.

Door shall be provided with adjustable hinge backup plates for each hinge. Backup plates shall be foamed-in-place behind the door leaf casing metal and shall consist of a minimum of 1/4" thick steel plate contained within a minimum 14 gauge enclosure. Adjustable hinge backing plates shall be precision drilled and tapped to accept hinge blade mounting screws and shall be designed to provide in-field adjustment of door hinges without removal of hinges or door from frame.

On all walk-ins, infitting door jamb shall be provided with thermostatically controlled warmer cables around both sides and top of opening. The warmer cables shall provide sufficient heat to prevent condensate or frost formation. Door heater has a thermostat that cuts off when it reaches a temperature of 50°F.

Door shall be equipped with contemporary design, heavy-duty, pull handle. Pull handle shall have a cylinder lock built into the handle. Latch shall be provided with inside safety release to prevent accidental or malicious entrapment in walk-in. Latch has brushed satin chrome finish. Two (2) keys are provided for lock.

34" x 78" doors to be provided with heavy-duty door closure in addition to spring-loaded hinges. Each door panel shall be equipped with a vapor proof light fixture installed in the header over the door connected to a three-way light switch with dual pilot light. Light can be turned on/off either on inside or on outside of box. Light switch over door is equipped with a pilot light which glows continuously on the inside and on the outside only when the lights are on. Concealed conduit and wiring shall be standard on each entrance door section.

A heavy gauge stainless steel threshold plate shall be provided with each door section. Separate sill

heater wire shall be provided beneath threshold.

A 2" diameter flush-mounted dial thermometer shall be included with each door section to indicate inside temperature.

Accessories and Optional Equipment:

Observation Windows:

Walk-in doors shall be provided with a nominal 14" x 14" observation window. Window glass, which shall be replaceable, will consist of hermetically sealed glass. The frame and glass are heated.

Pressure Relief Port:

A pressure relief port shall be provided to equalize atmospheric pressure inside and outside walk-in freezer caused by temperature changes due to product loading, door opening and defrost cycles. Size of cooler may necessitate heated pressure relief port. Relief port shall be provided with 115/60/1 AC. heater element to prevent freezing. In all freezer applications up through 3 H. P., a single 5" diameter relief port must be included. On all freezer applications of 4 HP and larger, two (2) or more relief ports must be provided.

Lights (Field-Mounted):

Cooler – Provide two (2) LED vapor-proof light fixtures. See drawing for location.

Freezer – Provide two (2) LED vapor-proof light fixtures. See drawing for location.

Food Service Equipment Contractor shall install fixtures for Electrical Contractor to wire to junction box provided by manufacturer. LED light fixtures are mounted to ceiling panels where shown on the drawings and are connected to a three-way light switch with dual pilot light. Pilot light glows continuously inside and is on outside of box only when lights are on. Light switch is mounted on exterior and interior door section. Electrical service required is 120 volt, 60 cycle, 1-phase. Electrical Contractor provides and installs conduit and wiring on inside ceiling of boxes. See Installation Instructions this section for additional requirements.

Vinyl Bumper Rails:

Provide and install (2) vinyl bumper rails on exposed front including door at 10" AFF and 34" AFF approximately (verify). Adjust heights to avoid interference with bicycle lock access through door handle.

Kick Plates:

Provide and install 36" high stainless steel kick plate on exterior of door.

Provide and install 36" high 3/16" aluminum tread-plate on interior of door.

Trim:

Supply and install trim made from material with same finish as exposed exterior where walk-in cooler/freezer is adjacent to walls; seal to walls and boxes for rodent, dirt and moisture protection. Attach trim to box and wall with non-corrosive fasteners and seal to wall and box with clear silicon caulking. Extend trim to height of dropped ceiling, or enclosure panel or trim and down to top of stainless steel base. Coordinate with stainless steel base on front of box and enclosure panel or trim.

Enclosure Panel:

Supply and install enclosure (made from material with same finish as exposed exterior) panel or ceiling

trim if height of box is lower than height of dropped ceiling. Enclosure panel to extend below seam between ceiling and wall panels of the walk-in. Attach panel to box with non-corrosive fasteners and seal to ceiling and box with clear silicon caulking. See Part 3, Installation

Refrigeration Systems:

Systems for cooler/freezer are for outside application and are located as shown on the Architectural drawings. Compressors are semi-hermetic. Systems are U.L. Approved and sized to maintain 34°F in cooler and -10°F in the freezer. Freezer evaporator coil defrost cycles are time initiated, temperature terminated to allow for energy efficient, cost saving defrost.

Systems are supplied with pump down cycle, weather proof (low ambient) controls and housings. Systems are built-up remote. Systems are equipped with headmaster controls for low ambient operation instead of fan cycling and crankcase heaters and pressure control valves.

Condensing units are completely factory assembled on an aluminum base. The following components are mounted and assembled by the manufacturer: Liquid line vibration absorber (eliminator); dual pressure control; head pressure control (flooding valve); suction line vibration absorber (eliminator); pre-wired electrical control panel with circuit breaker; suction line filter; liquid line drier; sight glass; crank case heater; low ambient kit; liquid and suction line kit with service valve; heavy duty channel leg base with lockable snap down hood latch; hinged weather hood. Weather hoods must be removable without the use of tools.

Weather hoods are to be manufacturer's standard hoods.

Copeland compressor/condensing units and Bohn or Russell evaporator coils are required. All work and materials are in full accordance with Local and/or State ordinances.

Installation Instructions:

Electrical Contractor will supply and run conduit and power wiring to cooler condensing unit and conduit and power wiring to freezer evaporator coil.

Electrical Contractor will supply and run conduit and control wiring from all coils to refrigeration control system. .

Electrical Contractor to supply conduit and wiring and make connections to and supply boxes provided and installed by the manufacturer for all lights, heated windows, door and sill heaters. Lights are not mounted by the factory. Food Service Equipment Contractor or approved installer to mount additional lights located on ceiling after walk-in box has been erected. Conduit and wiring for lights are supplied and installed by Electrical Contractor on the inside ceiling of the box. Electrical Contractor to provide conduit suitable for moist conditions. Conduit seal-offs are required for all electrical connections. All fasteners, etc., must be non-corrosive and mastic provided between dissimilar metals to prevent rusting. Food Service Equipment Contractor to supply and install refrigeration lines. Food Service Equipment Contractor is responsible for determining length of lines needed.

Condensation drain lines are supplied and installed by Food Service Equipment Contractor or approved installer.

Condensate heat tape shall be 208/1 and supplied by Food Service Equipment Contractor and wired into freezer evaporator by Electrical Contractor.

Installation will be performed by the Food Service Equipment Contractor or an approved professional refrigeration company with experience in the installation of walk-in Cooler/Freezer refrigeration systems. The installation includes, but is not limited to the following:

Building the box.

Setting the compressor/condensing unit assemblies.
Hanging the evaporator coils - verify locations.
Installation of all accessories unless indicated otherwise.
Installation of all refrigeration lines which includes supplying, running and connecting.
Installation of the drain lines - Verify locations; supply and install tubing.

Food Service Equipment Contractor seals and insulates all penetrations in the walk-in, regardless of who makes the penetration. Conduit seal-offs are required for all electrical connections and are supplied by the Electrical Contractor. Insulation and sealing is required between conduit and wiring and inside conduit where any type of connection or penetration is made. Food Service Equipment Contractor is responsible for informing and coordinating the use of conduit seal-offs by other contractors and for providing proper insulation and sealing for all other penetrations when conduit seal-offs cannot be used.

Perform start-up, test, check, and adjust all components and accessories and pull to proper operating temperatures. Walk-in Cooler/Freezer refrigeration systems to run for **five consecutive days** prior to equipment demonstrations.

Calibrate thermometers, etc.

Box is to be cleaned before refrigeration is started up. Cleaning includes all inside and outside surfaces.

Hard copper is required for entire job. All refrigerant piping is ACR copper tubing, hard drawn. Wrought copper sweat fittings are used on the hard-drawn tubing. Slope suction line down in direction of flow 1/8" per foot. Where vertical risers of more than 5 feet occur in a suction line, the riser is trapped at the bottom.

Refrigeration system is set for four defrost cycles as a minimum (two defrost cycles for cooler) with each cycle in defrost 30 minutes as a minimum. Defrost times are set at times other than the initial arrival of the employees or periods of heavy usage during the morning and are identified in the Operation and Maintenance Manuals. Training on re-setting defrost times is provided to Owner during training.

System is ready for use when the Owner is prepared to occupy the operation.

General Contractor Information:

Steel reinforced concrete pad for walk-in box is prepared and supplied by General Contractor. See Food Service Equipment Contractor's supplied drawings and shop drawings for dimensions. Pad area must be transit level and trowel smooth and capable of sustaining weight of box and contents.

Roof curbs (if required) are to be Food Service Equipment Contractor provided and install by the General Contractor.

All penetrations, including but not limited to, roof, wall and floor are provided by the General Contractor. Verification by the General Contractor with the Food Service Equipment Contractor as to location and size is required.

Sprinkler heads inside or over units must be loaded with a dry fire suppression substance.

Plumbing lines (supply, waste, drain, roof drain, sewer, condensation, slurry, etc.) cannot be routed over walk-in boxes.

Warranties:

1. One year parts, service, labor, mileage, time and transportation warranty on all parts supplied and

- all work performed.
2. Five year non-prorated replacement warranty for the compressor/ condensing unit assemblies.
3. Five year service and parts warranty.

ITEM 26 HALF SIZE PAN RACK Quantity: 1

Manufacturer: Advance Tabco

Acceptable Manufacturers: Eagle

Model: PR10-3ST

Standard Features:

1. Fully welded 6063-T52 extruded aluminum angles, upright tubing, and support pieces.
2. Capacity, 10 full/ 20 half size pans, 3" shelf spacing.

ITEM 27 SHELVING, WALK-IN FREEZER Quantity: 2

Manufacturer: Amco

Acceptable Manufacturer: InterMetro

Model: Amco II Wire
(4) A2148PG
(4) P72PG
Per Shelving Unit

Description:

1. Units consist of four (4) shelves; bottom shelf is 8" from the floor. Provide equal spacing between shelves.
The overall height is 72"

ITEM 28 SHELVING, WALK-IN FREEZER Quantity: 1

Manufacturer: Amco

Acceptable Manufacturer: InterMetro

Model: Amco II Wire
(4) A2142PG
(4) P72PG

Description:

1. Units consist of four (4) shelves; bottom shelf is 8" from the floor. Provide equal spacing between shelves.
The overall height is 72"

ITEM 29 SHELVING, WALK-IN FREEZER Quantity: 2

Manufacturer: Amco

Acceptable Manufacturer: InterMetro

Model: Amco II Wire
(4) A1848PG
(4) P72PG
Per Shelving Unit

Description:

1. Units consist of four (4) shelves; bottom shelf is 8" from the floor. Provide equal spacing between shelves.
The overall height is 72"

ITEM 30 SHELIVING, WALK-IN COOLER Quantity: 2

Manufacturer: Amco

Acceptable Manufacturer: InterMetro

Model: Amco II Wire
(4) A2148PG
(4) P72PG
Per Shelving Unit

Description:

1. Units consist of four (4) shelves; bottom shelf is 8" from the floor. Provide equal spacing between shelves.
The overall height is 72"

ITEM 31 SHELIVING, WALK-IN COOLER Quantity: 1

Manufacturer: Amco

Acceptable Manufacturer: InterMetro

Model: Amco II Wire
(4) A2142PG
(4) P72PG

Description:

1. Units consist of four (4) shelves; bottom shelf is 8" from the floor. Provide equal spacing between shelves.
The overall height is 72"

ITEM 32 SHELIVING, WALK-IN COOLER Quantity: 2

Manufacturer: Amco

Acceptable Manufacturer: InterMetro

Model: Amco II Wire
(4) A1848PG
(4) P72PG
Per Shelving Unit

Description:

1. Units consist of four (4) shelves; bottom shelf is 8" from the floor. Provide equal spacing between shelves.
The overall height is 72"

ITEM 33 MILK CABINET (by Owner) Quantity: 1

ITEM 34 SHELIVING, DRY FOOD STORAGE Quantity: 2

Manufacturer: Amco

Acceptable Manufacturer: InterMetro

Model: Amco II Wire
(4) A2148PG

- (4) P72PG
Per Shelving Unit

Description:

1. Units consist of four (4) shelves; bottom shelf is 8" from the floor. Provide equal spacing between shelves.
The overall height is 72"

ITEM 35 SHELIVING, DRY FOOD STORAGE Quantity: 2

Manufacturer: Amco

Acceptable Manufacturer: InterMetro

Model: Amco II Wire
(4) A2136PG
(4) P72PG
Per Shelving Unit

Description:

1. Units consist of four (4) shelves; bottom shelf is 8" from the floor. Provide equal spacing between shelves.
The overall height is 72"

ITEM 36 SHELIVING, DRY FOOD STORAGE Quantity: 1

Manufacturer: Amco

Acceptable Manufacturer: InterMetro

Model: Amco II Wire
(4) A2142PG
(4) P72PG

Description:

1. Units consist of four (4) shelves; bottom shelf is 8" from the floor. Provide equal spacing between shelves.
The overall height is 72"

ITEM 37 WORK TABLE Quantity: 1

Manufacturer: Advance Tabco

Acceptable Manufacturers: Eagle or Custom, reference 2.2 H.H. for list of Approved Fabricators.

Size: 36" long x 30" wide x 35" high, with 5" back splash.

Model: KSS-303

Standard Features:

1. Stainless steel top, undershelf, and legs.

Options/Accessories:

1. TA 25 casters, brakes on all casters.
2. One (1), NS-2020 stainless steel drawer units. See drawings for draw unit locations.
3. PT-10S-36 over shelf; 10" deep x 36" long, splash mounted supports.

ITEM 38 HEATED HOLDING CABINET Quantity: 2

Manufacturer: Cres Cor

Model: H-137-WSUA-12D

Electrical: 120/60/1

Description:

1. 22 ga. stainless steel body.
2. Drip trough.
3. 5" dia. Swivel casters.
4. Field reversable Dutch doors.
5. Solid state digital display controls.

Options/Accessories:

1. Tempered glass door windows.

ITEM 39 EXHAUST HOOD (By Other Trades) Quantity: 1

ITEM 40 RANGE Quantity: 1

Manufacturer: Vulcan

Model: 36S-6BN

Gas: Natural

Description:

1. 6 open burner range with standard oven.
2. Stainless steel front, sides, backriser, lift-off high shelf.
3. 6" stainless steel adjustable legs.
4. Heavy duty cast grates.
5. Two oven racks with four (4) rack positions.

Options/Accessories

1. Flame safety device with manual spark ignition for all open top burners and oven pilot.
2. Provide gas pressure regulator.
3. Provide T&S or Dormont quick disconnect gas hose, size as recommended by factory. Hose length as required to reach designated gas supply. Transfer to plumbing contractor for installation.
4. Provide and install Dormont Restraining Device Kit.

ITEM 41 CONV. OVEN Quantity: 1

Manufacturer: Blodgett

Model: Zephair 100-G-ES

Electrical: 120/60/1

Gas: Natural.

Size: Double.

Standard Features:

1. Stainless steel front, top, and sides.

2. Dual pane thermal glass windows.
3. Double-sided porcelainized baking compartment liner .
4. Five chrome-plated racks, eleven rack positions.
5. Electronic spark ignition control system.
6. Solid state thermostat.
7. 6" adjustable stainless steel legs.
8. Two year parts and labor warranty.
- 9.. Three year limited oven door warranty.

Options/Accessories:

1. Provide T&S or Dormont quick disconnect gas hose(s), size as recommended by factory. Hose(s) length as required to reach designated gas supply. Transfer to plumbing contractor for installation.
2. Provide gas regulator valve(s), if required, and transfer to plumbing contractor for installation.
3. Provide and install Dormont Restraining Device Kit.

ITEM 42 UTILITY CARTS Quantity: 6

Manufacturer: Lakeside

Model: 499

Description:

1. 500 lb. capacity, tubular chrome plated frame cart, three (3) 21" x 33" shelves.
2. All swivel casters
3. NSF Listed

ITEM 43 CAN RACK Quantity: 1

Manufacturer: Amco

Acceptable Manufacturer: InterMetro

Model: SM3-B

Description:

1. Unit to hold 162 #10 size cans.

ITEM 44 CAN OPENER Quantity: 1

Manufacturer: Edlund

Model: 203

Electrical: 120/60/1

ITEM 45 TRASH RECEPT Quantity: 3

Manufacturer: Rubbermaid, Brute Food Handling

Model: (1) 44G, 44 gal.
(1) Lid
(1) Dolly
Per Trash Container Unit

ITEM 46 MOP & BROOM HANGER Quantity: 1

Manufacturer: FMP

Model: 159-1140

END OF SECTION

SECTION 11.52.13
PROJECTION SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Front projection screen assemblies.

1.02 RELATED REQUIREMENTS

- A. Section 05.50.00 - Metal Fabrications: Supports for suspended projection screens.
- B. Section 06.10.00 - Rough Carpentry: Wood blocking in walls and ceilings.
- C. Section 09.51.00 - Acoustical Ceilings: Suspended panel ceilings for recessed screens.

1.03 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: For custom installations, indicate dimensions, verified field measurements, mounting details, and interface with adjacent construction.
- D. Samples: For screen fabrics, submit two samples 6 by 6 inch in size.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.
- G. Operation and Maintenance Data: Provide manufacturer's operation and maintenance instructions.
- H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 10 years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver projection screens to project site in manufacturer's original unopened packaging, and inspect for damage and proper size before accepting delivery.
- B. Store in a protected, clean, dry area with temperature maintained above 50 degrees F, and stack in accordance with manufacturer's recommendations.
- C. Acclimate screens to building temperatures for 24 hours prior to installation, in accordance with manufacturer's recommendations.

1.06 FIELD CONDITIONS

- A. Maintain interior of building between 60 degrees F and 80 degrees F during and after installation of projection screens.

1.07 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
- B. Provide 5 year manufacturer warranty for projection screen assembly.

PART 2 PRODUCTS

2.01 FRONT PROJECTION SCREENS

- A. Manufacturers:
 - 1. Da-Lite Screen Company: www.da-lite.com/#sle.
 - 2. Draper, Inc (Manual); Luma Series: www.draperinc.com/#sle.
- B. Front Projection Screens: Factory assembled unless otherwise indicated.
 - 1. Located in Multi-Use Room: Manual, matte light diffusing fabric screen, horizontally tensioned, ceiling recessed.
 - a. Screen Dimensions: 96 inch high by 144 inch wide.
- C. Matte Light Diffusing Fabric: Light diffusing screen fabric; washable, flame retardant and mildew resistant.
 - 1. Material: Matte white vinyl on fiberglass backing, with nominal gain of 1.0 over viewing angle not less than 70 degrees from axis, horizontally and vertically.
 - 2. Seams: No seams permitted in fabric up to 96 inch high by 72 inch wide.
- D. Concealed-in-Ceiling Screen Cases: Steel, with integral roller brackets.
 - 1. Door Slat: Self trim; self-closing and -opening.
 - 2. Case Finish: Baked enamel.
 - 3. Case Color: White.
 - 4. End Caps: Steel; finished to match case.
- E. Manually-Operated Screens:
 - 1. Roller: 1-3/4 inch aluminum; spring loaded with locking device.
 - 2. Screen Pull: Ring on bottom bar.
 - 3. Vertical Tensioning: Screen fabric weighted at bottom with steel bar and plastic end caps.
 - 4. Horizontal Tensioning: Tensioning bar.
- F. Provide mounting hardware, brackets, supports, fasteners, and other mounting accessories required for a complete installation, in accordance with manufacturer's recommendations for specified substrates and mountings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate is finished and ready to accept screen installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that openings for recessed screens are correctly sized.
- D. Do not install projection screens until climate control systems are in place and interior painting and other finishes are completed.

3.02 PREPARATION

- A. Coordinate screen installation with installation of projection systems.
- B. Coordinate installation with adjacent construction and fixtures, including ceilings, walls, lighting, fire suppression, and registers and grilles.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.
- B. Do not field cut screens.
- C. Install screens in mountings as specified and as indicated on drawings.
- D. Install plumb and level.

- E. Adjust projection screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 12.21.13
HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Horizontal slat louver blinds.
- B. Operating hardware.

1.02 RELATED REQUIREMENTS

- A. Section 06.10.00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

- A. WCMA A100.1 - Safety of Window Covering Products; 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the placement of concealed blocking to support blinds. See Section 06.10.00.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating physical and dimensional characteristics.
- C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.
- D. Samples: Submit two samples, 12 inch long illustrating slat materials and finish, cord type and color.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01.60.00 - Product Requirements, for additional provisions.
 - 2. Extra Blind Assemblies: One of each size.
 - 3. Extra Slats: 20 of each type and size.
 - 4. Extra Lift Cords, Control Cords, and Wands: One of each type.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Horizontal Louver Blinds Without Side Guides:
 - 1. Hunter Douglas Architectural; CD Model: www.hunterdouglasarchitectural.com/#sle.
 - 2. Levolor; Metal Blinds: www.levolor.com/commercial/#sle.
 - 3. SWFcontract, a division of Springs Window Fashions, LLC; ____:
www.swfcontract.com/#sle.
 - 4. Draper, Inc.: Venetian Blinds by Warema..
- B. Source Limitations: Furnish blinds and associated controls produced by a single manufacturer and obtained from a single supplier.

2.02 BLINDS WITHOUT SIDE GUIDES

- A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.
- B. Manual Operation: Control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.
- C. Plastic Slats: Polymer composite, square slat corners.
 - 1. Width: 2 inch.
 - 2. Color: As selected by Architect.

- 3. Texture: As selected by Architect.
- D. Slat Support: Woven polypropylene cord, ladder configuration.
- E. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
- F. Bottom Rail: Pre-finished, formed steel; with end caps.
 - 1. Color: Same as headrail.
- G. Lift Cord: Braided nylon; continuous loop; complying with WCMA A100.1.
 - 1. Free end weighted.
 - 2. Color: As selected by Architect.
- H. Control Wand: Extruded hollow plastic; hexagonal shape.
 - 1. Removable type.
 - 2. Length of window opening height less 3 inch.
 - 3. Color: As selected by Architect.
- I. Headrail Attachment: Wall brackets.

2.03 FABRICATION

- A. Determine sizes by field measurement.
- B. Fabricate blinds to fit within openings with uniform edge clearance of ____ inch.
- C. Fabricate blinds to cover window frames completely.
- D.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings are ready to receive the work.
- B. Ensure structural blocking and supports are correctly placed. See Section 06.10.00.

3.02 INSTALLATION

- A. Install blinds in accordance with manufacturer's instructions.
- B. Secure in place with flush countersunk fasteners.
- C. Place intermediate head supports at as required by manufacturer inch on center.

3.03 TOLERANCES

- A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.
- B. Maximum Offset From Level: 1/8 inch.

3.04 ADJUSTING

- A. Adjust blinds for smooth operation.

3.05 CLEANING

- A. Clean blind surfaces just prior to occupancy.
- B. See Section 01.74.19 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION

SECTION 12.32.00
MANUFACTURED WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured standard and custom casework, with cabinet hardware.

1.02 RELATED REQUIREMENTS

- A. Section 01.60.00 - Product Requirements: Requirements for sustainably harvested wood.
- B. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions: VOC limitations for adhesives and sealants.
- C. Section 06.10.00 - Rough Carpentry: Blocking and nailers for anchoring casework.
- D. Section 07.92.00 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.
- E. Section 12.36.00 - Countertops: Additional requirements for countertops.
- F. Section 22.05.50 - Plumbing Fixtures: Sinks and fittings installed in casework.
- G. Section 26.27.26 - Wiring Devices: Switches, receptacles installed in casework.

1.03 DEFINITIONS

- A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches above finished floor, tops of cases less than 72 inches above finished floor and all members visible in open cases or behind glass doors.
- B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches above finished floor and bottoms of cabinets more than 30 inches but less than 42 inches above finished floor.
- C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches above finished floor.

1.04 REFERENCE STANDARDS

- A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.
- C. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.
- F. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.
- G. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.
- H. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.06 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Component dimensions, configurations, construction details, joint details, attachments.
- C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors and reinforcements, placement dimensions and tolerances, clearances required, and keying information.

- D. Samples for Finish Selection: Fully finished, for color selection. Minimum sample size: 2 inches by 3 inches.
 - 1. Plastic laminate samples, for color, texture, and finish selection.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.
- G. Maintenance Data: Manufacturer's recommendations for care and cleaning.
- H. Finish touch-up kit for each type and color of materials provided.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years of documented experience.
- B. Quality Certification: Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section.
 - 1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 2. Provide designated labels on shop drawings as required by certification program.
- C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of documented experience and approved by manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.
- B. Acceptance at Site:
 - 1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.
- C. Storage:
 - 1. Store casework in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" Article of this section.

1.09 MOCK-UP

- A. Provide full size base cabinet complete with drawers, door, adjustable shelf and countertop.
- B. See Section 01.40.00 - Quality Requirements for additional requirements.
- C. Locate where directed.
- D. Mock-up may remain as part of the Work.

1.10 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:
 - 1. Ruptured, cracked, or stained finish coating.
 - 2. Discoloration or lack of finish integrity.
 - 3. Cracking or peeling of finish.
 - 4. Delamination of components.
 - 5. Failure of adhesives.
 - 6. Failure of hardware.

PART 2 PRODUCTS

2.01 CASEWORK, GENERAL

- A. Quality Standard: AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom Grade.

2.02 FABRICATION

- A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.
- B. Construction: As required for selected grade.
- C. Fixed panels at backs of open spaces between base cabinets.
 - 1. Provide cutouts for power receptacles where indicated on drawings.
- D. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- E. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.

2.03 PLASTIC-LAMINATE-CLAD CASEWORK

- A. Plastic-Laminate-Clad Casework: Solid wood and wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base cabinets.
 - 1. Style: Flush overlay. Ease doors and drawer fronts slightly at edges.
 - 2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions:
 - a. Base Cabinets: 22 inches.
 - b. Tall Cabinets: 22 inches.
 - c. Wall Cabinets: 16 inches.
 - 3. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.
 - a. Finish: Matte or suede, gloss rating of 5 to 20.
 - b. Surface Color and Pattern: As selected by Architect from manufacturer's full line.
 - c. Exposed Interior Surfaces: Thermally fused laminate.
 - 1) Color: White.

2.04 COUNTERTOPS

- A. Countertops: As specified in Section 12.36.00.

2.05 CABINET HARDWARE

- A. Manufacturer's standard types, styles and finishes.
- B. Comply with BHMA A156.9 requirements.
- C. Locks: Provide locks on casework drawers and doors where indicated. Lock with 5 pin cylinder and 2 keys per lock.
 - 1. Hinged Doors: Cam type lock, bright chromium plated over nickel on base material.
 - 2. Keying: Key locks alike within a space; key each room separately.
 - 3. Master Key System: All locks operable by master key.
- D. Shelves in Cabinets:
 - 1. Shelf Standards and Rests: Vertical standards with rubber button fitted rests, satin chromium plated over nickel on base material.
- E. Swinging Doors: Hinges, pulls, and catches.
 - 1. Hinges: Visible, number as required by referenced standards for width, height, and weight of door.

- a. Concealed Hinges: Installed in cabinet edge, and on door back, bright chromium plated over nickel on base material.
 - 1) European-Style Hinges for Overlay Doors: 110 degree opening angle.
- 2. Pulls: Finish to be selected wire pulls, 4 inches wide.
- 3. Catches: Magnetic.
- F. Drawers: Pulls and slides.
 - 1. Pulls: Finish to be selected wire pulls, 4 inches wide.
 - 2. Slides: Steel, full extension arms, ball bearings; self-closing; capacity as recommended by manufacturer for drawer height and width.

2.06 MATERIALS

- A. Adhesives Used for Assembly: Comply with VOC requirements for adhesives and sealants as specified in Section 01.61.16.
- B. Wood-Based Materials:
 - 1. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.
 - 2. Composite Wood Panels: Containing no urea-formaldehyde resin binders.
- C. Solid Wood: Clear, dry, sound, plain sawn, selected for compatible species, grain and color, no defects.
- D. Semi-Exposed Solid Wood: Dry, sound, plain sawn, no appearance defects, any species similar in color and grain to exposed portions.
- E. Hardwood Plywood: Veneer core; HPVA HP-1 Grade as indicated; same species as exposed solid wood, clear, compatible grain and color, no defects. Band exposed edges with solid wood of same species as veneer.
- F. Concealed Solid Wood or Plywood: Any species and without defects affecting strength or utility.
- G. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.
- H. Hardboard: ANSI A135.4, Class 1, tempered.
- I. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications. complying with Grade requirements, and standard with the manufacturer.

2.07 ACCESSORIES

- A. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- B. Concealed Joint Fasteners: Corrosion-resistant, standard with manufacturer.
- C. Sealant for Use in Casework Installation:
 - 1. One component, clear silicone base sealant, chemical curing complying with ASTM C920, Type S, Grade NS, Class 25, Use NT, when tested to glass and aluminum, anti-fungus composition.

PART 3 EXECUTION

3.01 PREPARATION

- A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

3.02 EXAMINATION

- A. Site Verification of Environmental Conditions:
 - 1. Do not deliver casework until the following conditions have been met:
 - a. Building has been enclosed (windows and doors sealed and weather-tight).
 - b. An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.

- c. Ceiling, overhead ductwork, piping, and lighting have been installed.
 - d. Installation areas do not require further wet work construction.
- B. For Base Cabinets Installation: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 1/2 inch leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.
- C. For Wall Cabinets Installation: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
 - 1. Maximum variation from plane of masonry wall exceeds 1/4 inch in 10 ft and 1/2 inch in 20 ft or more, and/or maximum variation from plumb exceeds 1/4 inch per story.
 - 2. Maximum Variation of finished gypsum board surface from true flatness: 1/8 inch in 10 feet in any direction.
- D. Verify adequacy of support framing and anchors.
- E. Verify that service connections are correctly located and of proper characteristics.

3.03 INSTALLATION

- A. Perform installation in accordance with manufacturer's instructions.
- B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.
- C. Set casework items plumb and square, securely anchored to building structure.
- D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.
- E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch. In addition, do not exceed the following tolerances:
 - 1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
 - 2. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
 - 3. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
 - 4. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.
- F. Secure wall and floor cabinets to concealed reinforcement at gypsum board assemblies.
- G. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
- H. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches on center. Each cabinet to have no less than four points of attachment.
- I. Install hardware uniformly and precisely.
- J. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges.
- K. Replace units that are damaged, including those that have damaged finishes.

3.04 ADJUSTING

- A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.05 CLEANING

- A. See Section 01.74.19 - Construction Waste Management and Disposal, for additional requirements.
- B. Clean casework and other installed surfaces thoroughly.

3.06 PROTECTION

- A. Do not permit finished casework to be exposed to continued construction activity.

- B. Protect casework and countertops from ongoing construction activities. Prevent workmen from standing on, or storing tools and materials on casework or countertops.
- C. Repair damage, including to finishes, that occurs prior to Date of Substantial Completion, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

SECTION 12.36.00
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for manufactured casework.

1.02 RELATED REQUIREMENTS

- A. Section 12.32.00 - Manufactured Wood Casework.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- B. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.
- E. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- G. PS 1 - Structural Plywood; 2009.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- 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. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- G. Installation Instructions: Manufacturer's installation instructions and recommendations.
- H. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Approved by manufacturer of solid surface material.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than 5 years of documented experience.
- C. Quality Certification:
 - 1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
 - 2. Provide designated labels on shop drawings as required by certification program.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD 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.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting self-supporting over structural members.
 - 1. Flat Sheet Thickness: 3/4 inch, minimum.
 - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) Dupont: www.corian.com.
 - 2) LG Hausys America, Inc: www.lghausysusa.com/#sle.
 - 3) Wilsonart: www.wilsonart.com/#sle.
 - 4) Substitutions: See Section 01.60.00 - Product Requirements.
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. NSF approved for food contact.
 - d. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - e. Color and Pattern: As indicated on drawings.
 - 3. Other Components Thickness: 1/2 inch, minimum.
 - 4. Exposed Edge Treatment: Built up to minimum 1-1/2" inch thick; square edge; use marine edge at sinks. Refer to Drawings for details.
 - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
 - 6. Skirts: As indicated on drawings.
 - 7. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

2.02 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, color to match solid surface.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.

2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
 1. Integral sinks: Shop-mount securely to countertop with adhesives, using flush configuration, as per manufacturer's instructions, and as detailed on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach solid surface countertops using compatible adhesive.
- C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 14.24.00
HYDRAULIC ELEVATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Complete hydraulic elevator systems.
 - 1. Machine room-less hydraulic passenger elevators as shown and specified. Elevator work includes:
 - a. Standard pre-engineered hydraulic passenger elevators.
 - b. Elevator car enclosures, hoistway entrances and signal equipment.
 - c. Operation and control systems.
 - d. Jack(s).
 - e. Accessibility provisions for physically disabled persons.
 - f. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
 - g. Materials and accessories as required to complete the elevator installation.
- B. Elevator Maintenance Contract.
- C. Work NOT Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Part 3 for hydraulic elevators. State or local requirements must be used if more stringent. The following scopes of Work are not included in the elevator bid package, as they are a part of the building construction.
 - 1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
 - 2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
 - 3. Hoistway walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
 - 4. Elevator hoistways shall have barricades, as required, during installation.
 - 5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
 - 6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
 - 7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
 - 8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
 - 9. All wire and conduit should run remote from the hoistways.
 - 10. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
 - 11. Install and furnish finished flooring in elevator cab.
 - 12. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
 - 13. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
 - 14. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
 - 15. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.

16. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
17. General Contractor shall fill and grout around entrances, as required.
18. All walls and sill supports must be plumb where openings occur.
19. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
20. Provide telephone line, light fixture (200 lx / 19 fc), and convenience outlet in the hoistway at the landing where the elevator controller is located. Typically this will be at the landing above the 1st floor. Final location must be coordinated with elevator contractor.
21. As indicated by elevator contractor, provide a light outlet for each elevator, in center of hoistway.
22. For signal systems and power operated door: provide ground and branch wiring circuits.
23. For car light and fan: provide a feeder and branch wiring circuits to elevator control cabinet.
24. Controller landing wall thickness must be a minimum of 8 1/2 inches thick. This is due to the controller being mounted on the second floor landing in the door frame on the return side of the door. For center opening doors, the controller is located on the right hand frame (from inside the elevator cab looking out). These requirements must be coordinated between the general contractor and the elevator contractor.
25. Cutting, patching and recesses to accommodate hall button boxes, signal fixtures, etc

1.02 RELATED REQUIREMENTS

- A. Section 03.30.00 - Cast-in-Place Concrete: Includes elevator pit.
- B. Section 04.20.00 - Unit Masonry: Masonry hoistway enclosure; Installing inserts, sleeves and anchors; building-in and grouting hoistway door frames.
- C. Section 05.12.00 - Structural Steel Framing: Includes hoistway framing, divider beams, overhead hoist beams, and auxiliary support steel for supporting guide-rail brackets.
- D. Section 05.50.00 - Metal Fabrications: Includes elevator pit ladder and sill supports.
- E. Section 09.65.00 - Resilient Flooring: Floor finish in car.
- F. Section 09.91.23 - Interior Painting: Field painting of hoistway entrance doors and frames.
- G. Section 21.13.00 - Fire-Suppression Sprinkler Systems: Sprinkler heads in hoistway.
- H. Section 22.30.00 - Plumbing Equipment: Pit drain and oil separator.
- I. Section 26.05.33.13 - Conduit for Electrical Systems:
 1. Conduit to elevator equipment devices remote from hoistway.
- J. Section 26.05.83 - Wiring Connections:
 1. Electrical characteristics and wiring connections.
 2. Electrical service to main disconnect located in location shown on electrical drawings.
 3. Emergency power supply, transfer switch and transfer cabinet.
 4. Electrical power for elevator installation and testing.
 5. Electrical service for convenience outlets, elevator pit, and lighting in elevator pit.
- K. Section 28.46.00 - Fire Detection and Alarm:
 1. Fire and smoke detectors and interconnecting devices.
- L. Section 31.23.16 - Excavation: Excavation for cylinder casing and hydraulic lines.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- D. AISC 360 - Specification for Structural Steel Buildings; 2016.
- E. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.

- F. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- G. ASME A17.1 - Safety Code for Elevators and Escalators; 2016.
- H. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks; 2020.
- I. ASME QEI-1 - Standard for the Qualification of Elevator Inspectors; 2018.
- J. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- K. ASTM A139/A139M - Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over); 2016.
- L. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- M. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.
- N. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- O. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- P. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- Q. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- R. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).
- S. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- T. NEMA MG 1 - Motors and Generators; 2016.
- U. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- V. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- W. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- X. PS 1 - Structural Plywood; 2009.
- Y. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work with other installers to provide conduits necessary for installation of wiring including but not limited to:
 - a. Elevator equipment devices remote from elevator machine room or hoistway.
 - b. Elevator pit for lighting and fire alarm wiring.
 - c. Automatic transfer switch from controller cabinet.
 - d. Fire alarm panel from controller cabinet.
 - 2. Coordinate work with other installers for equipment provisions necessary for proper elevator operation, including but not limited to, the following:
 - a. Automatic transfer switches with auxiliary contacts for emergency power transfer status indication.
 - b. Shunt trip devices for automatic disconnection of elevator power prior to fire suppression system activation.
 - c. Overcurrent protection devices selected to achieve required selective coordination.
- B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
 - 1. Review schedule of installation, proper procedures and conditions, and coordination with related work.

- C. Construction Use of Elevator: Not permitted.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on following items:
 - 1. Signal and operating fixtures, operating panels, and indicators.
 - 2. Car design, dimensions, layout, and components.
 - 3. Car and hoistway door and frame details.
 - 4. Electrical characteristics and connection requirements.
- C. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
 - 1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
 - 2. Hoistway Components: Size and location of car guide rails, buffers, jack unit and other components.
 - 3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
 - 4. Clearances and over-travel of car.
 - 5. Locations in hoistway of traveling cables and connections for car lighting and telephone.
 - 6. Location and sizes of hoistway and car doors and frames.
 - 7. Applicable seismic design data; certified by a licensed Professional Structural Engineer.
 - 8. Interface with building security system.
 - 9. Electrical characteristics and connection requirements.
 - 10. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.
- D. Samples: Submit samples illustrating car interior finishes, car and hoistway door and frame finishes, and handrail material and finish in the form of cut sheets, finish color selection brochures, or actual samples.
- E. Designer's Qualification Statement.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- I. Testing Agency's Qualification Statement.
- J. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- K. Initial Maintenance Contract.
- L. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
 - 1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.
- M. Operation and Maintenance Data:
 - 1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
 - 2. Operation and maintenance manual.
 - 3. Schematic drawings of equipment and hydraulic piping, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on machine room and hoistway apparatus.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design guide rails, brackets, anchors, and machine anchors under direct supervision of a licensed Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and approved by elevator equipment manufacturer, with not less than ten years documented experience.
- D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.
- E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.
- F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing agency acceptable to authorities having jurisdiction as suitable for the purpose indicated in construction documents.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Manufacturer shall deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

1.08 PROJECT CONDITIONS

- A. Temporary Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion.

1.09 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.

1.10 MAINTENANCE

- A. Furnish maintenance and call back service for a period of 12 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours excluding callbacks.
 - 1. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Maintenance work, including emergency call back repair service, shall be performed by trained employees of the elevator contractor during regular working hours.
 - 2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
 - 3. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design - Hydraulic Elevators: ThyssenKrupp Elevator;; Endura MRL, machine room-less, low-rise hydraulic, 2500 lb capacity.
- B. Other Acceptable Manufacturers - Hydraulic Elevators:
 - 1. Otis Elevator Company: www.otis.com/#sle.
 - 2. Schindler Elevator Corporation: www.schindler.com/#sle.
 - 3. United Elevators, Knoxville, Tennessee.
- C. Substitutions: See Section 01.60.00 - Product Requirements.

1. For any product not identified as Basis of Design, submit information as specified for substitutions.
- D. Products other than Basis of Design are subject to compliance with specified requirements and prior approval of Architect. By using products other than Basis of Design, the Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- E. Source Limitations: Provide elevator and associated equipment and components produced by the same manufacturer as the other elevator equipment used for this project and obtained from a single supplier .

2.02 HYDRAULIC ELEVATORS

- A. Hydraulic Passenger Elevator:
 1. Hydraulic Elevator Equipment:
 - a. Hydraulic with cylinder in buried casing below elevator pit.
 2. Drive System:
 3. Operation Control Type:
 - a. Selective Collective Automatic Operation Control.
 4. Service Control Type:
 - a. Standard service control only.
 5. Interior Car Height: 96 inch.
 6. Electrical Power: 480 volts; alternating current (AC); three phase; 60 Hz.
 7. Rated Net Capacity: 2500 pounds.
 8. Rated Speed: 125 to 150 feet per minute.
 9. Hoistway Size: As indicated on drawings.
 10. Interior Car Platform Size: As indicated on drawings.
 11. Elevator Pit Depth: 48 inch.
 12. Overhead Clearance at Top Floor: 144 inch.
 13. Travel Distance: As indicated on drawings.
 14. Number of Stops: Two.
 15. Number of Openings: Two total Front; Zero total Rear.
 16. Hydraulic Equipment Location: Adjacent to bottom of hoistway shaft

2.03 COMPONENTS

- A. Elevator Equipment:
 1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70. Refer to Section 26.05.83
 2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
 3. Buffers:
 - a. Spring type for elevators with speed less than or equal to 200 feet per minute.
 4. Lubrication Equipment:
 - a. Provide grease fittings for periodic lubrication of bearings.
 - b. Grease Cups: Automatic feed type.
 - c. Lubrication Points: Visible and easily accessible.
- B. Electrical Equipment:
 1. Motors: NEMA MG 1.
 2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70. Refer to Sections 26.05.33.13 and 26.05.83.
 3. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.
 4. Include wiring and connections to elevator devices remote from hoistway. Refer to Section 26.05.83.
- C. Power Unit

1. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit located in the elevator pit consisting of the following items:
 - a. NEMA 4/Sealed Oil reservoir with tank cover including vapor removing tank breather
 - b. An oil hydraulic pump.
 - c. An electric motor.
 - d. Electronic oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.
2. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.
3. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating – motors shall be capable of 80 starts per hour with a 30% motor run time during each start.
4. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
 - a. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
 - b. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
 - c. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
 - d. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
 - e. Provided with constant speed regulation in both up and down direction. Feature to compensate for load changes, oil temperature, and viscosity changes.
 - f. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
 - g. A secondary hydraulic power source (powered by 110VAC single phase) must be provided. This is required to be able to raise (reposition) the elevator in the event of a system component failure (i.e. pump motor, starter, etc.)
 - h. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas
5. Hoistway Entrances
 - a. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolteddown construction.
 - 1) Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
 - 2) Main landing door & frame finish: ASTM A1008 steel panels, factory applied powder coat finish with factory-applied powder coat finish entrance frame.
 - 3) Typical door & frame finish: ASTM A366 steel panels, factory applied powder coat enamel finish with factory-applied powder coat finish entrance frame.
 - b. Integrated Control System: the elevator controller to be mounted to hoistway entrance above 1st landing. The entrance at this level, shall be designed to accommodate the control system and provide a means of access to critical electrical components and troubleshooting features. See section 2.09 Control System for additional requirements.

- c. At the controller landing, the hoistway entrance frame shall have space to accommodate and provide a lockable means of access (group 2 security) to a 3 phase circuit breaker. See section 2.11 Miscellaneous Elevator Components for further details
- d. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.
- e. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
 - 1) Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
 - 2) Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
 - 3) Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.
- f. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum
- 6. Hall Stations, General: Buttons shall illuminate to indicate call has been registered at that floor for the indicated direction.
 - a. Provide one pushbutton riser with faceplates having a brushed stainless steel finish.
 - 1) Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.
- 7. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements
- 8. Miscellaneous Elevator Components:
 - a. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.
 - b. Lockable three phase circuit breaker with auxiliary contact with shunt trip capability to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb and should be sized according to the National Electrical Code.
 - c. Lockable single phase 110V circuit breaker for cab light and fan to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb should be sized according to the National Electrical Code

2.04 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
- B. Accessibility Requirements: Comply with ADA Standards.
- C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.
- D. Comply with seismic design requirements in accordance with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
 - 1. Complying with Elevator Safety Requirements for Seismic Risk Zone in accordance with ASME A17.1, ASCE 7 and other related requirements.
 - 2. Provide earthquake emergency operations in accordance with ASME A17.1 requirements.
- E. Perform welding of steel in accordance with AWS D1.1/D1.1M.
- F. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.
- G. Perform electrical work in accordance with NFPA 70.
- H. Comply with fire protection sprinkler system of hoistway design in accordance with NFPA 13 requirements and authorities having jurisdiction (AHJ). Refer to Section 21.13.00.

2.05 OPERATION CONTROLS

- A. Elevator Controls: Provide landing operating panels and landing indicator panels.

1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
 2. Landing Indicator Panels: Illuminating.
 3. Comply with ADA Standards for elevator controls.
- B. Interconnect elevator control system with building security, fire alarm, and card access systems.
- C. Door Operation Controls:
1. Program door control to open doors automatically when car arrives at floor landing.
 2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
 3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.

2.06 OPERATION CONTROL TYPE

- A. Controller: Shall be integrated in a hoistway entrance jamb. Should be microprocessor based, software oriented and protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.
- B. Service Panel – to be located outside the hoistway in the controller entrance jamb and shall provide the following functionality/features:
1. Access to main control board and CPU
 2. Main controller diagnostics
 3. Main controller fuses
 4. Universal Interface Tool (UIT)
 5. Remote valve adjustment
 6. Electronic motor starter adjustment and diagnostics
 7. Operation of pit motorized shut-off valve with LED feedback to the state of the valve in the pit
 8. Operation of auxiliary pump/motor (secondary hydraulic power source)
 9. Operation of electrical assisted manual lowering
 10. Provide male plug to supply 110VAC into the controller
 11. Run/Stop button
- C. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.
- D. Selective Collective Automatic Operation Control: Applies to car in single elevator shaft.
1. Refer to description provided in ASME A17.1.
 2. Automatic operation by means of one button in the car for each landing served and by "UP" and "DOWN" buttons at the landings.
 3. Stops are registered by momentary actuation of landing car buttons without consideration of the number of buttons actuated or the sequence buttons are actuated, but the stops are made in the order that landings are reached in each direction of travel.
 4. All "UP" landing calls are made when car is traveling in the up direction.
 5. All "DOWN" landing calls are made when car is traveling in the down direction.
 6. Uppermost and lowermost calls are answered as soon as they are reached without consideration of the car travel direction.

2.07 EMERGENCY POWER

- A. Set-up elevator operation to run with building emergency power supply when the normal building power supply fails, and in compliance with ASME A17.1 requirements.
- B. Building Emergency Power Supply: Supplied by backup generator; provide elevator system components as required for emergency power characteristics with phase rotation the same as for normal power.
1. Provide transfer switches and auxiliary contacts.

2. Install connections to power feeders.
- C. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.
- D. Provide operational control circuitry for adapting the change from normal to emergency power.
- E. Upon transfer to emergency power, advance one elevator at a time to a pre-selected landing, stop car, open doors, disable operating circuits, and hold in standby condition.

2.08 MATERIALS

- A. Steel Cylinder Casing: ASTM A139/A139M, Grade A steel.
- B. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel), with matte finish.
- D. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- E. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.
- F. Plywood: PS 1, Structural I, Grade C-D or better, sanded.
- G. Tempered Glass: 3/8 inch minimum thickness, fully tempered in compliance with ASME A17.1, 16 CFR 1201, ANSI Z97.1, and ASTM C1048 tempered glass requirements.
- H. Plastic Laminate: NEMA LD 3, color as selected by Architect from manufacturer's standard line of colors.

2.09 CAR AND HOISTWAY ENTRANCES

- A. Elevator, No. 1:
 1. Car and Hoistway Entrances, Each Elevator Floor Lobby:
 - a. Hoistway Fire Rating: 2 Hours.
 - b. Elevator Door Fire Rating: 1-1/2 Hours.
 - c. Framed Opening Finish and Material: Alkyd enamel on steel.
 - d. Car Door Material: Powder coat on steel, with rigid sandwich panel construction.
 - e. Hoistway Door Material: Powder coat on steel, with rigid sandwich panel construction.
 - f. Door Type: Double leaf.
 - g. Door Operation: Side opening, two speed.
 - h. Paint Color: As selected by Architect from manufacturer's standard line.
 - i. Door Width: 42 inch.
 - j. Door Height: 84 inch.
 - k. Sills: Extruded aluminum.

2.10 CAR EQUIPMENT AND MATERIALS

- A. Elevator Car:
 1. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons, "Door Open" button, "Door Close" button, and alarm button.
 - a. Panel Material: Integral with front return; one per car.
 - b. Car Floor Position Indicator: Above car operating panel with illuminating position indicators.
 - c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.
 - d. Provide matching service cabinet integral with front return panel, with hinged door and keyed lock in each car.
 - e. Provide following within service cabinet as part of car operating panel:
 - 1) Switch for each auxiliary operational control, keyed.
 - 2) Switches for fan, light, and inspection control.
 - 3) Telephone cabinet and hard-wired connection with hands-free telephone.
 2. Ventilation: Single speed fan with grille in ceiling.
 3. Flooring: Resilient vinyl tile.
 4. Wall Base: Recessed stainless steel, 4 inch high.
 5. Front Return Panel: Match material of car door.

6. Door Wall: Plastic laminate on plywood.
 7. Side Walls: Plastic laminate on plywood.
 8. Rear Wall: Plastic laminate on plywood.
 9. Hand Rail: Aluminum, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
 - a. Aluminum Finish: Clear anodized.
 10. Ceiling:
 - a. Canopy Ceiling: Plastic laminate on plywood.
 - b. Lighting: As selected from manufacturer's standard line.
 11. Provide emergency access panel for egress from car at ceiling.
- B. Car Accessories:
1. Certificate Frame: Stainless steel frame glazed with tempered glass, and attached with tamper-proof screws.
 2. Protective Pads: Canvas cover, padded with impact-resistant fill material, sewn with piping edges; fire resistant in compliance with ASME A17.1; brass grommets for supports, covering side and rear walls and front return, with cut-out for control panel; provide one set for each elevator.
 - a. Color: Tan.
 - b. Provide at least 4 inch clearance from bottom of pad to finished floor.
 - c. Pad Supports: Stainless steel studs, and mounted from ceiling frame.

2.11 FINISHES

- A. Powder Coat on Steel: Clean and degrease metal surface; apply one coat of primer; two coats of powder coat.
- B. Finish Paint for Metal Surfaces: Alkyd enamel, semi-gloss, color as selected, complying with VOC limitations of authorities having jurisdiction (AHJ).
- C. Clear Anodized Finish: Class I, AAMA 611 AA-M12C22A41 clear anodic coating with electrolytically deposited organic seal; not less than 0.7 mils, 0.0007 inch thick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting this work.
- B. Verify that hoistway and pit are ready for work of this section.
- C. Verify hoistway shaft and openings are of correct size and within tolerance.
- D. Verify location and size of machine foundation and position of machine foundation bolts.
- E. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION

- A. Arrange for temporary electrical power for installation work and testing of elevator components, and comply with requirements of Section 01.50.00 - Temporary Facilities and Controls.
- B. Excavate for in-ground hydraulic cylinder casing in accordance with Section 31.23.16, and remove subsoil from site.
- C. Maintain in-ground shaft alignment of 1/2 inch maximum from plumb.
 1. Fill over-excavated shaft depth with lean concrete.
- D. Maintain elevator pit excavation free of water.
- E. Place in-ground plunger casing full depth of shaft. Align to 1/4 inch from plumb. Cut top of casing at hoistway pit slab elevation.

3.03 INSTALLATION

- A. Coordinate this work with installation of hoistway wall construction.
- B. Install system components, and connect equipment to building utilities.

- C. Provide conduit, electrical boxes, wiring, and accessories. Refer to Sections 26.05.33.13 and 26.05.83.
- D. Install hydraulic piping between cylinder and pump unit.
- E. Mount motors and pumps on vibration and acoustic isolators.
 - 1. Place on structural supports and bearing plates.
 - 2. Securely fasten to building supports.
 - 3. Prevent lateral displacement.
- F. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.
- G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.
- H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.
- I. Bolt brackets to self drilling expansion shell anchors.
- J. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.
- K. Fill hoistway door frames solid with grout in accordance with Section 04.20.00.
- L. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.
- M. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.
- N. Adjust equipment for smooth and quiet operation.

3.04 TOLERANCES

- A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.
- B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.05 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements, for additional requirements.
- B. Testing and inspection by regulatory agencies certified in accordance with ASME QEI-1 will be performed at their discretion.
 - 1. Schedule tests with agencies and notify Owner and Architect.
 - 2. Obtain permits as required to perform tests.
 - 3. Document regulatory agency tests and inspections in accordance with requirements.
 - 4. Perform tests required by regulatory agencies.
 - 5. Furnish test and approval certificates issued by authorities having jurisdiction.
- C. Perform testing and inspection in accordance with requirements.
 - 1. Inspectors shall be certified in accordance with ASME QEI-1.
 - 2. Perform tests as required by ASME A17.2.
 - 3. Provide at least two weeks written notice of date and time of tests and inspections.
 - 4. Supply instruments and execute specific tests.
- D. Operational Tests:
 - 1. Perform operational tests in the presence of Owner and Architect.
 - 2. Test single elevator system by transporting at least 8 persons up from main floor to top floor landing during a five minute period.
 - 3. At an agreed time, and the building occupied with normal building traffic, conduct tests to verify performance.
 - a. Furnish event recording of each landing call registrations, time initiated, and response time throughout entire working day.
 - 4. Set period of time elevator takes to travel between typical floor landings at not more than 20 seconds.
 - a. Measure time from moment doors start to close until car has stopped level at next floor landing and doors are opening.

3.06 ADJUSTING

- A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.
- B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

3.07 CLEANING

- A. Remove protective coverings from finished surfaces.
- B. Clean surfaces and components in accordance with manufacturers written instructions.
- C. See Section 01.74.19 - Construction Waste Management and Disposal, for additional requirements.

3.08 CLOSEOUT ACTIVITIES

- A. See Section 01.78.00 - Closeout Submittals, for closeout submittals.
- B. See Section 01.79.00 - Demonstration and Training, for additional requirements.
- C. Demonstrate proper operation of equipment to Owner's designated representative.
- D. Demonstration: Demonstrate operation of system to Owner's personnel.
 - 1. Use operation and maintenance data as reference during demonstration.
 - 2. Briefly describe function, operation, cleaning and maintenance of each component.
- E. Training: Train Owner's personnel on cleaning and operation and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of training.
 - 3. Instructor: Manufacturer's training personnel.
 - 4. Location: At project site, unless noted otherwise.

3.09 PROTECTION

- A. Do not permit construction traffic within car after cleaning.
- B. Protect installed products until Date of Substantial Completion.
- C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

3.10 MAINTENANCE

- A. Refer to Section 01.70.00 - Execution and Closeout Requirements, for additional requirements relating to initial maintenance service.
- B. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for 3 months from Date of Substantial Completion.
- C. Submit proposal for continuation of Maintenance Contract in accordance with ASME A17.1 and requirements as indicated for installed elevator equipment.
- D. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or original installer.
- E. Maintenance contract services shall not be assigned or transferred to any agent or other entity without prior written consent of Owner.
- F. Examine system components periodically.
- G. Include systematic examination, adjustment, and lubrication of elevator equipment.
- H. Maintain and repair or replace parts, whenever required, using parts produced by original equipment manufacturer.
- I. Perform work without removing cars from use during peak traffic periods.
- J. Provide emergency call back service during regular working hours throughout period of this maintenance contract.

- K. Maintain an adequate stock of parts for replacement or emergency purposes, and have personnel available to ensure the fulfillment of this maintenance contract without unreasonable loss of time.

END OF SECTION

SECTION 21.05.00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

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.
- B. Section 22 05 10 – Hangers and Supports for Plumbing Piping and Equipment shall also apply to this section.

1.02 SUBMITTALS

- A. Product Data: For the following:
 - 1. Piping materials, including dielectric fittings, and sprinkler specialty fittings.
 - 2. Pipe hangers and supports, including seismic restraints.
 - 3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
 - 4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
 - 5. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
 - 6. Alarm devices, including electrical data.
- B. Fire-hydrant flow test report. Flow test must be performed by the sprinkler contractor preparing the calculations, prior to preparing calculations, to determine adequate water availability.
- C. Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, including hydraulic calculations.
- D. Field Test Reports and Certificates: Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.03 DESCRIPTION OF WORK

- A. A complete sprinkler system shall be furnished and installed to insure the lowest insurance rate possible; however, no requirements of NFPA 13, Local Fire Marshal, State Fire Marshal, Division of Fire Prevention, water Department, and Building Insurance Co. shall be violated and/or omitted.
- B. All areas indicated on plans, including attic areas, shall be provided with an automatic sprinkler system in accordance with N.F.P.A. 13.
- C. It shall be the Contractors responsibility to examine all architectural drawings, sections, details and structural drawings to determine areas required to be sprinklered to meet applicable code requirements.
- D. All cutting of holes necessary for the installation of work specified under this section of the specifications shall be done by this Contractor. Applicable provisions elsewhere in the specifications apply here, also. Cutting will be done under the supervision of the General Contractor. Do all patching of concrete, masonry and other materials which are cut by this Contractor, employing the services of the Contractor whose work is cut. Patching shall be of the same material and shall be finished neatly.

1.04 DRAWINGS

- A. The drawings show and the specifications describe the work intended under this section, but the Contractor shall be solely responsible for taking his own measurements, performing his own flow test, and installing the work to fit the conditions encountered. Everything necessary for a complete and satisfactory installation shall be furnished and installed by this Contractor performing work under this contract, whether or not specifically shown or specified. This is not intended to cover major items of equipment not shown or specified but is intended and will be interpreted to cover all miscellaneous parts, devices, accessories, controls, and appurtenances which are required by any applicable code, ordinance, regulation or law required to complete and place the system in satisfactory operation and required for a first class job which is complete in every respect.
- B. It shall be the responsibility of this Contractor to install all sprinkler work to coordinate with other trades in advance so as to clean all interferences with all architectural, structural, electrical, heating, ventilating, air conditioning, plumbing, sewerage, and other work. Any work installed by this Contractor which interferes with any other work by failure to coordinate said work shall be altered by this Contractor at his own expense as directed by the Architect to clear such interferences.
- C. Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.05 DEVIATIONS

- A. No deviations from the plans and specifications shall be made without the full knowledge and consent of the Architect. Should this Contractor find at any time during the progress of the work that, in his judgment, existing conditions made desirable a modification in requirements covering any item he shall report such items to the Architect for his decision and instructions. No changes shall be made until written request has been made by the Contractor to the Architect and written approval of said change has been given by the Architect.

1.06 OMISSIONS

- A. The drawings and specifications shall both be considered as part of the contract. Any work or material shown in one and omitted in the other shall be furnished and performed as though shown in both to give a complete sprinkler job approvable by the Authority Having Jurisdiction. The awarding of the contract shall be construed to mean that this Contractor will install a complete and satisfactory system, furnishing all items of materials and labor to accomplish this result whether or not such items are particularly specified or shown on plans. Should any discrepancy or omission be discovered in the plans or specifications, such must be reported to the Architect immediately in order that any necessary addenda may be issued before the bids are received.

1.07 INTERPRETATION

- A. The meaning and intent of the plans and specifications shall be subject to the interpretations of the Architect whose decision on all questions pertaining thereto shall be binding upon the Contractor.

1.08 LOCAL STANDARDS

- A. Term, "Local Standards", as used herein, means the standards of design and construction of respective municipal (or county) department or utility company.

1.09 COORDINATION

- A. This Contractor shall visit the job site and thoroughly inform himself as to the conditions under which the work is to be done.

- B. Failure to route pipes through the building without interfering with other Contractor's equipment or construction and at maximum possible elevation shall not constitute a reason for an extra charge.
- C. All equipment requiring service shall be made easily accessible.

1.10 PERMITS, LICENSES AND INSURANCE

- A. The Contractor shall obtain and pay for all permits, licenses, fees, etc., required for his work.

1.11 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- C. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
- D. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.12 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

1.13 SHOP DRAWINGS

- A. Submit shop drawings to Designer's Office. Obtain stamped approved plans and letter of approval and then submit approved drawings to Authorities Having Jurisdiction for approval. No sprinkler work shall be done prior to all above approvals. Contractor shall include in his bid all equipment and labor necessary to comply with the Authority Having Jurisdiction requirements.
- B. Submit 5 equipment submittals of all materials proposed for use in the work, giving name of manufacturer, trade name, catalog number and all information hereinafter requested. It is understood and agreed by all concerned that the Architect shall have the authority to reject any or all material, equipment or workmanship not complying with these specifications and that Contractor shall replace such rejected equipment, materials or workmanship upon notification by the Architect. Submission of shop drawings electronically is acceptable in lieu of hard copy material.
- C. Submittal data and drawings shall be examined by the General Contractor prior to his transmitting to the above-mentioned authorities. The submittals shall bear the Contractor's stamp of approval evidencing that he has examined and checked same and that he found the information contained to be in accordance with the Contract requirements.
- D. All materials and equipment furnished under this Division 21 shall be new and approved by Underwriters' Laboratories, Inc. (UL), Factory Mutual (FM), or American Water Works Association (AWWA) where applicable.

1.14 GUARANTEE

- A. The Contractor shall furnish a guarantee covering all labor and materials for a period of one year from date of acceptance of his work which shall include an agreement to repair replace and make good at his expense, any and all defects which may appear in his work or materials during that time, which in the judgment of the Architect arise from defective workmanship or imperfect or inferior materials.

1.15 SEISMIC REQUIREMENTS

- A. Piping shall be seismically braced in accordance with the latest IBC Requirements, chapter 16, determined by building site classification

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for 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, the manufacturers specified.

2.02 PIPE AND FITTINGS

- A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- C. Pipe Grooved Joints: ASME / AWWA C606. Fittings and couplings shall be of a single manufacturer, UL listed and FM approved. Fittings shall be ductile iron, short-pattern with flow equal to standard pattern, Victaulic FireLock™. Couplings shall consist of two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts.
 - 1. Grooved Joint Lubricants: Lubricate gaskets in accordance with the manufacturer's recommendations with lubricant supplied by the coupling manufacturer that is suitable for the gasket elastomer and system media. Standard of Acceptance: Victaulic 'Vic-Lube'.
 - 2. Grooved Joints: Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer.
- D. Pipe and Fittings, Inside Buildings: Schedule 40 or Schedule 10 black steel pipe conforming to ASTM A120 or A53, plain end, threaded end, or grooved end, as applicable to joint types involved; class 125 for pressure rating 175 psi black cast iron threaded fittings conforming to ANSI 816.4 or Schedule 40 black steel butt welding fittings conforming to ANSI 816.9 or Victaulic, Gustin-Bacon, or equal black malleable iron fitting, as applicable to joint types involved; fittings shall have at least 175 or 300 psi cold water working pressure ratings, and UL listing for fire protection service. Schedule 10 can be used for 2½" and up, all other piping Schedule 40.

2.03 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Metraflex Co.

- c. Pipeline Seal and Insulator, Inc.
- 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- 3. Pressure Plates: Plastic. Include two for each sealing element.
- 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.04 SLEEVES

- A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- B. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.

2.05 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

2.06 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. 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.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping free of sags and bends.

- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. 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, cast-brass type with polished chrome-plated finish.
 - d. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - f. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.
- K. Sleeves are not required for core-drilled holes.
- L. Permanent sleeves are not required for holes formed by removable PE sleeves.
- M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor slabs.
 - 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. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint.
- O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using 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.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to details on drawings for U.L. system numbers and penetration firestops.
- R. Verify final equipment locations for roughing-in.

3.02 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. 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 unless dry seal threading is specified.
 - 2. 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.
- E. Grooved Joints: Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer.

3.03 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

END OF SECTION

SECTION 21.10.00 - WATER-BASED FIRE-SUPPRESSION 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 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.03 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig
- B. Fire-suppression 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. Building Service Areas: Ordinary Hazard, Group 1.
 - b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - c. General Storage Areas: Ordinary Hazard, Group 1.
 - d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - e. Office, Classrooms, and Public Areas: Light Hazard.
 - 3. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard: .10 GPM over 1500-sq. ft. area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
 - 4. Maximum Protection Area per Sprinkler: Per UL listing.
 - 5. Maximum Protection Area per Sprinkler:
 - a. Public Spaces, Office Spaces and Classrooms: 225 sq. ft
 - b. Storage Areas: 130 sq. ft. Mechanical Equipment Rooms: 130 sq. ft
 - c. Electrical Equipment Rooms: 130 sq. ft
 - d. 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 60 to 90 minutes.
 - b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
- C. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.04 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test performed by sprinkler subcontractor.
- B. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."

1.05 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.06 EXTRA MATERIALS

- 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. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, 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 on Project.

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.

2.02 STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed threaded ends.
 1. Cast-Iron Threaded Flanges: ASME B16.1.
 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 3. Gray-Iron Threaded Fittings: ASME B16.4.
 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
 5. Steel Threaded Couplings: ASTM A 865.
- B. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, roll-grooved ends.
 1. Grooved-Joint Piping Systems:
 - a. Available Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) Shurjoint Piping Products, Inc.
 - 3) Victaulic Co. of America.
 - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts.
- C. Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10.
 1. Cast-Iron Threaded Fittings.
 2. Ductile-Iron Threadable Fittings.
 3. Grooved End Couplings and Fittings.

2.03 DIELECTRIC FITTINGS

- A. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.
- B. Dielectric Unions: Factory-fabricated assembly, designed for 250-psig minimum working pressure at 180 deg F Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Industries, Inc.; Wilkins Div.
- C. Dielectric Flange Insulation Kits: Components for field assembly shall include CR or phenolic gasket, PE or phenolic bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Available Manufacturers:
 - a. Advance Products and Systems, Inc.
 - b. Central Plastics Company.
 - c. Pipeline Seal and Insulator, Inc.
- D. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psig working-pressure rating at 225 deg F.
 - 1. Available Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
 - c. Central Plastics Company.
- E. Dielectric Nipples: Electroplated steel with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psig working-pressure rating at 225 deg F.
 - 1. Available Manufacturers:
 - a. Perfection Corporation.
 - b. Precision Plumbing Products, Inc.
 - c. Victaulic Co. of America.

2.04 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
 - 1. Available Manufacturers:
 - a. Central Sprinkler Corp.
 - b. Viking Corp.
 - c. Victaulic Co. of America.
- B. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
 - 1. Available Manufacturers:
 - a. Elkhart Brass Mfg. Co., Inc.
 - b. Fire-End and Croker Corp.
 - c. Potter-Roemer; Fire-Protection Div.
- C. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
 - 1. Available Manufacturers:
 - a. AGF Manufacturing Co.
 - b. Central Sprinkler Corp.
 - c. Triple R Specialty of Ajax, Inc.

2.05 LISTED FIRE-PROTECTION VALVES

- A. Valves shall be UL listed, with 175-psig minimum pressure rating. Valves shall have 250-psig minimum pressure rating if valves are components of high-pressure piping system.
- B. Ball Valves: Comply with UL 1091, except with ball instead of disc.
 - 1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
 - 2. NPS 2 and NPS 2-1/2 Bronze body with threaded ends or ductile-iron body with grooved ends.
 - 3. NPS 3 Ductile-iron body with grooved ends.
 - 4. Available Manufacturers:
 - a. NIBCO.
 - b. Victaulic Co. of America.
 - c. Apollo.
- C. Butterfly Valves: UL 1091.
 - 1. NPS 2 and Smaller: Bronze body with threaded ends.
 - a. Available Manufacturers:
 - 1) Global Safety Products, Inc.
 - 2) Milwaukee Valve Company.
 - 3) NIBCO
 - 2. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Available Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) McWane, Inc.; Kennedy Valve Div.
 - 3) NIBCO.
- D. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
 - 1. Available Manufacturers:
 - a. Clow Valve Co.
 - b. Grinnell Fire Protection.
 - c. Hammond Valve.
 - d. Mueller Company.
- E. Gate Valves: UL 262, OS&Y type.
 - 1. NPS 2 and Smaller: Bronze body with threaded ends.
 - a. Available Manufacturers:
 - 1) Crane Co.; Crane Valve Group; Crane Valves.
 - 2) Hammond Valve.
 - 3) NIBCO.
 - 2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.
 - a. Available Manufacturers:
 - 1) Milwaukee Valve Company.
 - 2) Mueller Company.
 - 3) NIBCO.
- F. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.
 - 1. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Available Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) Grinnell Fire Protection.

3) Victaulic Co. of America.

2.06 UNLISTED GENERAL-DUTY VALVES

- A. Ball Valves NPS 2 and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig minimum CWP rating, blowout-proof stem, and threaded ends.
- B. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.
- C. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.
- D. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.07 SPECIALTY VALVES

- A. Sprinkler System Control Valves: UL listed cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.
 - 1. Available Manufacturers:
 - a. Grinnell Fire Protection.
 - b. Victaulic Co. of America.
 - c. Viking Corp.

2.08 SPRINKLERS

- A. Sprinklers shall be UL listed, with 175-psig minimum pressure rating.
- B. Available Manufacturers:
 - 1. Central Sprinkler Corp.
 - 2. Grinnell Fire Protection.
 - 3. Victaulic Co. of America.
- C. Automatic Sprinklers: With heat-responsive element complying with the following:
 - 1. UL 199, for nonresidential applications.
- D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
- E. Sprinkler Finishes: Chrome plated, unless noted otherwise.
- F. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.09 BACKFLOW PREVENTERS

- A. Double-Check, Assembly Backflow Preventers:
 - 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. Ames Co.
 - b. FEBCO; SPX Valves & Controls.
 - c. Watts Industries, Inc.; Water Products Div.
 - d. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1048 and FMG approved or UL listed.
 - 3. Operation: Continuous-pressure applications.
 - 4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
 - 5. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
 - 6. End Connections: Flanged.
 - 7. Configuration: Designed for vertical flow.

8. Accessories:
 - a. Valves: Outside screw and yoke gate-type with flanged ends on inlet and outlet with tamper switch.

2.10 FIRE DEPARTMENT CONNECTIONS

- A. Available Manufacturers:
 1. Central Sprinkler Corp.
 2. Elkhart Brass Mfg. Co., Inc.
 3. Guardian Fire Equipment Incorporated.
 4. Potter-Roemer; Fire-Protection Div.
- B. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR." NOTE: Verify w/Local Fire Department and Authority Having Jurisdiction if specialized connections are required.
 1. Type: Flush, with two inlets and square or rectangular escutcheon plate.
 2. Type: Exposed, projecting, with two inlets and round escutcheon plate.
 3. Finish: Rough chrome-plated.

2.11 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Alarm: UL 464, with 8-inch-minimum- diameter, vibrating-type, metal alarm bell with red-enamel factory finish and suitable for outdoor use.
 1. Available Manufacturers:
 - a. Potter Electric Signal Company.
 - b. System Sensor.
 - c. Grinnell Fire Protection.
- C. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include 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.
 1. Available Manufacturers:
 - a. Grinnell Fire Protection.
 - b. ITT McDonnell & Miller.
 - c. Potter Electric Signal Company.
 - d. System Sensor.
- D. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
 1. Available Manufacturers:
 - a. McWane, Inc.; Kennedy Valve Div.
 - b. Potter Electric Signal Company.
 - c. System Sensor.
- E. Indicator Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled indicator valve is in other than fully open position.
 1. Available Manufacturers:

- a. Potter Electric Signal Company.
- b. System Sensor.
- c. Grinnell Fire Protection.

2.12 PRESSURE GAGES

- A. Available Manufacturers:
 - 1. AGF Manufacturing Co.
 - 2. AMETEK, Inc.; U.S. Gauge.
 - 3. Dresser Equipment Group; Instrument Div.
- B. Description: UL 393, 3-1/2- to 4-1/2-inch diameter, dial pressure gage with range of 0 to 250 psig minimum.
 - 1. Water System Piping: Include caption "WATER" or "AIR/WATER" 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 Part 1 "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.02 PIPING APPLICATIONS, GENERAL

- A. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- B. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.

3.03 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig Maximum Working Pressure:
 - 1. NPS 1-1/2 and Smaller: Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
 - 2. NPS 2 Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
 - 3. NPS 2 Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
 - 4. NPS 2½ to NPS 6 Grooved-end, threadable, thinwall steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.04 JOINT CONSTRUCTION

- A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping joint construction.
- B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 (DN 200) with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.
- C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
 - 1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.

2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
 3. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.
- D. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.
1. NPS 2 and Smaller: Use dielectric unions, couplings, or nipples.
 2. NPS 2-1/2 to NPS 4 Use dielectric flanges.
 3. NPS 5 and Larger: Use dielectric flange insulation kits.

3.05 SERVICE-ENTRANCE PIPING

- A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

3.06 PIPING INSTALLATION

- A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 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.
- C. Use approved 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. Unions are not required on flanged devices or in piping installations using grooved joints.
- E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- I. Install alarm devices in piping systems.
- J. Hangers and Supports: Comply with NFPA 13 for hanger materials.
 1. Install sprinkler system piping according to NFPA 13.
- A. Earthquake Protection: Install piping according to NFPA 13 AND International Building Code, Chapter 16, to protect from earthquake damage. Bracing requirements shall be determined by building site classification.
- B. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS ¼ and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- C. Fill wet-pipe sprinkler system piping with water.

3.07 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 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. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.

3.08 SPRINKLER APPLICATIONS

- A. Drawings indicate sprinkler types to be used.

3.09 TESTING

- A. All piping in the sprinkler system, both inside and outside of the building, shall be tested at a water pressure of 200 psi for a period of not less than two hours. All bracing shall be in place and air shall be removed from the system through the hydrants, drain valves, etc., before the test pressure is applied.

3.10 CLEANING

- A. During the progress of the work, keep the premises reasonably clean as regards trash, debris, etc., caused by his materials and workmen. After all work has been completed and prior to final inspection, all equipment shall be thoroughly cleaned and all trash and debris removed from the job site.

3.11 INSTALLATION

- A. All sprinkler work including the installation of underground fire main shall be installed by a Licensed Registered Fire Protection Contractor. Underground fire mains and hydrants shall be installed and in service prior to construction.
- B. Install piping with ample flexibility to permit free expansion and contraction of pipework without putting excessive stress on piping, supports, or equipment, or causing damage or breakage. Do not bend any pipe. Ream pipe ends after cutting pipe. For threaded joints, use suitable non-hardening tape. Screw flanges to cast iron and ductile iron pipe; screw or weld flanges to steel pipe.
- C. Pipe passing under building grade beams shall have a 6 inch minimum clearance to prevent possible damage from building settlement.
- D. Pipe passing through building walls, and building floors below grade shall be provided with sleeves of standard weight galvanized steel pipe. The annular spaces between pipe and sleeves shall be sealed with link seal hydro-static pipe wall seal. Sleeves shall be sized as follows:
 - 3" pipe - 8" ID sleeve
 - 4" pipe - 10" ID sleeve
 - 6" pipe - 12" ID sleeve
- E. Before permanently filling the site fire water system with water and before connections are made to the automatic sprinkler risers, all parts of the system to be thoroughly flushed until water runs clear. Minimum flow during flushing shall be as follows:

PIPE SIZE	FLOW GPM
3	300
4	400
6	750

- F. Install sprinklers in suspended ceiling in center of acoustical ceiling panels and tiles, unless otherwise indicated on plans.
- G. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.
- H. System shall be hydraulically calculated by a licensed sprinkler contractor.
- I. All areas shown on the Architectural drawings shall be provided with automatic sprinkler protection.
- J. Sprinkler protection in freezers, cold rooms, and like occupancies shall be provided with automatic sprinkler protection and dry pendent heads shall be utilized.
- K. Sprinkler heads subject to mechanical damage shall be provided with approved type wire guards.
- L. All sprinkler heads installed for light hazard occupancy shall be quick response type in accordance with NFPA 13.

3.12 AS-BUILT DRAWINGS

- A. Contractor shall keep an accurate record of the location of all site fire water lines and site potable water lines installed by him and shall provide Owner upon completion of work with a drawing showing all location dimensions and elevations.

3.13 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire department connections in vertical wall.
- B. Install ball drip valve at each check valve for fire department connection.

3.14 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping.
- D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- F. Connect alarm devices to fire alarm.
- G. Connect wiring according to "Low-Voltage Electrical Power Conductors and Cables."

3.15 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14.

3.16 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 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. Energize circuits to electrical equipment and devices.
 - 4. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 5. Coordinate with fire alarm tests. Operate as required.
 - 6. Verify that equipment hose threads are same as local fire department equipment.
- B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.17 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

END OF SECTION

SECTION 21.10.10 – ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide a UL/FM Fire Pump to deliver not less than 150% of rated capacity as scheduled on the drawings, at a pressure not less than 65% of rated head. Shutoff pressure should not exceed 120% of the rated pressure. Jockey pump shall deliver 10 psi TDH more than fire pump.

PART 2 - PRODUCTS

2.01 FIRE PUMP

- A. Pump to be in line, vertical. See plans for required performance criteria.
- B. Acceptable Manufacturers: Peerless, Aurora, Allis-Chalmers, Fairbanks Morse.
- C. Pump unit to meet all requirements of NFPA Pamphlet No. 20 and shall be listed by the UL or approved by the Associated Factory Mutual Fire Insurance Companies.
- D. The following accessories to be included with pump unit:
 - 1. Eccentric tapered suction reducer.
 - 2. Concentric tapered discharge increaser.
 - 3. Hose valve head.
 - 4. Hose valves, caps, and chain with local Fire Department hose thread (test manifold connection).
 - 5. 3/4" casing relief valve.
 - 6. Suction and discharge gauges.
 - 7. Automatic air release valve.
 - 8. Pump and driver to be mounted on a common base plate of either cast iron or fabricated steel and direct connected through a flexible coupling.
 - 9. Driver shall be an electric motor of the open dripproof type wound for 480-volt 3-phase, 60-cycle current. Motor to be of such capacity that 110% of full-load amp rating shall not be exceeded at any condition of pump load. Motor winding shall be closed transition wye-delta. Coordinate motor requirements with controller specification.
 - 10. System pressure relief valve. Valve size to be determined by the pump manufacturer.
 - 11. Test header.
- E. With an ambient temperature not exceeding 40 degrees C, motor to be designed for a temperature rise not exceeding 40 degrees C when carrying full rated load continuously and be capable of operating continuously with an overload of 15% without stress or injurious rise in temperature. Locked rotor current shall not exceed the values specified in NFPA Pamphlet No. 20.
- F. Bearings to be antifriction ball or roller type.

2.02 CONTROLLER

- A. Fire and jockey pump controllers to be completely assembled, wired, and tested at factory; and assembly to be specifically listed for fire pump and jockey pump service. Controllers to be marked "Fire Pump Controller" and "Jockey Pump Controller".
- B. Acceptable Manufacturers: Firetrol, Master, Joslyn-Clark, Metron.
- C. All equipment to be enclosed in one or more approved NEMA 3R or 4 enclosure(s).

- D. The controllers shall be of the combined manual and automatic wye-delta, electronic closed transition type incorporating the following:
1. Disconnect Switch: Externally operable, quick-break type.
 2. Circuit Breaker: Time delay type with trips in all phases set for 300% of the motor full-load current. Reference Division 26 plans and specifications for fault current ratings.
 3. Pressure switches.
 4. Running Period Timer: Set to keep motor in operation when started automatically for a minimum of 1 minute for each 10-hp motor rating but not to exceed 7 minutes. Jockey pump shall have a minimum running timer, also.
 5. Pilot Lamp: To indicate power available and pump run.
 6. Ammeter test link and voltmeter test studs.
 7. Alarm Features: Controller shall contain local alarms for pump running, power failure, and phase reversal. Auxiliary contacts, both normally open and closed, shall be provided for remote alarming of the above listed conditions.
 8. Control circuits shall be supervised. Upon failure, the controller shall automatically start the fire pump.
 9. A remote fire pump alarm panel shall be furnished and installed at the building's fire alarm panel or 24-hour manned location. Remote alarm shall signal - Pump Running, Phase Reversal, Power Failure, and Supervisory Power Failure. Remote alarm panel shall have a separate 115-volt power source. Coordinate wiring the alarms from the controller to the remote alarm panel with Division 26.
 10. Manual start/stop buttons and emergency start latch mechanism.
 11. Means shall be provided on the controller to operate an alarm signal continuously while the pump is running.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of fire pumps.
- B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
- B. Equipment Mounting:
 1. Install fire pumps on cast-in-place concrete equipment bases.
- C. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA.
- D. Support piping and pumps separately, so weight of piping does not rest on pumps.
- E. Install valves that are same size as connecting piping.
- F. Install pressure gages on fire-pump suction and discharge flange pressure-gage tapings.
- G. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.
- H. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.

- I. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.
- J. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

3.03 ALIGNMENT

- A. Align pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
- B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.
- C. Align piping connections.
- D. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.

3.04 CONNECTIONS

- A. Comply with requirements for piping and valves specified in "Wet-Pipe Sprinkler Systems." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps and equipment to allow service and maintenance.
- C. Connect relief-valve discharge to drainage piping or point of discharge.
- D. Connect flowmeter-system meters, sensors, and valves to tubing.
- E. Connect fire pumps to their controllers.

3.05 IDENTIFICATION

- A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

3.06 FIELD QUALITY CONTROL

- A. Test each fire pump with its controller as a unit.
- 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 the following tests and inspections with the assistance of a factory-authorized service representative.
 - 1. After installing components, assemblies, and equipment, including controller, test for compliance with requirements.
 - 2. Test according to NFPA 20 for acceptance and performance testing.
 - 3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 5. Test according to NFPA 20 for acceptance and performance testing.
- D. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

- F. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

3.07 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.

3.08 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION

SECTION 22.05.00 - COMMON WORK RESULTS FOR PLUMBING

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 QUALITY ASSURANCE

- A. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- B. Electrical Characteristics for Plumbing Equipment: Contractor shall verify existing voltage available at the site prior to ordering equipment. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. 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.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.04 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete, masonry walls and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces.
- D. All equipment shall be installed in accordance with the manufacturer's drawings and recommendations.
- E. The Contractor shall furnish and install all rough-in work and make final connections to all equipment requiring water, gas, drains, and other mechanical work required for connection to equipment furnished under this contract.
- F. The equipment shall be properly prepared structurally and mechanically ready to receive a single connection for each of the various mechanical items with all plumbing, piping drains, traps, tailpieces, supply fittings, etc., internal to and part of the equipment installed by the equipment manufacturer or supplier.

1.05 CODES AND FEES

- A. All work shall be installed in accordance with the applicable provisions of the local codes, latest adopted International Plumbing Code, AGA, UL, AWWA, ASTM, ASME and ANSI.
- B. The Contractor shall pay for fees and inspections as may be required for water, sanitary sewer and gas service, and all other systems requiring inspection by agencies having jurisdiction.

1.06 ELECTRICAL WORK

- A. All control wiring and conduit not shown on Electrical drawings shall be furnished and installed under Division 22 according to the National Electrical Code and Division 26 requirements.
- B. All power wiring and conduit for items furnished under Division 22 shall be furnished and installed under Division 26.
- C. All disconnects shall be furnished and installed by Division 26.
- D. Toggle switches for 1/2 HP motors and less shall be furnished and installed by Division 26.
- E. Wiring and conduit for solenoid valves, and control transformers including the transformers shall be furnished and installed by Division 22.
- F. Division 26 shall install all starters, toggle switches, disconnects, and all wiring to the respective motor or device. Wiring and conduit from starter to a controller shall be by Division 22.
- G. Definitions:
 - 1. Power wiring: Line voltage circuitry rough-in including conduit, boxes, conductors, etc. between the overcurrent protection and the equipment including the connection of the starters.
 - 2. Control wiring: Any voltage circuitry rough-in including conduit, boxes, conductors, etc. between control activator and the controller or starter.
- H. Conduit: All power wiring and 120V control wiring shall be in conduit. Low voltage control wiring shall be installed in conduit where exposed, or in return air plenums, in masonry walls, or below slab.
- I. It shall be the Contractor's responsibility to determine the characteristics of electrical currents available to operate the mechanical equipment prior to ordering such equipment. All electrically operated equipment shall be designed for operation with the type of electric current available to the project.

1.07 RECORD DRAWINGS

- A. The Contractor shall maintain a marked up set of prints that reflect site conditions including location of valves, underground piping, equipment, etc. that have been changed to suit job conditions. Final payment shall not be made until such document(s) is turned over to the architect upon completion of the project.

1.08 SEISMIC DESIGN

- A. Seismic restraints shall be provided in accordance with Chapter 16 of the latest adopted International Building Code. Specific seismic requirements shall be determined by building site classification.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for 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, the manufacturers specified.

2.02 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.03 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials, installed between dissimilar metals.
- B. Unions shall be installed on each side of all special valves, regulators, etc., on one side of each check valve and each trap, and at all equipment such as coils, tanks, compressors, pumps, etc., so that such equipment may be readily disconnected. No unions shall be placed in a location which will be inaccessible after completion of the building.
- C. Where flanged valves, regulators, etc., do not permit the removal of flange bolts, two such devices shall be separated by a spool. (3) Connections between pipes of dissimilar metals shall be made with Dielectric (insulated) unions.
- D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Industries, Inc.; Wilkins Div.
- E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Epco Sales, Inc.
 - c. Watts Industries, Inc.; Water Products Div.

2.04 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Metraflex Co.
 - c. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Plastic. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.05 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.

2.06 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

2.07 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.08 FIRE STOPPING

- A. Description: Fire stopping compounds, caulks, wraps, as required to maintain integrity of fire rated floors, ceilings, walls and floor/ceiling, roof ceiling assemblies for all pipe penetrations for metal and plastic pipe.
 - 1. Available manufacturer's:
 - a. 3M Corporation
 - b. Hilti
 - c. Pro-Set
 - 2. See plumbing drawings for U.L. system numbers and specific penetration details.

2.09 ACCESS PANELS

- A. Description: For ceiling applications utilize 16 gauge bonderized steel door frame with prime coat finish, 20 gauge bonderized steel door panel with prime coat finish, automatic closure, self-latch, interior latch release, rated as required for ceiling construction. For wall applications utilize the following:

1. Block Walls and Drywall – 14 gauge galvanized steel frame with 16 gauge door panel, concealed hinge, key operated lock. Fire rating shall be consistent with wall construction.
2. Available manufacturer's:
 - a. Elmore Manufacturing Company
 - b. Milcor Products, Inc.
 - c. Amberaproducts, Inc.

PART 3 - EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas. Run piping parallel to principle parts of the building and avoid diagonal runs unless specifically indicated on plans.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping and hangers to allow application of insulation.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install escutcheons for penetrations of walls, ceilings, and floors chrome plated, metal at all visible locations:
- K. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs. Refer to specific details for sleeves thru fire rated floors and walls.
 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. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.

- L. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- M. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to details on plumbing drawings for U.L. system numbers and specific penetration types.
- N. Verify final equipment locations for roughing-in.
- O. Verify exact required rough-in dimensions with equipment manufacturer.

3.02 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. 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 unless dry seal threading is specified.
 - 2. 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.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to manufacturer's instructions.

3.03 PIPE PRESSURE TESTING

- A. Test all plumbing piping, following installation, but before it is covered or connected to the sewers or fixtures. Furnish necessary labor, materials and equipment for making test. All leaks disclosed by testing shall be reworked in an approved manner and the leaking system shall then be retested until proved tight under pressure. Test all systems for watertightness (or gas-tightness) as required by the authorities having jurisdiction, or in the absence of such requirements the minimum tests shall be made as follows:

1. Fill all storm and sanitary drainage and vent piping with water and allow to stand thus filled for 3 hours without showing leaks. Piping may be tested in sections, but no sections shall be tested with less than a ten foot head. Air pressure testing with equivalent pressure is acceptable when cast iron piping is utilized. Plastic piping will not be permitted to be tested with air.
2. Test all water supply piping by applying a hydro-static pressure of not less than 125 pounds per square inch or $1\frac{1}{2}$ times the working pressure, whichever is greater.
3. Test all gas piping systems with air or inert gas only. Test pressure shall be not less than five times the maximum pressure to which the piping will be subjected in operation for a period not less than 30 minutes.

3.04 EXCAVATING AND BACKFILLING

- A. Do all excavating and backfilling required for the installation of underground work required by the plumbing work.
- B. Width of trench shall be not less than 18" wider than the pipe outside diameter. Minimum cover over top of water pipe shall not be less than the frost line for the area plus 6". Minimum cover for gas piping, sanitary sewer, and storm sewer shall be not less than 24". Fire service mains shall have minimum 36" cover.
- C. Copper piping, shall be laid on a 6" bed of sand and backfilled with sand to 12" above top of pipe. Complete backfilling with Washed #57 Stone to underside of building slab and outside of building to underside of pavement. The balance of the fill outside the building not under pavement shall be clean earth thoroughly tamped and crowned, void of stones larger than 4" diameter to allow for subsequent settlement. Compact to 100% density under buildings and paved areas. Protect copper piping at building slab penetration with sleeve or $\frac{1}{2}$ " thick "Armaflex" insulation.
- D. Gas piping downstream of meter below grade shall be laid on a 6" bed of sand and backfilled with sand to 12" above top of pipe. Complete backfilling with clean earth thoroughly tamped and crowned, void of stones larger than 4" diameter to allow for subsequent settlement.
- E. PVC piping, shall be laid on a 6" bed of Washed #57 Stone and backfilled with same stone to 12" above top of pipe. Complete backfilling with Washed #57 Stone to underside of building slab and outside of building to underside of pavement. The balance of the fill outside the building not under pavement shall be clean earth thoroughly tamped and crowned, void of stones larger than 4" diameter to allow for subsequent settlement. Compact to 100% density under buildings and paved areas.
- F. All trenches shall be braced as required to protect workmen and adjacent work. Comply with local regulations.

3.05 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.06 PIPE PROTECTION

- A. In concealed locations where piping, other than cast-iron or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1-1/2" from the nearest edge of the member, the pipe shall be protected by steel plates. Such shield plates shall have a minimal thickness of 0.0575 inch (No. 16 gage). Such plates shall cover the area of the pipe where the member is notched or bored, and shall extend not less than 2" above sole plates and below top plates.

3.07 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases not less than 4 inches larger in all directions than supported water heater and equipment.
 - 2. 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 the base.
 - 3. Concrete pad shall be minimum of 4" thick.
 - 4. All water heaters, unless indicated on stands or mounted on walls, shall be installed on a 4" thick dedicated concrete base.

3.08 ACCESS PANELS

- A. Furnish steel access panels, not smaller than 12" for single valve and 12" X 24" or 18" X 18" for two or more valves, for access of concealed valves, traps, clean outs, unions, etc., where no other means of access is shown or specified. Access panels shall be turned over to the general contractor for installation. Contractor shall include in their bid all costs charged by the general contractor for installation.
- B. Access panels in fire rated construction shall have a UL label Class B rating. All panel styles to be verified by the Designer.

3.09 GUARANTEE

- A. The Contractor shall guarantee all work to be in accordance with contract requirements and free from defective or inferior materials, equipment, and workmanship for a period of one year, and he shall guarantee that all equipment is of proper size and design and so installed as to produce the capacities and results specified and shown on the drawings.

3.10 SUBSTITUTIONS

- A. Substitutions shall be allowed in accordance with Division 1. Substitution approval shall be at the sole discretion of the Engineer.
- B. Contractor shall note on shop drawings all major differences from specified material or equipment.
- C. The contractor shall be responsible to verify that all dimensions, weights, electrical and mechanical requirements of substituted materials and equipment meet project requirements. Any required modifications to other trades for substituted equipment shall be the responsibility of the contractor making the substitution.
- D. All requests for substitution must be submitted to the architect and engineer a minimum of 14 calendar days prior to project bid date. Such submission does not constitute approval. Only items or manufacturers specifically stated in the project specifications, drawings or addenda for use shall be considered as approved.

3.11 SHOP DRAWINGS

- A. Submit to the Architect for approval, within 30 days after receipt of Notice to Proceed with the work, detailed shop drawings of all equipment and all material required to complete the

- project. The shop drawing shall be complete as described herein. The Contractor shall furnish the number of copies required by the General and Special Conditions of the Contract, but in no case less than six (6) copies. Electronic shop drawings are acceptable.
- B. All shop drawings to be submitted at one time in a 3-ring binder with cover and drawing index sheet, or one electronic submission.
 - C. The shop drawings shall be detailed, with dimensioned drawings or catalog cuts, showing construction, size, arrangement, operating clearances, performance characteristics and capacity. Each item of equipment proposed shall be a standard catalog product of an established manufacturer and of equivalent quality, finish, and durability to that specified. Submission material and all shop drawings for the various items of equipment shall be marked with the respective mark number or identification of the equipment shown on the drawing or in the specification.
 - D. Provide a cover sheet for all major equipment, including but not limited to, pumps, plumbing fixtures, water heaters, that shall list in detail all accessories called for in specifications and on drawings that are being supplied. Failure to list these items will result in resubmittal. A copy of a standard catalog will not be sufficient.
 - E. Shop drawings shall show sizes and details of required concrete and steel machine foundation, location of anchor bolts, physical dimension of equipment, equipment weight or other pertinent data required for equipment support or installation.
 - F. The contractor shall verify all electrical requirements of equipment with the electrical service available before ordering said equipment.
 - G. Approved shop drawings do not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings or specifications.
 - H. All shop drawings to be reviewed must bear the general contractor's stamp indicating they have reviewed the items being submitted and their approval/comments attached. Submission without this stamp is grounds for rejection of the submittal package.

END OF SECTION

SECTION 22.05.05 - GENERAL-DUTY VALVES FOR DOMESTIC WATER

PART 1 - GENERAL

1.01 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.02 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 ball and plug valves open to minimize exposure of functional surfaces.
 - 4. Set butterfly valves closed or slightly open.
 - 5. Block 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.

1.03 SUBMITTALS

- A. Product Data: For all valves listed herein.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 2. Butterfly Valves: With extended neck.
- E. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With threads according to ASME B1.20.1.
- F. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRASS OR BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Brass or Bronze Ball Valves with Brass or Bronze Trim:
 - 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. Conbraco Industries, Inc.; Apollo Valves.

- b. Milwaukee Valve Company.
 - c. Valves in PEX piping shall be by same manufacturer as PEX piping.
- 2. 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 or forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze or brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.
- B. Three-Piece, Full-Port, Brass or Bronze Ball Valves with Brass Trim:
 - 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. Conbraco Industries, Inc.; Apollo Valves.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Valves in PEX piping shall be by same manufacturer as PEX piping.
 - 2. 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 or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.03 IRON, SINGLE-FLANGE BUTTERFLY VALVES

- A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
 - 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. Conbraco Industries, Inc.; Apollo Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Aluminum bronze.

2.04 BRONZE SWING CHECK VALVES

- A. Class 150, Bronze Swing Check Valves with Bronze Disc:
 - 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. Kitz Corporation.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

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.

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: Ball, butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.

- B. Select valves, except wafer types, 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 and Larger: Flanged ends.

3.05 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. Ball Valves: Two piece, full port, brass or bronze with bronze trim.
 - 3. Ball Valves: Three piece, full port, brass or bronze with bronze trim.
 - 4. Bronze Swing Check Valves: Class 150, bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.

END OF SECTION

SECTION 22.05.10 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 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.

1.02 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."

PART 2 - PRODUCTS

2.01 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. Available Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. Grinnell Corp.
 - 3. Globe Pipe Hanger Products Inc.
- 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.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Insulation-Insert Material: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- 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 cold piping operating below ambient air temperature.

2.04 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated 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. Available Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head.

2.05 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.06 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. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- B. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- C. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

3.02 PIPING SUPPORT

- A. Support spacing of piping hangers shall not exceed the following:
 - 1. Copper Tube:
 - a. 1-1/4 NPS and smaller – 6' horizontal – 3/8" rod dia., 10' vertical.
 - b. 1-1/2 NPS and 2 NPS – 10' horizontal – 3/8" rod dia., 10' vertical.
 - c. 2-1/2 NPS and 3 NPS – 10' horizontal – 1/2" rod dia., 10' vertical.
 - d. 4 NPS – 10' horizontal – 5/8" rod dia., 10' vertical.
 - 2. PVC, Schedule 40:
 - a. 1/2 NPS thru 2 NPS – 4' horizontal – 3/8" rod dia., 10' vertical plus mid-story guide.
 - b. 3 NPS – 4' horizontal – 1/2" rod dia., 10' vertical plus mid-story guide.
 - c. 4 NPS – 4' horizontal – 5/8" rod dia., 10' vertical plus mid-story guide.
 - d. 6 NPS and 8 NPS – 4' horizontal – 3/4" rod dia., 10' vertical plus mid-story guide.
 - 3. Steel Pipe:
 - a. 3/4 NPS thru 2 NPS – 12' horizontal – 3/8" rod dia., 15' vertical.
 - b. 2-1/2 NPS thru 4 NPS – 12' horizontal – 1/2" rod dia., 15' vertical.
 - 4. Sway Bracing:
 - a. Provide rigid sway support bracing at changes in direction greater than 45 degrees for pipe sizes 4" and larger.

- B. Horizontal-Piping Hangers and Supports: Unless otherwise indicated, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, all sizes.
 2. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): Acceptable for suspension of noninsulated steel pipes.
 3. Trapeze hangers may be utilized where multiple pipes are to be installed side by side at same elevation.

3.03 ATTACHMENTS

- A. 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. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- B. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, support
1. From concrete using inserts
 2. From beams using beam clamps, rivets or bolts
 3. From blocks using toggle or thru-bolts.
 4. Do not use plastic anchors, adhesives or explosive charges.
 5. Do not support from roof deck.
 6. Fasten supports to building in the following order of preference:
 - a. Steel Framing
 - b. Concrete
 - c. Masonry
 - d. Wood Sheathing
 7. All hangers, rods and inserts shall be UL approved for service intended and shall be the following types per MSS SP-58:
 - a. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - b. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
 - c. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - d. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - e. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - f. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 - g. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 - h. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 - i. 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:
 - 1) Light (MSS Type 31): 750 lb.
 - 2) Medium (MSS Type 32): 1500 lb.

- 3) Heavy (MSS Type 33): 3000 lb.
- j. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- C. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Protection Shields (MSS Type 40): 12 Inch minimum length or of length recommended by manufacturer to prevent crushing insulation, if greater.
 - 2. Steel Pipe-Covering Protection Saddles, for rollers (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

3.04 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. On all pipe, provide hanger within 18" of each elbow or fitting and within 18" of connection to each piece of equipment.
- C. Pipes passing through walls shall not bear on construction.
- D. 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 above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- F. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. 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.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 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.
- L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide specified slope for drainage piping.
- N. Insulated Piping: Comply with the following:
 - 1. When pipes carry material colder than 90 deg F, provide shields at each hanger. On 2½" and larger pipe, insulated with fiberglass, provide thermal hanger shield insert.

2. Install MSS SP-58, Type 40, protective shields on all insulated piping. Shields shall span an arc of 180 degrees. Use MSS SP-58.
 - a. Option: Thermal-hanger shield inserts may be used.
3. 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 and larger: 12 inches long and 0.06 inch thick.
4. Thermal-Hanger Shields: On pipes 2-1/2" or larger, install with insulation same thickness as piping insulation.

3.05 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands 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.
- D. Cut, drill, and fit miscellaneous metal fabrications for equipment supports. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- E. 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.

3.06 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.

3.07 PAINTING

- A. Touch Up: Clean and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 22.05.15 - IDENTIFICATION FOR PLUMBING PIPING & 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.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated herein.
- 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.

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, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Black.
 - 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: 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.
 - 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.

- 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. Manufacturers: Subject to compliance with requirements, acceptable manufacturers offering products that may be incorporated into the Work include, but are not limited to, to those specified.
 - 1. Craftmark Duramark
 - 2. Seton Set Mark
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Pretensioned, Snap-Around Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings 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: Minimum 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.

3.03 PIPE LABEL INSTALLATION

- A. 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 30 feet along each run. Reduce intervals to 15 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Pipe Label Color Schedule:
 - 1. Domestic Water Piping – Cold Water:
 - a. Background Color: Green.

- b. Letter Color: White.
- 2. Domestic Water Piping – Hot Water:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.
- 3. Domestic Water Piping – Hot Water Return:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.
- 4. Natural Gas Piping:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.

END OF SECTION

SECTION 22.05.20 - PLUMBING 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:
 - 1. Insulation Materials:
 - a. Mineral fiber.
 - b. Flexible Elastomeric.
 - 2. Insulating cements.
 - 3. Adhesives.
 - 4. Mastics.
 - 5. Sealants.
 - 6. Factory-applied jackets.
 - 7. Tapes.
 - 8. Securements.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated herein. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled, qualified tradesmen who are employed by a company whose sole business is the sale and installation of commercial/industrial insulation. This company shall have been in business a minimum of 10 years. Plumbing contractors shall not install insulation.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting 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 and inspecting 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 size and location of insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. 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, where/if heat tracing is required.

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.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Johns Manville Micro-Lok.
 - b. Knauf Insulation.
 - c. Owens Corning Fiberglas Pipe Insulation.
 - 2. 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.
- D. FLEXIBLE TUBULAR ELASTOMERIC
 - 1. Provide fire-retardant, closed-cell, slip-on flexible type. Product must be guaranteed by manufacturer to have continuous operational temperature limits between -297°F and +220°F, with a minimum "R" value of 3.57 at 75° F 50% RH.
 - 2. Products: Subject to compliance with requirements, available manufacturers that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.
 - b. Armacel, Inc.
 - c. Rubatex, Inc.
- E. Polyolefin
 - 1. Polyolefin insulation Is Not permitted to be used on this project.

2.02 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, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. Marathon Industries, Inc.; 225.
- C. FLEXIBLE TUBULAR ELASTOMERIC ADHESIVE:
 - 1. Utilize Insulation Manufacturer's recommended contact adhesive.
- D. ASJ 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, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Childers Products, Division of ITW; CP-82.
- b. Foster Products Corporation, H. B. Fuller Company; 85-20.
- c. Marathon Industries, Inc.; 225.

2.03 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. Marathon Industries, Inc.; 590.
 2. Water-Vapor Permeance: ASTM E 96, 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, 59 percent by volume and 71 percent by weight.
 5. Color: White.

2.04 SEALANTS

- A. Metal Jacket Flashing Sealants:
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 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.

2.05 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.

2.06 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, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
 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.
 - b. 0.016 Inch thickness.

- c. 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.

2.07 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.08 SECUREMENTS

- A. Bands:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
 - 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. 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 equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and 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. At vapor barrier, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with mastic or sealing compound recommended by insulation material manufacturer.
 - 2. 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. Install insulation continuously through hangers and around anchor attachments. All hangers shall be of a type that will allow insulation products to be installed in an un-interrupted manner, without breaks or disruptions in the integrity of the vapor barrier.
- L. Apply mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- 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. Insulate base of all primary and secondary roof drains.

3.04 PENETRATIONS

- A. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations 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: Install insulation continuously through penetrations of fire-rated walls and partitions.
- E. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies.

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 and Flanges:
 - 1. Install insulation over fittings, valves and flanges with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - 2. Insulate copper 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 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 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 flanges 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.
 - 6. Cover segmented insulated surfaces with a layer of finishing cement and coat with mastic. Install a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 7. For services not specified to receive a field-applied jacket except for flexible elastomeric, 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 matching PVC tape.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. 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, for a vapor tight seal.

3.06 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 2. For insulation with factory-applied jackets, do not staple longitudinal tabs but 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 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.

3.07 FLEXIBLE TUBULAR ELASTOMERIC PIPING INSULATION INSTALLATION

- A. Insulation installation on straight pipes and tubes:
 - 1. Install pipe insulation by slitting tubular sections and applying onto piping or tubing. All terminations, seams and butt joints shall be adhered and sealed using manufacturer recommended adhesive.
 - 2. Insulation shall be pushed on the pipe, never pulled. Stretching of insulation will result in open seams and joints.
 - 3. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp knives must be used.
 - 4. On cold piping insulation shall be adhered directly to the piping at the high end of the run using a one inch strip of Adhesive on the ID of the insulation and on the pipe.
 - 5. Sheet insulation shall be used on all pipes larger than 6" IPS. Insulation shall not be stretched around the pipe.
 - 6. Seams shall be staggered when applying multiple layers of insulation.
 - 7. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with Adhesive. Screwed fittings shall be sleeved and adhered with a minimum one inch overlap onto the adjacent insulation.

3.08 FIELD-APPLIED JACKET INSTALLATION

- A. 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.

3.09 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water, Hot Water and Recirculated Hot Water: Copper.
 - 1. All sizes, insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation: 1 inch thick.
- B. Horizontal Rainwater Leaders and Secondary Roof Drainage System:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation: 1 inch thick.
- C. Cold Condensate Drain:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric Insulation: ½" inch thick.
- D. Horizontal Sanitary Sewer Piping Overhead:
 - 1. Horizontal sewer piping connected to floor drains or hub drains receiving cold condensate from HVAC units, freezers, coolers, ice machines:
 - a. All pipe sizes: Flexible Elastomeric Insulation; ½ inch thick.

3.11 OUTDOOR, ABOVEGROUND WATER PIPING INSULATION SCHEDULE

- A. Increase insulation thickness by ½ Inch and provide protective aluminum jacketing.

3.12 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. Provide for the following:
 - 1. Insulated Piping, outside, above-ground: Aluminum, Stucco Embossed: 0.016 inch thick.
 - 2. Insulated Piping exposed in all rooms, within 7 feet of floor: Aluminum, Stucco Embossed: 0.016 inch thick.

END OF SECTION

SECTION 22.05.25 - DOMESTIC WATER PIPING AND APPURTENANCES

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 SUBMITTALS

- A. Product Data: For the following products:
 - 1. Vacuum Breakers
 - 2. Backflow preventers.
 - 3. Water Pressure-Reducing Valves.
 - 4. Balancing valves.
 - 5. Thermometers.
 - 6. Pressure gauges.
 - 7. Strainers for domestic water piping.
 - 8. Wall Hydrants.
 - 9. Domestic water pressure booster pumps

1.03 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.

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.

2.02 PIPE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
 - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Soft Copper Tube: ASTM B88, Type "K", soft drawn.
 - 1. Wrought copper solder-joint fittings; and brazed joints.

2.03 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; 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. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.04 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Valves in PEX piping systems shall be of same manufacturer as PEX piping system.

2.05 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.

2.06 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 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. Ames Co.
 - b. FEBCO; SPX Valves & Controls.
 - c. Watts Industries, Inc.; Water Products Div.
 - 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.

2.07 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers:
 - 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. FEBCO; SPX Valves & Controls.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1013.
 - 3. Operation: Continuous-pressure applications.
 - 4. Size: 1/2" – 4".
 - 5. Body: Bronze for NPS 2 and smaller; ductile iron 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: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.08 WATER PRESSURE-REDUCING VALVES

- A. Water Regulators:
 - 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. Conbraco Industries, Inc.

- b. Watts Industries, Inc.; Water Products Div.
- c. Zurn Plumbing Products Group; Wilkins Div.
- 2. Standard: ASSE 1003.
- 3. Pressure Rating: 300 PSIG (2070 kPa).
- 4. Size: 4" NPS and smaller
- 5. Body: Bronze for NPS 3 and smaller.
- 6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and above.

2.09 BALANCING VALVES

- A. Thermostatic Self Activating:
 - 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. Therm Omega Tech.
 - b. Taco, Inc.
 - 2. Type: Ball valve with union.
 - 3. Body: 303 Stainless Steel.
 - 4. Activator: 303 Stainless Steel
 - 5. Size: Same as connected piping, but not larger than NPS 2.
 - 6. Accessories: Integral Check Valve.
 - 7. See drawings for hot water temperature.

2.10 THERMOMETERS

- A. Metal-Case, Liquid-In-Glass:
 - 1. Available 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. Terice, H. O. Co.
 - b. Weiss Instruments, Inc.
 - c. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
 - 2. Case: Die-cast aluminum or brass, 9" long.
 - 3. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.
 - 4. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
 - 5. Window: Glass or plastic.
 - 6. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
 - 7. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
 - 8. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.
 - 9. Thermowells provide pressure-tight, socket type metal fitting made for insertion into piping, and of same manufacturer as thermometer.
- B. Bimetallic-Actuated Dial Thermometers:
 - 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. Terice, H. O. Co.
 - b. Weiss Instruments, Inc.
 - c. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
 - 2. Description: Direct-mounting, bimetallic-actuated dial thermometers complying with ASME B40.3.

3. Case: Dry type, stainless steel with 3-inch diameter.
4. Element: Bimetal coil.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red or other dark-color metal.
7. Window: Glass or plastic.
8. Ring: Stainless steel.
9. Connector: Rigid, bottom type.
10. Stem: Metal, for thermowell installation and of length to suit installation.
11. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.11 PRESSURE GAUGES

- A. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
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. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
 - b. Trerice, H. O. Co.
 - c. Weiss Instruments, Inc.
 2. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch diameter.
 3. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
 4. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
 5. Movement: Mechanical, with link to pressure element and connection to pointer.
 6. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
 7. Pointer: Red or other dark-color metal.
 8. Window: Glass or plastic.
 9. Accuracy: Plus or minus 2 percent of middle half scale.
 10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
 11. Range for Fluids under Pressure: Two times operating pressure.
- B. Pressure Gauge Fittings:
1. Valves: NPS 1/4 brass or stainless-steel needle type.
 2. Snubbers: ASM B-40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.12 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:
1. Available 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. Watts Industries, Inc.
 - b. Zurn Plumbing Products; Wilkins Division
 - c. Apollo
 2. Pressure Rating: 125 psig minimum, unless otherwise indicated.
 3. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating for NPS 2-1/2 and larger.
 4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 5. Screen: Stainless steel with round perforations, unless otherwise indicated.
 6. Drain: Pipe plug.

2.13 WALL HYDRANTS

- A. Nonfreeze Wall Hydrants:
 - 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. Josam Company.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Woodford Manufacturing Company.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.21.3M for exposed-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 (DN 20).
 - 7. Outlet: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
 - 8. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
 - 9. Nozzle and Wall-Plate Finish: Rough bronze.
 - 10. Operating Keys(s): Two with each wall hydrant.

2.14 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. Josam Company.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASSE 1010 or PDI-WH 201.
 - 3. Type: Metal bellows. Piston type will not be acceptable.
 - 4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.15 DOMESTIC WATER BOOSTER PUMPS

- A. Domestic Water Booster Pumps:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Grundfos
 - b. Bell & Gossett
 - c. Hydro Flo
 - 2. Type: Duplex
 - 3. See Schedule on plans for sizing.

PART 3 - EXECUTION

3.01 PIPING SCHEDULE

- A. Under-building-slab, domestic water, building service piping, NPS 4 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints.

- B. Aboveground domestic water piping, all sizes, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought- copper solder-joint fittings; and soldered joints.

3.02 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.03 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 couplings or nipples.

3.04 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow 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 all fixtures and equipment in domestic water system.

3.05 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.

3.06 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. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.
- D. Provide Bacteriological Test Report prepared by a Certified Water Testing Laboratory.

3.07 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 by designer.
- B. Install water-pressure-reducing valves downstream from shutoff valves.
- C. Install domestic water piping level and plumb.
- D. Install unions in copper tubing at final connection to each piece of equipment.
- E. 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 where indicated on drawings.
 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 not acceptable for this application.
 3. Do not install bypass piping around backflow preventers.
- F. Install water regulators with inlet and outlet shutoff valves and full size valved by-pass. Install pressure gauges on inlet and outlet sides where indicated on drawing.
- G. Install balancing valves in locations where indicated on hot water recirculating system.
- H. Install liquid-in-glass thermometers in the outlet of each domestic, hot-water heater where indicated on water heater piping diagram.
- I. Provide the following temperature ranges for thermometers:
1. Domestic Hot Water: 30 to 180 degree F, with 2-degree scale divisions.
- J. Install dry-case type, bimetallic-activated dial thermometers at suction side of hot water recirculation pumps.
- K. Install dry-case-type pressure gauges for discharge of each pressure-reducing valve.
- L. Install direct-mounting thermometers and adjust vertical and tilted positions.
- M. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.
- N. Install direct-mounting pressure gauges in piping tees with pressure gauge located on pipe at most readable position.

- O. Install needle-valve and snubber fitting in piping for each pressure gauge.
- P. Install test plugs in tees in piping.
- Q. Install thermometers and gauges adjacent to machines and equipment to allow service and maintenance for thermometers, gauges, machines and equipment.
- R. Adjust faces of thermometers and gauges to proper angle for best visibility.
- S. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.
- T. Install water hammer arresters in all areas where indicated on plans including locations with solenoid valves, flush valves, and washer boxes in accordance with PDI-WH 201.
- U. Install air vents at high points of water piping.

3.08 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

3.09 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each reduced pressure backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest.

3.10 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.

END OF SECTION

SECTION 22.05.30 – DRAINAGE, WASTE, VENT PIPING AND APPURTENANCES

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 for soil, waste, and vent piping, chemical resistant waste and vent piping and condensate drainage piping inside the building.

1.03 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.

1.04 SUBMITTALS

- A. Product Data: For pipe, drains, cleanouts, and fittings listed herein.

1.05 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. 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; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

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 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.03 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns, Schedule 40.

2.04 CLEANOUTS

- A. Exposed Metal Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 3. Size: Same as connected drainage piping
 4. Body Material: 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.
 7. Closure: Stainless-steel plug with seal.
- B. Metal Floor Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.36.2M for adjustable housing cleanout.
 3. Size: Same as connected branch.
 4. Type: Adjustable housing.
 5. Body or Ferrule: Cast iron.
 6. Outlet Connection: Inside calk.
 7. Closure: Brass plug with straight threads and gasket.
 8. Adjustable Housing Material: Cast iron with threads set-screws or other device.
 9. Frame and Cover Material and Finish: Nickel-bronze.
 10. Frame and Cover Shape: Round.
 11. Top Loading Classification: Heavy Duty.
 12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
 13. Standard: ASME A112.3.1.
 14. Size: Same as connected branch.
 15. Housing: Stainless steel.
 16. Closure: Stainless steel with seal.
 17. Riser: Stainless-steel drainage pipe fitting to cleanout.
- C. Cast-Iron Wall Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.36.2M. Include wall access.
 3. Size: Same as connected drainage piping.
 4. Body: 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.
 7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
 8. Wall Access: Round, nickel-bronze, wall-installation frame and cover.

2.05 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

- c. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.6.3.
- 3. Body Material: Gray iron.
- 4. Outlet: Bottom.
- 5. Backwater Valve: Not required.
- 6. Top or Strainer Material: Nickel bronze.
- 7. Top of Body and Strainer Finish: Nickel bronze.
- 8. Top Loading Classification: As specified on plans.

2.06 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies:
 - 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. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.
- B. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 - 1. Open-Top Vent Cap: Without cap.
 - 2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 - 3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.07 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
 - 2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
 - 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Applications: 12 oz./sq. ft..
 - 2. Vent Pipe Flashing: 8 oz./sq. ft..
- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.08 OIL INTERCEPTORS

- A. Oil Interceptors:
 - 1. Refer to details and specifications on drawings.

2.09 ELEVATOR SUMP PUMPS

- A. Submersible elevator sump pump in elevator pit sump:
 - 1. Available Manufacturers:
 - a. Weil Pump.
 - b. Grundfos Pumps Corporation.
 - c. Zoeller Company.
 - d. Liberty
 - 2. Stainless steel shaft.
 - 3. Bronze impeller.
 - 4. Mechanical seals.
 - 5. Mercury type float switch.
 - 6. Fractional horsepower (1/3 – 1/2), 115 volt, single phase, with 3 prong ground.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

- A. Aboveground, soil and waste piping shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- B. Aboveground, vent piping NPS 1-1/4" - 1-1/2" shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- C. Aboveground, vent piping NPS 2 (DN 50) shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- D. Underground, soil, waste, and vent piping shall be the following:
 - 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- E. Aboveground, condensate piping all sizes shall be the following:
 - 1. Type "M" copper tube, wrought-copper solder-joints.
- F. Underground, condensate piping all sizes shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings and solvent-cemented joints.

3.02 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install seismic restraints on piping per local building codes.
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- E. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
- F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. 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. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 2 and smaller; 1 percent downward in direction of flow for piping NPS 3 and larger.
 - 2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- I. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- J. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- L. PVC piping will not be permitted in return air plenums.

3.03 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.04 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 drainage and vent piping to all plumbing fixtures and drains.

3.05 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains 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.

3.06 PROTECTION

- A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.07 INSTALLATION OF APPURTENANCES

- A. 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.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Cleanout Types:
 1. Exterior: Cast iron cutoff ferrule with round scoriated frame and cover, secured.
 2. Finished Concrete Floors: Neolock Connection, with round Nikaloy scoriated frame and cover.
 3. Ceramic Tile Floors: Neolock Connection, with round Nikaloy scoriated frame and cover.
 4. Resilient Tile Floors: Neolock Connection, with round recessed Nikaloy smooth round frame and cover.
 5. Wall: Smooth round stainless steel access cover with securing screw.
 6. Carpet Floor: Neolock Connection with round Nikaloy scoriated frame and cover with carpet marker.
 7. Note: Use clamping device on cleanouts than occur in floors having waterproof membrane.
- E. 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. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
 4. Where square grates are utilized, align with adjacent floor tiles.
- F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- G. Install deep-seal traps on floor drains.
- H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
- I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- J. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.
- K. Install check valve and ball valve in elevator sump pump discharge line.
- L. Refer to plumbing drawings for elevator sump pump discharge location.

3.08 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. 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.

3.09 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

SECTION 22.05.35 - FACILITY STORM DRAINAGE PIPING AND APPURTENANCES

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 storm drainage piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.
 - 3. Encasement for underground metal piping.

1.03 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:
 - 1. Storm Drainage Piping: 10-foot head of water.
- B. Seismic Performance: Storm drainage piping and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.04 SUBMITTALS

- A. Product Data: For pipe, drains and fittings.

1.05 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

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 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.03 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. PVC piping not permitted in return air plenums.

2.04 CLEANOUTS

- A. Exposed Metal Cleanouts:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 3. Size: Same as connected drainage piping
 - 4. Body Material: 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.
 - 7. Closure: Stainless-steel plug with seal.
- B. Metal Floor Cleanouts:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for adjustable housing cleanout.
 - 3. Size: Same as connected branch.
 - 4. Type: Adjustable housing.
 - 5. Body or Ferrule: Cast iron.
 - 6. Outlet Connection: Inside caulk.
 - 7. Closure: Brass plug with straight threads and gasket.
 - 8. Adjustable Housing Material: Cast iron with.
 - 9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 - 10. Frame and Cover Shape: Round.
 - 11. Top Loading Classification: Heavy Duty.
 - 12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
 - 13. Standard: ASME A112.3.1.
 - 14. Size: Same as connected branch.
 - 15. Housing: Stainless steel.
 - 16. Closure: Stainless steel with seal.
 - 17. Riser: Stainless-steel drainage pipe fitting to cleanout.
- C. Cast-Iron Wall Cleanouts:
 - 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. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M. Include wall access.
 - 3. Size: Same as connected drainage piping.
 - 4. Body: 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.
 - 7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
 - 8. Wall Access: Round, nickel-bronze, wall-installation frame and cover.

2.05 ROOF DRAINS

- A. Metal Roof Drains/Secondary Roof Drains:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.21.2M.
 - 3. Pattern: Roof drain.
 - 4. Body Material: Cast iron.
 - 5. Outlet: Bottom.
 - 6. Dome Material: Cast iron.
 - 7. Extension Collars: Required.
 - 8. Underdeck Clamp: Required.
 - 9. Sump Receiver: Required.
 - 10. 2" External or internal dam on secondary roof drains.

2.06 FLASHING MATERIALS

- A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft. thickness.
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.
- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- F. Solder: ASTM B 32, lead-free alloy.
- G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

- A. Aboveground storm drainage piping shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- B. Underground storm drainage piping shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

3.03 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers.
- C. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- D. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- E. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Storm Drain: 1 percent downward in direction of flow for all piping unless noted otherwise.
- F. Install PVC storm drainage piping according to ASTM D 2665.
- G. Install underground PVC storm drainage piping according to ASTM D 2321.
- H. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- I. Secondary storm drainage piping system shall be of same materials as primary system.

3.04 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results Plumbing."
- B. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.05 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

3.06 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains, secondary roof drains, and storm drainage specialties.

3.07 INSTALLATION OF APPURTENANCES

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground 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 rain water leader.
- 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. Cleanout Types:
1. Exterior: Cast iron cutoff ferrule with round scoriated frame and cover, secured.
 2. Finished Concrete Floors: Neolock Connection, round Nikaloy scoriated frame and cover.
 3. Ceramic Tile Floors: Neolock Connection, with round Nikaloy scoriated frame and cover.
 4. Resilient Tile Floors: Neolock Connection, with round recessed Nikaloy smooth round frame and cover.
 5. Wall: Smooth round stainless steel access cover with securing screw.
 6. Carpet Floor: Neolock Connection with round Nikaloy scoriated frame and cover with carpet marker.
 7. Note: Use clamping device on cleanouts than occur in floors having waterproof membrane.
- F. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 2. Position roof drains for easy access and maintenance.
- G. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- H. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- I. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.
- J. Base of all roof drains and overflow drains shall be insulated in accordance with Division 22, "Plumbing Insulation."

3.08 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
 2. Copper Sheets: Solder joints of copper sheets.
- B. 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.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Fabricate and install flashing and pans, sumps, and other drainage shape.

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.
 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.

3.10 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains 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.

END OF SECTION

SECTION 22.05.45- 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. This Section includes the following fuel-fired water heaters:
 - 1. Commercial, high efficiency, condensing, non-storage, gas water heaters
 - 2. Compression tanks.
 - 3. Water heater accessories.
 - 4. Hot water circulators.

1.03 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated herein. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Warranty: Special warranty specified in this Section.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer where multiple water heaters are utilized on project.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance:
 - 1. Where ASME-code construction is indicated by specified model, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.
- E. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.05 COORDINATION

- A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.06 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired 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 Period(s): From date of Substantial Completion:
 - a. Instantaneous, Gas Water Heaters:

- 1) Heat Exchanger: Five years. 2) Controls and Other Components: Two years.
- b. Compression Tanks: One year.

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

2.02 INSTANTANEOUS, GAS WATER HEATERS

- A. Description: Comply with ANSI Z21.10.3/CSA 4.3, except storage is not required.
 1. Available Manufacturers:
 - a. Intellihot
 - b. NORITZ America Corporation
 - c. Takagi Industrial Co. USA, Inc.
 - d. Rinnai
 2. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Heat Exchanger: Copper tubing.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
 - e. Burner: For use with tankless water heaters and for natural-gas fuel.
 - f. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
 - g. Temperature Control: Adjustable thermostat.
 - h. Jacket: Metal with enameled finish or plastic.
 - i. Controller: Electronic controller to control multiple unit sequencing.
 3. Support: Bracket for wall mounting.

2.03 COMPRESSION TANKS

- A. 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.
 1. Available Manufacturers:
 - a. AMTROL Inc.
 - b. Armstrong Pumps, Inc.
 - c. Flexcon Industries.
 2. 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 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.

2.04 WATER HEATER ACCESSORIES

- A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.

- B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.
- C. Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.
 - 1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.
- D. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.
- E. Where water heaters are not noted as being installed on stands, mounted on the wall, or mounted above ceiling install water heater on a 4" thick dedicated reinforced concrete pad dowelled into concrete floor slab. Pad shall be minimum of 4" larger in all directions than installed water heater.

2.05 HOT WATER CIRCULATORS

- A. In-line domestic hot water recirculating pump:
 - 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. Bell & Gossett; ITT Fluid Handling Division.
 - b. Grundfos, Inc.
 - c. Taco Pump Co.
 - 2. Taco Pump Co.
 - 3. Flanged connections.
 - 4. Hardened steel shaft.
 - 5. Bronze sheathed, diamond-bored sleeve bearing.
 - 6. Bronze impeller.
 - 7. Mechanical seals.
 - 8. Flexible-coupled motor, supported from pump casing.
 - 9. Refer to plumbing drawings for horsepower, voltage and capacities.
 - 10. Strap-on aquastat when mixing valves are not utilized

PART 3 - EXECUTION

3.01 WATER HEATER INSTALLATION

- A. Install 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.
- B. Install seismic restraints for commercial water heaters. Anchor to substrate.
- C. Install gas water heaters according to NFPA 54.
- D. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.
- E. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
- F. Install combination temperature and pressure relief valves in water piping for water heaters without storage. 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.

- G. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains.
- H. Install thermometer on outlet piping of water heaters.
- I. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater.
- J. Fill water heaters with water - Before Energizing.
- K. Charge compression tanks with air.

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing for all commercial water heaters.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain and commercial water heaters.

END OF SECTION

SECTION 22.05.50 - 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 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For plumbing fixtures to include in operation, and maintenance manuals.

1.03 COORDINATION

- A. Contractor shall examine Architectural drawings for exact location and number of plumbing fixtures required. Architect/Engineer shall be notified of any discrepancies between the architectural and plumbing drawings prior to bidding. Failure to examine all drawings will not constitute a change order for fixtures to be added which were shown on one but not the other.
- B. Refer to Architectural plans for rough-in dimensions. Do not scale plumbing drawings for rough-in dimensions.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

PART 2 - PRODUCTS

2.01 PLUMBING FIXTURES

- A. Specific manufacturers and model numbers of all plumbing fixtures and trim required for this project are indicated in the plumbing fixture schedule on the plumbing drawings. Items specified indicate the quality and appearance required.
- B. China or enamel fixtures shall be white in color unless noted otherwise.
- C. All fixtures designed for handicap use shall be mounted at handicap height as indicated on plans and herein.
- D. Residential grade fixtures will not be accepted unless so specified as the quality and appearance required in the plumbing fixture schedule or by Architect.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - a. All China fixtures: Kohler, American Standard, Toto USA, Zurn
 - b. Lavatory and Sink Faucets: Zurn, Kohler, T and S Brass, Chicago Faucet, Moen
 - c. Flush Valves: Zurn, Sloan, Toto USA, Delany
 - d. Toilet Seats: Centoco, Church, Bemis
 - e. Drop-in Stainless Steel Sinks: Elkay, Just, Advance Tabco, Kohler
 - f. Drinking Fountains/Water Coolers: Elkay, Halsey Taylor, Haws, Oasis
 - g. Service Sinks and Basins: Stern Williams, Zurn, Kohler, American Standard
 - h. Laundry Sinks: Fiat, Florestone, Mustee, Zurn, Kohler
 - i. Traps/Supplies/Stops: Zurn, McGuire
 - j. Wrap Kits: Trubro, Brocar, McGuire, Zurn

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 cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Utilize floor mounted carriers with extended arm supports for support of wall mounted china and enameled cast iron lavatories.
- G. Install counter-mounting fixtures in and attached to casework.
- H. Install fixtures level and plumb according to roughing-in drawings.

- I. 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.
- J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- K. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- L. Install toilet seats on water closets.
- M. 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.
- N. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- O. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- P. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.
- Q. Coordinate installation of all counter mounted sinks and lavatories with casework manufacturer's shop drawings prior to installation. Install offset tailpieces where required to maintain required clearance for angled aprons. Locate sink or lavatory in casework as required to avoid conflict with counter apron.

3.03 HANDICAP PLUMBING FIXTURE MOUNTING REQUIREMENTS

- A. Plumbing fixtures designated for handicap usage shall be mounted at handicap height in accordance with I.C.C A117.1 - 2009 Accessibility Code.

3.04 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. See schedule on plans for connection sizes to fixtures.
- D. Connect wall-hung urinals to waste piping with red brass nipples.
- E. Each fixture, floor drain, and piece of equipment requiring connection to drainage system to have separate traps installed as close to fixture as possible.

3.05 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.06 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.
- D. Install fresh batteries in sensor-operated mechanisms.

3.07 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.08 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22.05.55 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.01 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 - 2. Service Regulators: 65 psig minimum unless otherwise indicated.

1.02 SUBMITTALS

- A. Product Data: For piping, valves, and regulators herein.
- B. Welding Certificates.
- C. Field quality-control reports.
- D. Operation and Maintenance Data: For pressure regulators to include in operation, and maintenance manuals.

1.03 QUALITY ASSURANCE

- A. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1.04 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.

1.05 PROJECT CONDITIONS

- A. Perform site survey, and verify existing utility locations. Contact utility-locating service for area where Project is located.

1.06 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 Division 22 Common Work Results for Plumbing.

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.

2.02 PIPING SPECIALTIES

- A. 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; welded for NPS 2-1/2 and larger, flanged ends for NPS 2-1/2 and larger at valves..
 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 4. CWP Rating: 125 psig
- B. 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 "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 "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 and Smaller: 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 "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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Conbraco Industries, Inc.; Apollo Div.
 - b. McDonald, A. Y. Mfg. Co.
 - c. 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.
 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. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78. (2 ½" and Up)
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. Mueller Inc.
 - b. Nordstrom Inc.
 - c. Pratt Valves
 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.
 7. Operator: Square head or lug type with tamperproof feature.
 8. Pressure Class: 125 psig.
 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.05 PRESSURE REGULATORS

- A. Line Pressure Regulators:
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. Sensus.
 - b. Maxitrol
 - c. Emerson Fisher Control Valves.
 2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 6. Orifice: Aluminum; interchangeable.
 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 10. Overpressure Protection Device: Factory mounted on pressure regulator.
 11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 12. Maximum Inlet Pressure: 2 psig (13.8 kPa).

2.06 DIELECTRIC FITTINGS

- A. 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. McDonald, A. Y. Mfg. Co.
 - b. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
 - c. Wilkins; Zurn Plumbing Products Group.
2. Minimum Operating-Pressure Rating: 150 psig
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

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 piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to firestop details on plumbing drawings for U.L. system numbers and specific penetrations utilized.

- 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. Extend relief vent connections for line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- N. 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.
- O. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - 1. Exception: Tubing passing through partitions or walls does not require striker barriers.
- P. Prohibited Locations:
 - 1. 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.
 - 2. 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.

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.

3.06 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.

3.07 PAINTING

- A. Paint exposed, exterior metal piping, valves, service regulators, and piping specialties, except components, with field-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 (flat).
 - d. Color: As selected by architect.
- B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.08 TESTING AND ACCEPTANCE

- 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.
- E. For test pressures refer to Section 22 "Common Work Results for Plumbing."

3.09 ROOF MOUNTED GAS PIPING

- A. Install gas piping on adjustable piping roller supports per detail on plumbing drawings.
- B. Provide protective matting below gas piping supports to prevent roof damage from weight or movement.
- C. Prime and paint gas piping.

3.10 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 5.0 PSIG (34.5 kPa)

- A. Aboveground, piping NPS 2 (DN 50) and smaller shall be steel pipe with malleable-iron fittings and threaded joints.

- B. Aboveground piping NPS 2-1/2" and larger shall be steel pipe with wrought steel fittings and welded joints.

3.11 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:
 - 1. One-piece, bronze ball valve with bronze trim.
- B. Distribution piping valves for pipe sizes NPS 2-1/2" and larger shall be the following:
 - 1. Cast-iron, non-lubricated plug valve.
- C. Valves in branch piping for single appliance shall be the following:
 - 1. One-piece, bronze ball valve with bronze trim.

END OF SECTION

SECTION 23.05.00 - COMMON WORK RESULTS 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. It shall be the contractor's responsibility to furnish and install complete all systems, equipment, and related items described under Division 23.
- B. It shall be the Contractor's responsibility to determine the characteristics of electrical currents available to operate the mechanical equipment prior to ordering such equipment. All electrically operated equipment shall be designed for operation with the type of electric current available to the project.
- C. It shall further be the Contractor's responsibility to locate, layout and make provisions for all openings required in precast or cast in place concrete slabs, etc., necessary to accommodate his work.
- D. Provide labor, materials, tools, and services for a complete installation of equipment and systems specified herein and indicated on drawings.
- E. Contractor agrees to assume responsibility for liability, workmanship and quality of materials concerning work sublet to others. Before part of contract is sublet, submit to Architect in writing names of proposed subcontractors and obtain written approval.
- F. The Contractor shall furnish and install all rough-in work and make final connections to all equipment requiring exhaust systems, ductwork and other mechanical work required for connection to equipment furnished under this contract.
- G. The equipment shall be properly prepared structurally and mechanically ready to receive a single connection for each of the various mechanical items with all supply and return ductwork, piping, etc., internal to and part of the equipment installed by the equipment manufacturer or supplier.
- H. All equipment shall be installed in accordance with manufacturer's drawings and recommendations.
- I. Verify all connections and rough-in locations with the Architect and / or the equipment supplier or contractor prior to the start of their work.

1.03 CODES AND FEES

- A. All work shall be installed in accordance with the applicable provisions of the local codes, latest adopted International Mechanical Code, NFPA, UL, ASTM, ASHRAE, SMACNA, ASME and ANSI.
- B. The Contractor shall pay for fees and inspections as may be required for all systems requiring inspection by agencies having jurisdiction.

1.04 ELECTRICAL WORK

- A. All control wiring and conduit not shown on Electrical drawings shall be furnished and installed under Division 23 according to the National Electrical Code and Division 26 requirements.

- B. All power wiring and conduit for items furnished under Division 23 shall be furnished and installed under Division 26.
- C. All disconnects shall be furnished and installed by Division 26.
- D. Toggle switches for 1/2 HP motors and less shall be furnished and installed by Division 26.
- E. Wiring and conduit for solenoid valves, and control transformers including the transformers shall be furnished and installed by Division 23.
- F. Division 26 shall install all starters, toggle switches, disconnects, and all wiring to the respective motor or device. Wiring and conduit from starter to a controller shall be by Division 23.
- G. Definitions:
 - 1. Power Wiring: Line voltage circuitry rough-in including conduit, boxes, conductors, etc. between the overcurrent protection and the equipment including the connection of the starters.
 - 2. Control Wiring: Any voltage circuitry rough-in including conduit, boxes, conductors, etc. between control activator and the controller or starter.
- H. Conduit: All power wiring and 120V control wiring shall be in conduit. Low voltage control wiring shall be installed in conduit where exposed, or in return air plenums, in masonry walls, or below slab.
- I. Smoke Detectors and Firestats:
 - 1. Smoke detectors shall be furnished and installed by Division 23 unless the project has a fire alarm system, then smoke detectors shall be furnished by Division 28, installed in ductwork by Division 23. All wiring and conduit from detector to fan shall be considered control wiring. 120 Volt wiring to the detector shall be power wiring. Wiring from the detector to fire alarm system shall be furnished and installed by Division 26 and 28.
 - 2. All firestats shall be furnished, installed, and wired by Division 23.

1.05 RECORD DRAWINGS

- A. The Contractor shall maintain a set of prints that reflect site conditions including location of valves, dampers, underground piping, ductwork, equipment, etc. that have been changed to suit job conditions. The contractor shall prepare a corrected reproducible tracing of the project using the results of the record print. Final payment shall not be made until such document(s) is turned over to the architect upon completion of the project.

1.06 QUALITY ASSURANCE

- A. Perform work of this section using skilled workers who are trained and experienced in the required crafts and who are knowledgeable and familiar with the specified requirements and the methods to be used for proper performance of the work.

1.07 COMPLETE WORK

- A. Contractor shall provide and install all systems in complete working order. All items normally required for operation shall be provided.

PART 2 - PRODUCTS

2.01 IDENTIFICATION

- A. All pipe lines installed under the contract shall be clearly labeled to indicate their function and flow direction. Labels shall be applied by stencil, decal, printed tape, or equivalent method, and shall be so spaced that the lines may be traced from start to finish.

- B. Round brass tags shall be provided to identify the function of each valve in the various piping systems, except valves for which the purpose is self evident. Tags shall be approximately 1½" in diameter, properly stamped and securely fastened to the valve. A valve tag list showing valve tag number, and valve type and function shall be framed under clear plastic glazing and placed in main mechanical room.
- C. All starters and pushbutton stations shall be labeled to identify the equipment which they control.
- D. All air units, fans, etc., shall be labeled with drawing mark number and with description of area served, utilizing engraved plastic laminate nameplates.
- E. All air unit thermostats shall be labeled with proper mark number identifying it with air unit it serves.

2.02 INDOOR ENVIRONMENTAL QUALITY – LOW EMITTING MATERIALS

- A. All adhesive and sealants used on the interior of the building (inside the weatherproofing and applied on-site) shall comply with "South Coast Air Quality Management District (SCAQMD) Rule #1168", current VOC limits.
- B. Paints and coatings used on the interior of the building shall comply with the following criteria for VOC limits:
 - 1. Architectural paints, coatings and primers - Green Seal Standard GS-11, for Paints, Coatings, Stains and Sealers.
 - 2. Anti-corrosive and anti-rust paints - 250 g/l per Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.

2.03 EQUIPMENT LIST, SHOP DRAWINGS AND SAMPLES

- A. Submit to the Architect for approval, within 30 days after receipt of Notice to Proceed with the work, detailed shop drawings of all equipment and all material required to complete the project. The shop drawing shall be complete as described herein. The Contractor shall furnish the number of copies required by the General and Special Conditions of the Contract, but in no case less than six (6) copies.
- B. All shop drawings to be submitted at one time in a 3-ring binder with cover and drawing index sheet.
- C. The shop drawings shall be detailed, with dimensioned drawings or catalog cuts, showing construction, size, arrangement, operating clearances, performance characteristics and capacity. Each item of equipment proposed shall be a standard catalog product of an established manufacturer and of equivalent quality, finish, and durability to that specified. Submission material and all shop drawings for the various items of equipment shall be marked with the respective mark number or identification of the equipment shown on the drawing or in the specification.
- D. Provide a cover sheet for all major equipment that shall list in detail all accessories called for in specifications and on drawings that are being supplied. Also, list operating capacities shown in schedules or described on drawings. Failure to list these items will result in resubmittal. A copy of a standard catalog will not be sufficient. Shop drawings for controls shall contain a detailed sequence of operation. Provide shop drawings for piping firestop details.
- E. Shop drawings shall show sizes and details of required concrete and steel machine foundation, location of anchor bolts, physical dimension of equipment, equipment weight or other pertinent data required for equipment support or installation.

- F. The contractor shall verify all electrical requirements of equipment with the electrical service available before ordering said equipment.
- G. Approved shop drawings do not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings or specifications.

2.04 EQUIPMENT START-UP

- H. Before final payment, provide architect and engineer with letter from each equipment supplier stating that equipment has been started and checked by factory qualified field service technicians and is installed and running satisfactory in every respect.

PART 3 - EXECUTION

3.01 TEST

- A. Test all piping, following installation, but before it is covered or connected to equipment. Furnish necessary labor, materials and equipment for making test. All leaks disclosed by testing shall be reworked in an approved manner and the leaking system shall then be retested until proved tight under pressure. Test all systems for watertightness (or gas-tightness) as required by the authorities having jurisdiction, or in the absence of such requirements the minimum tests shall be made as follows:
 - 1. All refrigerant piping systems shall be tested at 200 pounds with dry nitrogen until all leaks have been made tight. After the pressure tests use suitable vacuum pump to evacuate the system to at least 1000 microns, then charge the system with refrigerant and oil as required. Prior to running the refrigerant equipment all safety and operating devices and controls shall be properly adjusted and tested for proper operation and protection of the equipment.
 - 2. Test all gas piping systems with air or inert gas only. Test pressure shall be not less than five times the maximum pressure to which the piping will be subjected in operation for a period not less than 30 minutes.
- B. Test all heating, cooling and ventilating equipment. When installation is complete, all equipment shall be tested for proper operation and functioning as directed by Architect.
 - 1. All equipment, motors, fans, etc., shall run at their required speed and be free from excessive vibration and noise. No bearings, journals, or any part of the motors shall heat to a temperature in excess of 40°C. above the temperature of the surrounding air.
 - 2. The equipment, diffusers, registers, dampers, etc., shall be adjusted to deliver air at all outlets according to the amount of air shown on the drawings or as required to obtain adequate room temperature.
 - 3. Architect reserves the right to require the Contractor to demonstrate the uniformity of heating and cooling in each area of the building.

3.02 COORDINATION

- A. The mechanical work shall be installed as neatly as possible in the locations shown but shall be subject to such deviations, modifications and relocations as may be necessary to conform to the requirements of the architectural drawings and as necessary to avoid interferences with the structural work and the work of other trades, and interferences between the various trades. This shall be done at no cost to the Owner. No ductwork or equipment shall be installed which would require ceilings to be lower than required by drawings, unless approval is obtained from the Architect.
- B. It is the responsibility of the General Contractor to coordinate the work of his subcontractors. To this end, the General Contractor shall require that the various subcontractors carefully examine and familiarize themselves with the architectural and structural drawings and

drawings covering the work of other trades, and that they frequently consult with all other trades so that the work may be coordinated.

- C. If necessary to coordinate and expedite the work, the Contractor shall prepare "interference drawings" and submit them to the Architect for approval. Such drawings shall show the work of the various trades involved, illustrate proposed details of construction and arrangement of equipment and apparatus, and clearly indicate any deviations from contract requirements.
- D. Minor changes in arrangement may be made to suit unforeseen conditions, but no major deviation shall be made without written approval from the Architect. If any deviations are deemed necessary, submit all details of proposed changes and all reasons therefore, in writing, to the Architect for approval prior to making installation of such work.
- E. Do not fabricate ductwork and piping before interferences are verified. No extra will be allowed for piping or ductwork fabricated in advance which cannot be used.
- F. Field verify exact sizes of fire dampers and duct balancing dampers before ordering. No extra will be allowed for dampers ordered in advance which cannot be used.

3.03 CUTTING AND REPAIRING

- A. All chases, recesses, sleeves and other openings in masonry and concrete shall be built in as the construction work progresses, and it shall be the responsibility of the subcontractor to see that such chases, recesses, sleeves and other openings required for their work are properly located and installed. If this is not done by the subcontractor whose work required such accommodation, it shall be performed at his expense.
- B. Structural members or finished work shall not be cut without the express permission of the Architect. Cutting shall be done neatly and patching or repairing shall match adjacent work.

3.04 PROTECTION AND CLEANING

- A. Work shall be protected at all times. Pipe openings shall be closed with caps or plugs until permanent connections are made. Fixtures and equipment shall be covered, if necessary, to protect against dirt, water, chemical or mechanical damage or defacement. The installation of fixtures liable to damage shall be deferred by the Architect. Cover all machine openings and open ends of ductwork to prevent entry of dirt and debris as project construction progresses.
- B. Upon completion of the work and after all tests have been made and piping systems proven tight, clean all fixtures and equipment, traps, dirt pockets, water tanks, circulating systems, filters, etc., and leave in correct operating condition. No air unit shall be operated without filters.

3.05 PAINTING

- A. Painting of mechanical equipment, piping, and exposed ductwork in finished spaces, or exposed on the exterior, shall be finished as specified under Division 09, PAINTING. All equipment exposed on the exterior furnished without factory finish shall be painted.
- B. Equipment with a factory applied finish shall have scratches, chips, etc., primed and touched up with materials which will protect the surface and match the adjacent area.

3.06 OPERATING INSTRUCTIONS

- A. Furnish the services of competent personnel to instruct the Owner's personnel in the proper operation and maintenance of all equipment, for a period of not less than 3 working days. All owner training sessions shall be videotaped and at the completion of training a DVD format copy of the video shall be given to the owner with all installation, operation, and maintenance manuals.

- B. Furnish and deliver to the Owner three sets of operating instructions for all equipment installed under this contract, including shop drawings, piping diagrams, wiring diagrams, maintenance recommendations and information concerning replacement parts. This information must contain mechanical and plumbing contractor names, equipment supplier names, contact personnel, telephone numbers, and facsimile telephone numbers. This information shall be contained in a three ring binder of suitable size, and labeled on the exterior with project name.

3.07 QUIETNESS OF OPERATION

- A. All fans, motors and other apparatus shall be selected and installed for reasonably quiet operation. Any objectionable noise which develops shall be corrected before the work will be accepted. Equipment or duct connections and fittings which produces objectionable noise shall be adjusted or insulated so as to eliminate the noise, or shall be removed and replaced by satisfactory equipment. Provide spring or rubber machine mounting isolators and flexible piping and duct connections where necessary to prevent transmission of vibration to building structure or to piping and duct system.

3.08 GUARANTEE

- A. The Contractor shall guarantee all work to be in accordance with contract requirements and free from defective or inferior materials, equipment, and workmanship for a period of one year, and he shall guarantee that all equipment is of proper size and design and so installed as to produce the capacities and results specified and shown on the drawings. Compressors shall have an extended 4 year warranty.

3.09 SUBSTITUTIONS

- A. Substitutions shall be allowed in accordance with Division 01. Substitution approval shall be at the sole discretion of the Engineer.
- B. Contractor shall note on shop drawings all major differences from specified material or equipment.
- C. When making requests for substitutions, Contractor assumes the following responsibilities:
 - 1. To have personally investigated the proposed substitute product and determined it is equal or superior in all respects to that specified;
 - 2. To provide the same warranty for substitute that Contractor would for that specified;
 - 3. To provide complete cost data, and waive all claims for additional costs related to substitution, which subsequently become apparent; and
 - 4. To coordinate installation of the accepted substitute, making such changes as may be required for Work to be complete in all respects.
- D. All requests for substitution must be submitted to the architect and engineer a minimum of 14 calendar days prior to project bid date. Such submission does not constitute approval. Only items or manufacturers specifically stated in the project specifications, drawings or addenda for use shall be considered as approved.

END OF SECTION

SECTION 23.05.10 - BASIC MATERIALS AND METHODS

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 BASIC REQUIREMENTS

- A. Equipment and materials used in the work shall be in accordance with the contract documents, of the best quality and grade for use intended, shall be new and unused and shall be the manufacturer's latest standard or current model for which replacement parts are readily available.
- B. Work shall be installed under the constant supervision of a competent superintendent and by skilled and competent mechanics experienced in the trade that contractor is practicing.
- C. All apparatus and equipment shall be installed and connected in accordance with the best engineering practices and in accordance with the manufacturer's recommendations. All auxiliary piping, water seals, valves, electrical connections, etc., recommended by the manufacturer or required for proper operation shall be furnished and installed complete.
- D. The work of this section is subject to the requirements of the Mechanical Common Work Results and the General and Supplemental Conditions in Division 01.

PART 2 - PRODUCTS

2.01 SLEEVES AND PLATES

- A. All pipes that pass through masonry partitions and walls and concrete floor slabs shall be installed with standard weight galvanized steel sleeves. Sleeves through floors shall be long enough to project a minimum of 2" above finished floor. Sleeves shall be large enough for pipe, pipe insulation and required fire caulking. Sleeves in concrete shall be accurately located in the forms and secured in place to prevent displacement during pouring of concrete. Sleeves below grade in exterior walls shall be Link-Seal with wall penetration seal or approved substitution.
- B. Sleeves in finished spaces shall finish flush with the finished wall surface. Sleeves for insulated water or refrigerant pipe shall be large enough to accommodate the insulation.
- C. Pipes passing through masonry walls and partitions in finished spaces shall be fitted with metal escutcheons or collar plates. Plates occurring in painted walls or ceiling shall be prime coated for painting; other plates shall be chromium plated.
- D. Exposed ducts passing through finished walls shall be furnished with sheet metal escutcheons.
- E. All pipe penetrations of fire rated floors or walls are to be protected. Space between metal pipe and wall or sleeve shall be protected with Hilti Fire Barrier Penetration Sealing System or approved substitute. Installation shall be in accordance with the manufacturer's recommendations for the hourly fire rating of the partition. The system shall be U.L. listed. For insulated chilled water, domestic cold water and refrigerant pipe, continue insulation and vapor barrier through wall. The sleeve through the wall shall be large enough for the pipe, insulation and fire caulking.
- F. PVC pipe passing through rated walls, ceilings or floors shall have Hilti UL Listed Fire Protection System or approved substitute. System number shall be as required by construction and rating.

2.02 ACCESS PANELS

- A. Furnish steel access panels, not smaller than 12" for single valve and 12" X 24" or 18" X 18" for two or more valves, for access of concealed valves, unions, dampers, etc., where no other means of access is shown or specified. Access panels shall be turned over to the general contractor for installation.

- B. Panels shall be Milcor, or approved substitute, with screw driver operated cam latch, and of proper design and style for installation in wall, floor or ceiling construction called for on architectural drawings. Access panels in fire rated construction shall have a UL label Class B rating. All panel styles to be verified by the Architect.

PART 3 - EXECUTION

3.01 GENERAL

- A. Run exposed ducts and piping parallel to the principal parts of the building. Ducts and piping shall be run concealed when provisions are made in floors, walls, ceilings and chases through all finished spaces, except at fixture connections and where specifically noted otherwise. Do not run water pipe below ground floor slab except where necessary.
- B. Piping, ducts, and equipment shall be kept as close as possible to ceilings, walls, columns, etc., and shall be installed in such an orderly manner as to take up a minimum of space and allow a maximum of headroom, and all offsets, fittings, etc., required to accomplish this shall be furnished and installed, whether or not each offset and fitting is specifically shown or noted. Minimum clearances on exposed piping shall be maintained as specified under "Piping Clearances" herein.

END OF SECTION

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.
- B. The work of this section is subject to the requirements of the Mechanical Common Work Results and Basic Materials and Methods.

1.02 SUMMARY

- A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.
- B. Support (1) from wood using coach screws on open construction and hanger flanges on sheeting, (2) from concrete using inserts, (3) from steel using beam clamps, rivets or bolts, (4) from concrete blocks using toggle or through bolts. Fasten supports to building in following order of preference: (1) steel framing, (2) concrete, (3) wood framing, (4) masonry, (5) wood sheathing. Do not support from roof deck without approval. Do not use plastic wall anchors. All hangers, rods, and inserts shall be Underwriters Laboratories approved for the service intended and shall meet MSS #SP-58 & 69.
- C. Adhesives are not acceptable as mounting or supporting devices.

PART 2 - PRODUCTS

2.01 HANGERS

- A. Use adjustable swivel ring band type for pipe 2½" and smaller, except C.I.. For pipe 3" and larger and for cast iron pipe, unless otherwise noted, use adjustable steel, clevis type.
- B. At each hanger on insulated pipe provide (1) pipe covering protection saddles on hot lines and (2) insulation shields on cold lines.
- C. Saddles to be 16 gauge, minimum 12° saddles arc with the following minimum saddle lengths:
 - 1. Pipe Size: minimum Saddle Length of 12"
- D. Hanger surface material shall be such that there will be no possibility of electrolytic corrosion between hanger and pipe.
- E. Anchors requiring explosive charges shall not be used. Phillips "Red-head" shields can be used for loads under 300 lbs.

PART 3 - EXECUTION

3.01 HORIZONTAL PIPING SUPPORT SCHEDULE

- A. Support of piping shall not exceed the following:

Pipe Size	Rod Dia. Min.	Steel Pipe Max. Spacing, Ft.	Copper Pipe Max. Spacing, Ft.	PVC Pipe Max. Spacing Ft.
1. Up to ½"	¼"	6	4	3 ½
2. ¾" to 1"	3/8"	7	5	4

3.	1 ¼"	3/8"	7	7	5
4.	1 ½"	3/8"	8	8	5
5.	2"	3/8"	10	8	5
6.	2 ½"	½"	10	9	6
7.	1 ½"	3/8"	7	7	5
8.	3"	½"	10	10	6
9.	4"	5/8"	10	10	6 ½
10.	6"	¾"	10	--	7 ½
11.	8" – 10"	7/8"	10	--	8
12.	12"	1"	10	--	9 ½

- B. Support horizontal cast iron pipe with hanger, or pier, located close to the hub; use one support for each pipe length, or every other joint, whichever is closer.
- C. Provide hanger within 18" of each elbow, also provide hanger within 18" of connection to each piece of equipment.
- D. Support vertical pipe at base and at each floor. In addition, 1" or smaller copper pipe shall be supported at 5 foot intervals.
- E. Support hubless cast iron at every length near fitting. Where maintenance requirements may impose torque, as at a cleanout, support on both sides of torque point.
- F. Glass pipe hangers shall be padded.
- G. When supporting PVC pipe, provide 18 ga. 12" long shield at each hanger.
- H. Pipes passing thru walls shall not bear on building construction.
- I. Where pipes carry material colder than 90F, except domestic cold water, hangers shall be sized to fit outside diameter of insulation. Provide shields at each hanger. On 2½" and larger pipe, insulated with fiberglass, provide calcium silicate insulation at hangers.
- J. All floor-mounted equipment shall be mounted on a reinforced concrete base covering the complete floor area of equipment. This concrete base shall be 4" high and shall extend 3" beyond the equipment on all sides. Provide all necessary anchor bolts and templates. Provide ¼" thick layer of non-shrinking grout between floor-mounted machinery and concrete pad. Where equipment mounts on structural steel, provide shims.
- K. Any piece of equipment installed in a finished ceiling, or wall area, shall be supported independently of the building finish. Ceiling-mounted items shall be supported directly from the building structure except, with Engineer's written approval, can be from ceiling suspension system if the hanger load is less than 10 lbs.
- L. Suspended equipment shall be supported from building structure by adjustable rods.

END OF SECTION

SECTION 23.05.93 – TESTING, ADJUSTING AND BALANCING

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. The work required under this section includes all work necessary for the proper testing, adjusting and balancing of all air and water systems to achieve the results specified by the contract drawings and specifications.

1.03 SUBMITTALS

- A. Qualification Data: Within 45 days from Contractor's Notice to Proceed, submit 6 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Certified TAB Reports: Submit four copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- C. The mechanical contractor shall submit a complete resume of the balancing agency for approval by the architect and engineer prior to beginning any work. The resume shall contain examples of previous projects, references, personnel available, certifications and test and balancing report format.
- D. TAB Report Forms: Use standard forms from:
 - 1. AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.
 - 2. NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
 - 3. SMACNA's TAB "HVAC Systems - Testing, Adjusting, and Balancing."
 - 4. TAB firm's forms approved by Architect.

1.04 QUALITY ASSURANCE

- A. Work required under this section shall comply with American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE), National Environmental Balancing Bureau (NEBB) or Associated Air Balance Councils (AABC), Recommendations Pertaining To Measure, Instruments, and Testing, Adjusting and Balancing by Certified technicians.
- B. The mechanical contractor shall make arrangements with an independent balancing agency to balance all air flow to the flow rates indicated on the contract drawings and schedules. This shall include all split system heat pump air handlers, supply fans, exhaust fans, air handling systems and VAV terminal units. The balancing agency shall be one normally engaged in such work and **shall be either AABC or NEBB Certified**. Test and balance reports not prepared by an AABC or NEBB certified contractor will be rejected and the complete system shall be retested by an AABC or NEBB certified contractor at no cost to the owner. All test and balance reports shall be certified per AABC or NEBB.
- C. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
 - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

- D. Architect and engineer reserve the right to require the contractor to demonstrate the uniformity of heating and cooling in each area of the building.
- E. All equipment, fans, motors, etc., shall run at their required speeds and be free from excessive vibration and noise. No bearings, journals, or any part of the motors shall heat to a temperature in excess of 40°C above the temperature of the surrounding air.

1.05 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed. The work required under this section includes all work necessary for the proper testing, adjusting and balancing of all air and water systems to achieve the results specified by the contract drawings and specifications.

PART 2 - PRODUCTS

2.01 PATCHING MATERIALS

- A. Except as otherwise indicated, use same products as used by original installer for patching holes in insulation, ductwork, and housing which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes. At technician's option, plastic plugs with retainers may be used to patch drilled holes in ductwork and housing. Leave no test holes or access openings uncovered and insure vapor barrier continuity of all insulation.

PART 3 - EXECUTION

3.01 INSPECTION AND REPORTS

- A. Prior to the start of any test and balancing work, a representative of the test and balancing agency shall visit the project for the purpose of inspecting the work in place, and shall prepare and submit a written report to the mechanical contractor and engineer stating work which is to be completed before testing and balancing can proceed. Do not proceed with testing and balancing until all items listed in said report have been completed. Failure to do this will render the test and balance report null and void. If the report is deemed null and void, all testing must be performed again at no additional cost to the owner, in the presence of the architect and/or engineer. The contractor shall reimburse the architect and/or engineer for any expenses and time related to supervision of system re-testing.
- B. The testing and balancing agency shall record the test results in tabulated formats for both cooling and heating conditions, and shall submit a minimum of three copies to the architect for review and approval. A copy of the completed and approved report shall be placed in each copy of the facility operating and maintenance manuals as stated hereinbefore.

3.02 AIR BALANCING

- A. The air balance shall include the following air tests in accordance with the following requirements. Test all air systems with new, clean filters in place.
 - 1. Test and record fan total CFM (design and actual).
 - 2. Test and record fan outside air CFM (design & actual.)
 - 3. Test and record fan suction static pressure and fan discharge static pressure (actual.)
 - 4. Test and record static pressure on both sides of all filters and coils (actual.)
 - 5. Test and record fan RPM (design and actual.)

6. Record fan sheave, motor sheave, pitch diameter after adjustment (if variable), center line to center line distance from fan shaft to motor shaft, belt size, and number of belts (actual.)
7. Change sheaves, pulleys, and belts, if required to obtain design air flow.
8. Test and record fan motor horsepower, amperage, voltage, and RPM (rated and actual.)
9. Record fan motor manufacturer, model and serial numbers and service factor (actual.)
10. Record motor starter size (actual.)
11. Test and record diffuser, register and grille CFM (preliminary, design and actual) for supply, return and exhaust systems. If the return air quantities are not shown at the return grille locations on the contract documents, use the percentage method (supply air less the outside air equals the percentage of return air) and balance the return air grilles accordingly.
12. Test and record main duct traverse readings for all air handling units and fans (preliminary, design and actual.) This shall include exhaust, supply, return and outside air ducts.
13. Record each system supply air temperature, return air temperature mixed air temperature and outside air temperature (dry bulb and wet bulb) in heating and cooling modes.
14. Record air temperature and humidity in each room at time of air balance.
15. Record AHU type, location, manufacturer, model number, and serial number.
16. Mark all damper quadrants as to final adjusted position, and lock into place.
17. Check fan rotation on all fan units.
18. Check filters for cleanliness prior to balancing. Test only with new, clean filters of the type specified in place.
19. In cooperation with the control manufacturer's representatives, set and adjust all automatically operated dampers to operate as specified.
20. Record the date, time, outside temperature and outside humidity at the time of recording unit temperatures.

3.03 TESTING TOLERANCES

- A. Air and water balancing shall be as follows:
- | | |
|--------------------------|------|
| 1. Air Units | ± 5% |
| 2. Supply Fans | ± 5% |
| 3. Exhaust Fans | ± 5% |
| 4. Kitchen Hoods | ± 5% |
| 5. Grilles and Registers | ± 5% |

END OF SECTION

SECTION 23.07.00 - HVAC 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. Work required under this section consists of insulation for piping and duct systems and equipment as hereinafter specified.
- B. The work of this section is subject to the requirements of the Mechanical Common Work Results and Basic Material Specifications.

1.03 QUALITY ASSURANCE

- A. All materials used for insulation of pipe and ducts and equipment covered in this section shall be UL listed. Fire hazard ratings shall be as follows:
 - 1. Flame spread of 25, and smoke development of 50 for all duct insulation and other insulation located in ceiling plenums or rooms utilized for return air plenums.
 - 2. Flame spread of 25 and smoke development of 200 for other pipe and equipment insulation.
- B. Increase the insulation thickness of ½" on all piping outside the building insulation envelope and weatherproof with 0.016" thick aluminum jacket with aluminum fitting covers. This piping shall be protected with electric heat tape installed under the insulation.
- C. All insulation and thicknesses are selected to meet the International Energy Conservation Code.
- D. Install 0.016" thick aluminum jacket on all pipe insulation in mechanical rooms 7'-0" from finished floor.

PART 2 - PRODUCTS

2.01 FLEXIBLE TUBULAR ELASTOMERIC

- A. Provide fire-retardant closed-cell slip-on flexible type. Product must be guaranteed by manufacturer to have continuous operational temperature limit of not less than 180°F and a minimum "R" value of 3.57 at 75°F 50% RH. Provide insulation for the following:
 - 1. Refrigerant suction and hot gas bypass lines - ½" thick on lines 1" or less - 1" thick on lines larger than 1". Install a 0.016" thick aluminum jacket on insulation outside the building.

2.02 FIBERGLASS BLANKET FOR DUCTS

- A. Provide 2" thick 3/4" lb. density fiberglass blanket insulation with FSK or FRK jacket installed R value of 5.6. Install according to manufacturer's recommendations. For ducts 30" wide and over support insulation on bottom of duct with rows of welded insulpins on 18" center. Lap jacket 2" at seams and vapor seal. Provide this insulation for the following:
 - 1. All supply air ducts. Supply ducts exposed in conditioned spaces do not require external insulation.
 - 2. Outside air ducts.
 - 3. Top of supply air diffusers.
 - 4. Unlined return air ducts in attic or plenum spaces not heated or cooled.
 - 5. Relief air ducts and grilles.

6. Supply and return duct insulation in attic spaces above roof insulation shall be 3"- 3/4# density with installer "R" value of 8.3.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install all insulation products in strict accordance with manufacturer's instructions.
- B. All items requiring service such as strainers, balancing valves, etc., provide removable insulation caps of insulation equal in thickness to pipe covering.
- C. Cover and repair all joints, rips, tears, punctures, staples, insulpins, and other breaks in the insulation vapor barrier jacket with sections of foil tape to match the insulation vapor barrier facing. The integrity of the insulation vapor barrier shall be maintained.
- D. No insulation shall be cut where a hanger is located.
- E. Flexible tubular elastomeric piping installation shall be as follows:
 1. Install pipe insulation by slitting tubular sections and applying onto piping or tubing. Alternately, whenever possible, slide unslit sections over the open ends of piping or tubing. All seams and butt joints shall be adhered and sealed using Armstrong 520 Adhesive. When using AP Armaflex SS only the butt joints shall be adhered using 520 Adhesive.
 2. Insulation shall be pushed on the pipe, never pulled. Stretching of insulation may result in open seams and joints.
 3. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp knives must be used.
 4. On cold piping, insulation shall be adhered directly to the piping at the high end of the run using a one inch strip of 520 Adhesive on the ID of the insulation and on the pipe. All exposed end cuts of the insulation shall be coated with 520 Adhesive.
 5. Sheet insulation shall be used on all pipes larger than 6" IPS. Insulation shall not be stretched around the pipe. On pipes larger than 12" IPS, adhere insulation directly to the pipe on the lower 1/3 of the pipe.
 6. Seams shall be staggered when applying multiple layers of insulation.
 7. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with 520 Adhesive. Screwed fittings shall be sleeved and adhered with a minimum one inch overlap onto the adjacent insulation.
 8. Valves, flanges, backflow preventers, strainers and couplings shall be insulated using Armaflex donuts that shall then be covered with sheet or oversized tubular insulation.

END OF SECTION

SECTION 23.23.00 - REFRIGERANT 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. The work included under this section of the specification includes all work necessary for the complete installation of a refrigerant piping system.

PART 2 - PRODUCTS

2.01 REFRIGERANT PIPING SYSTEM

- A. The refrigerant piping shall be Type L copper with wrought copper fittings and high temperature solder joints, Sil-Fos, or approved equal. The piping system shall include but not be limited to the following: liquid line solenoid valves, hot gas bypass and control where noted, charging valves sight glass with moisture indicator, liquid line strainer drier, flexible connectors where required. The piping shall be installed according to the diagrams furnished by the manufacturer's Engineer for approval prior to installation. The piping system shall be tested at 200 pounds with dry nitrogen until all leaks have been made tight. After the pressure test use suitable vacuum pump to evacuate the system to a least 1000 microns, then charge the system with refrigerant, all safety and operating devices and controls shall be properly adjusted and tested for proper operation and protection of the equipment.

PART 3 - EXECUTION

- 3.01** Route all refrigerant piping between condensing units and evaporator coils by the most direct route possible in order to minimize refrigerant line length.
- 3.02** All refrigerant piping must be supported from the building structure and affixed to the structure.
- 3.03** Reasonable measures should be taken to insure that the installed refrigerant piping forms no traps for the system lubricating oil.
- 3.04** Refrigerant piping extending through the roof shall be sleeved, water proofed and flashed watertight.
- 3.05** Refrigerant piping underground shall be run in PVC piping sleeve. Seal openings between PVC sleeve and refrigerant piping with foam to form a weatherproof seal.
- 3.06** All refrigerant suction and hot gas lines shall be insulated with flexible tubular elastomeric insulation as required in section 23 07 00 "HVAC Insulation" hereinbefore.

END OF SECTION

SECTION 23.31.00 - AIR DISTRIBUTION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The work required under this section includes all work necessary for the complete installation of an air distribution system.
- B. The work of this section is subject to the requirements of the Mechanical General Provisions and Basic Materials specifications.

1.02 CERTIFIED RATINGS

- A. All fans shall have AMCA certified ratings and be UL listed.

PART 2 - PRODUCTS

2.01 FANS

- A. Ceiling fans shall be direct drive centrifugal type with grille, insulated housing, wall switch, backdraft damper, and discharge duct to roof with roof jack.
- B. Centrifugal Wall Sets shall be direct drive type conforming to all applicable requirements for low contour roof fans, EXCEPT that centrifugal wall fans shall be arranged for horizontal mounting, and disconnect switches are not required.

2.02 DUCTWORK

- A. Type
 - 1. All ductwork shall be sheet metal unless noted otherwise (26 ga. minimum.)
 - 2. Ductwork type as follows:
 - a. Supply duct from air unit to VAV box and all exposed round duct to be medium pressure type.
 - b. Supply return and outside air duct on constant volume system to be low pressure.
 - c. Exhaust duct to be low pressure.
- B. Low Pressure Sheet Metal Ductwork:
 - 1. Sheet metal work, unless noted otherwise, shall be fabricated of Armco Zincgrip-Paintgrip galvanized steel where exposed to weather or to be painted. Sheet metal for concealed ductwork shall be fabricated of galvanized steel, and be "Bethcon", as manufactured by Bethlehem Steel Company, or "Softite", as manufactured by Wheeling or approved substitute.
 - 2. Ducts shall be sizes shown on the drawings, crossbroken, rigidly braced, adequately supported and securely fastened in place. Fabricate and install ducts in accordance with latest SMACNA Duct manual details.
 - 3. Duct connections 24" wide and larger to be made using the "Ductmate System" or approved substitute. The installation to be complete using angles, corners, cleats, gaskets, sealer, and bolts. Install according to Manufacturers instructions.
- C. Leakage Testing of Installed System Acceptance Criteria
 - 1. The installed duct system shall be tested to the designed operating pressure. This includes supply, return, and exhaust duct.
 - 2. The air leakage at the test pressure shall be measured by a calibrated orifice type of flow meter. Total allowable leakage of the system shall not exceed ½ % of the air handling design capacity of the system.
 - 3. Leakage concentrated at one point may result in objectionable noise even if the system passes the leakage rate criteria. This noise source must be corrected to the satisfaction of the engineer.

4. The orifice flow measurement device must have been individually calibrated against a primary standard, and this calibrated curve permanently attached to the orifice tube assembly.
- D. Joint Sealing
1. All joints shall be sealed with an approved duct sealer specifically formulated for sealing the field joints in duct systems. Sealer for low pressure duct systems (<2"w.g.) Shall be Ductmate Proseal or Foster 32-17 water based sealants.
 2. Flanged joints shall be sealed by neoprene rubber gaskets.

2.03 DUCT ACCESSORIES

- A. Fire Dampers - All fire dampers shall be Type B, constructed and tested for compliance with the latest edition of UL Standard 555. All dampers shall bear the UL label. Each damper shall be suitable for use in either the horizontal or vertical position and must include an integral drive spring. Sleeves and collars shall be furnished with fire dampers. Dampers shall be designed so as not to restrict air flow. A suitable access door in duct shall be provided for resetting all fire dampers. Install all dampers in accordance with all manufacturer installation instructions.
- B. Louvers - Louvers in outside walls shall be high performance, drainable blade weather louvers. Louver to have extruded aluminum construction with anodized finish, color by Architect and 4" frame thickness. Adjustable louvers to have vinyl blade gasket. Louvers to have 0.15" wg., pressure drop maximum at 900 fpm velocity through free area and no water carryover at designed air flow. All louvers to have aluminum bird screen and exterior frame. All louvers are stationary type unless noted on drawings, and shall have AMCA seal.
- C. Combination Fire/Smoke Dampers - All combination fire/smoke dampers shall be constructed and tested for compliance with the latest editions of UL Standard 555 and 555S. All dampers shall bear the UL label. The 120 volt (or 24 volt - designer specify) electric (or pneumatic - designer specify) damper shall be rated to 350° Fahrenheit, with blade seals of silicone rubber capable of withstanding 450° Fahrenheit. Additionally, the damper must be factory supplied with an actuator and sleeve to comply with the requirements of UL 555 and UL 555S. Install all dampers in accordance with all manufacturer installation instructions. Provide a suitable access door in duct for resetting of damper.
- D. Brick Vents
1. Brick vents in exterior walls shall be fabricated of extruded aluminum, 4" deep, with 45° blades. Frame and blades shall be 0.125" thick. Brick vent color shall be as selected by the architect.
- E. Manual Balancing Dampers
1. Manual balancing dampers in rectangular ducts shall be American Warming. Dampers in duct runs and branches shall be Model VC-21. Dampers to be constructed of 16 ga galvanized steel, with vinyl seals for low leakage at shutoff. All dampers to be caulked with silicone between damper and duct, and have external adjustment marked Open-Closed. Dampers shall be furnished with controls when motor operated. Dampers to be opposed blade type if either side is 12" or larger. Dampers under 12" may be single blade type.
 2. Manual Balancing Dampers in round ducts shall be American Warming Model VC-22 in sizes up to and including 10" and Model VC-23 in sizes 12" and larger. Dampers to be 16 ga galvanized steel. Provide EPT sponge seals for low leakage.
 3. Dampers to have 1% leakage rate at 1" wg duct pressure in accordance with AMCA 500.
 4. All dampers to be installed with 2" standoff bracket.
 5. Dampers with motor operated control to be furnished under Section 15900 by control contractor.

- F. Gravity Shutters or Relief Dampers - Gravity shutter shall be American Warming Model BD-20. Dampers to be of galvanized steel construction and have vinyl seals.
- G. Flexible Duct
 - 1. Flexible connections from main to terminal supply diffusers may be used above accessible ceiling areas.
 - 2. Flexible duct shall be UL listed Class 1 air duct connector and be Flexmaster type 4M or approved substitute, with 1-1/2", 3/4 pound density glass fiber with flame resistant vapor barrier, R=6.0. Maximum lengths not to exceed 6 feet. Provide air tight inner liner, wire helix, and reinforced metalized outer jacket.
 - 3. Use adjustable steel strap clamps or flexible nylon wire ties when attaching flexible duct to sheet metal collars. Wrap duct and collar with 2" wide duct tape before attaching clamp.
 - 4. System to be UL 181, SBCC, BOCA, NFPA 90A & 90E, and HUD approved.
 - 5. Do not use flexible duct in return or exhaust systems.
- H. Grilles, Registers, and Ceiling Outlets
 - 1. All flat grilles and registers shall be as scheduled on drawings, or approved substitute, as scheduled on the drawings, with baked enamel finish; color as selected by Architect.
 - 2. Coordinate location with reflected ceiling plans.
 - 3. Provide square to round adaptors if required.
 - 4. All outlets and inlets to have sealing gaskets and volume control dampers. Provide frame suitable for wall or ceiling installation used. Verify with Architectural drawings.
 - 5. Diffusers in UL ceilings to be steel with radiation damper and insulation blanket.
- I. Roof Air Intakes and Reliefs - Roof air intake and outlet assemblies shall be Jenn Air, Penn, or as approved factory fabricated air hood, complete with: all aluminum weatherproof construction; lock formed or welded seams; turned down flanged base for curb mounting; removable hood; angle framing and reinforcement; bird screens; and damper with gasketed blade edges. Dampers shall be motor operated where indicated otherwise, dampers shall be gravity operated (See Control System, hereinafter). Dampers for reliefs to have counterbalance weights and anti-sweat covering. Provide factory fabricated aluminum or galvanized steel roof curb assembly with flashings for each roof air intake. Roof curbs shall be selected to match the roof conditions. As a minimum, the base of the intake or relief must be 12" above the finished roof. Contractor should determine exact height of curb required at each unit location and shall verify roof construction with the architectural drawings and specifications and existing conditions if warranted.
- J. Flexible Connectors
 - 1. Provide flexible connectors between each air unit or fan and the duct distribution, on both the supply side and the return side.
 - 2. Connectors shall not exceed 10 inches in lengths.
 - 3. Connectors to be of an approved flame retardant fabric with a maximum flame spread of (25) and a maximum smoke development rating of (50).
 - 4. All connectors on supply duct to be insulated.
- K. Branch Connections
 - 1. Main Supply Branch: (See SMACNA Manual Figure 2-7, 2-8) use unvaned radius transition elbow with splitter damper when branch width is 36" or smaller, and vaned square throat transition elbow when branch width is larger than 36".
 - 2. Sub-Branch Supply: (See SMACNA Manual Figure 2-16) use straight tap with extractor, having manual control rod extended thru main branch side, when extractor weight is 50 lbs or less. For sub-branch sizes where extractor would be heavier than 50 lbs, use 45° or radius entry clinch lock collar. (See SMACNA Figure 2-8, and manual balancing dampers.)
 - 3. Sub-Branch Return: (See SMACNA Manual Figure 2-8) use 45° or radius entry clinch lock collar. (Provide each with manual balancing damper.)

4. Round Supply Take-Offs: Use factory fabricated rectangular to round type galvanized steel fittings and 26 ga manual balancing damper with 2 wing nuts and handle. System to be Crown Model 3300-DS or approved substitute. Provide 2" standoff bracket.
 5. Round Return/Exhaust Tap-ins: Use factory fabricated beaded straight spin-in type galvanized steel tap fittings.
 6. For low pressure return and/or exhaust application of duct connectors to square ceiling mounted grilles or registers, use factory fabricated square-to-round galvanized steel minimum 3" deep adapter boxes having 2" long beaded round collar.
- L. Vanes and Deflectors
1. Vanes and deflectors to be galvanized steel sheet same thickness as used in ductwork of corresponding size. Vanes to be securely anchored to duct or casing and have freestanding edges braced as necessary for making rigid.
- M. Transitions
1. Increase-in-area transition: Transformation slope not to exceed 20°.
 2. Decrease-in-area transition: Transition slope to be maximum 30°, but 20° is preferable.
 3. Angle of transformation at connections to heaters or other equipment not to exceed 30° on approaching side of equipment and 45° on leaving side. Angle of approach may be increased to meet space conditions when transformation section is provided with vanes.
- N. Elbows
1. Elbows shall be either full radius type or square throat with turning vanes. No mitred elbows allowed. Short radius elbows with vanes also allowed.
 2. Unvaned full radius elbow, shall have throat radius equal to width of duct and full heel radius over than 36" in width.
 3. All square heel elbows shall have 3" square throat elbow with large class single thickness vanes thru 36" unsupported vane length and large double thickness vanes for unsupported vane length of 37" thru 72" as per SMACNA Manual Figures 2-3 and 2-4.

2.04 AIR FILTERING EQUIPMENT

- A. All air units, shall be provided with air filters. Filters shall be installed in the return air upstream from any heat exchanger or coil, in an approved convenient location and shall be easily accessible for removing to clean or replace. 1" thick filters to have UL Class 2 rating, 2" and above to have UL Class 1 rating.
- B. Air filters shall be of the types specified below. Type of filter required in each case, arrangements, sizes, capacities number of cells, and other requirements not specified hereinafter shall be as indicated on the drawings or as recommended by the unit manufacturer.
- C. Rooftop Air Unit Filters shall be Farr 30-30 extended area type. The filter to be completely disposable and have non-creased radial pleat design with media support grid and enclosing frame. Filter to be 2" thick with 30% efficiency rated on ASHRAE Test Standard 52-76 initial resistance to be 0.08" WG at 250 FPM. Filter to be UL listed Class 2.
- D. Split System Air Unit Filters shall be Farr Cam Farr 20-20, 1" thick pleated disposable type. Each filter to have a non-woven cotton and synthetic fabric media, media support grid and enclosing frame. The filter to be UL listed Class 2. The filter to have 20% efficiency by ASHRAE Test 52-76. Initial air resistance to be 0.09" WG at 250 FPM.
- E. Media Fill: Provide filter media as follows:
1. Initial fill for each filter of each type installed for testing and adjusting AC system, and left in place for Owner's immediate use.
 2. One complete spare fill for each filter of each type for Owner's future use. Store all spare media on premise in factory sealed containers, and obtain signed receipt therefore from Owner's authorized representative.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install Air Distribution Equipment as specified above and as recommended by manufacturer.
- B. Sheet metal ducts shall be securely supported, hung or suspended by metal trapeze hangers or straps having a minimum width of one inch. Nails or screws shall not be driven through the duct walls.
- C. All duct joints and seams shall be securely fastened and sealed to make air tight. All leaks shall be sealed with Hardcast.
- D. All exposed openings in fan housing shall be protected with screens or gratings. All fans shall have belt guards on exposed drives.
- E. Flexible duct connectors shall not pass through a fire wall or a partition having a fire resistance rating of (1) hour or more.
- F. Do not install flexible ducts that have more than a 90° turn.
- G. Contractor to verify duct sizes and fittings required with actual field measurements before fabrication of ductwork. The contractor shall not receive compensation for ductwork fabricated that cannot be used. See section 3.02.

3.02 EXCESSIVE NOISE AND VIBRATION

- A. All air distribution equipment was selected for a noise level recommended for the space it serves. Any equipment causing excess noise or vibration will be replaced at the Contractor's expense.

END OF SECTION

SECTION 23.38.13 - COMMERCIAL-KITCHEN HOODS

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 Type I and Type II commercial kitchen hoods.

1.03 DEFINITIONS

- A. Listed Hood: A hood, factory fabricated and tested for compliance with UL 710 by a testing agency acceptable to authorities having jurisdiction.
- B. Standard Hood: A hood, usually field fabricated that complies with design, construction, and performance criteria of applicable national and local codes.
- C. Type I Hood: A hood designed for grease exhaust applications.
- D. Type II Hood: A hood designed for heat and steam removal and for other nongrease applications.

1.04 SUBMITTALS

- A. Product Data: For the following:
 - 1. Standard hoods.
 - 2. Filters/baffles.
 - 3. Fire-suppression systems.
 - 4. Lighting fixtures.
- B. Shop Drawings:
 - 1. Show plan view, elevation view, sections, roughing-in dimensions, service requirements, duct connection sizes, and attachments to other work.
 - 2. Show cooking equipment plan and elevation to confirm minimum code-required overhang.
 - 3. Indicate performance, exhaust and makeup air airflow, and pressure loss at actual Project-site elevation.
 - 4. Show water-supply and drain piping connections.
 - 5. Show control cabinets.
 - 6. Show fire-protection cylinders, piping, actuation devices, and manual control devices.
 - 7. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 8. Wiring Diagrams: Power, signal, and control wiring.
 - 9. Piping Diagrams: Detail fire-suppression piping and components and differentiate between manufacturer-installed and field-installed piping. Include roughing-in requirements for drain connections. Show cooking equipment plan and elevation to illustrate fire-suppression nozzle locations.
- C. Welding certificates.

1.05 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

- B. Welding: Qualify procedures and personnel according to AWS D1.1/D 1.1M, "Structural Welding Code - Steel," for hangers and supports; and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for joint and seam welding.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.06 COORDINATION

- A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.

PART 2 - PRODUCTS

2.01 HOOD MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304.
 - 1. Hood shall be constructed of 18 gauge 304 stainless steel.
 - 2. Finish: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.
 - a. Finish shall be free from tool and die marks and stretch lines and shall have uniform, directionally textured, polished finish indicated, free of cross scratches. Grain shall run with long dimension of each piece.
 - 3. Concealed Stainless-Steel Surfaces: ASTM A 480/A 480M, No. 2B finish (bright, cold-rolled, unpolished finish).
 - 4. Exhaust Duct shall be 16 gauge liquid tight welded steel. Exhaust duct must extend a minimum of 18" above roof line.
- B. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR, Section 177.2600, for use in areas that come in contact with food.
 - 1. Color: As selected by Architect from manufacturer's full range.
 - 2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.
- C. Sound Dampening: NSF-certified, nonabsorbent, hard-drying, sound-deadening compound for permanent adhesion to metal in minimum 1/8-inch thickness that does not chip, flake, or blister.
- D. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and that passes testing according to UL 710.

2.02 GENERAL HOOD FABRICATION REQUIREMENTS

- A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.
 - 1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
 - 2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
 - 3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.

4. Coat concealed stainless-steel welded joints with metallic-based paint to prevent corrosion.
 5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780/A 780M.
- B. For metal butt joints, comply with SMACNA's "Kitchen Equipment Fabrication Guidelines."
- C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.
- D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.
- E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.
- F. In food zones, as defined in NSF, fabricate surfaces free from exposed fasteners.
- G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.
- H. Fabricate pipe slots on equipment with turned-up edges sized to accommodate service and utility lines and mechanical connections.
- I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.
- J. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Equipment Fabrication Guidelines."
- K. Fabricate enclosure panels to ceiling and wall as follows:
1. Fabricate panels on all exposed side(s) with 20 gauge stainless steel, and extend from ceiling to top of hood canopy and from canopy to wall.
 2. Wall Offset Spacer: Minimum of 3 inches.
 3. Wall Shelves and Overshelves: Fabricate according to SMACNA's "Kitchen Equipment Fabrication Guidelines," with minimum 0.0625-inch- thick, stainless-steel shelf tops.

2.03 TYPE I EXHAUST HOOD FABRICATION

- A. 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. Captive-Aire Systems.
 2. Greenheck.
 3. Kalthoff Fabricators, Inc.
- B. Weld all joints exposed to grease with continuous welds, and make filters/baffles or grease extractors and makeup air diffusers easily accessible for cleaning.
1. Fabricate hoods according to NSF 2, "Food Equipment."
 2. Hoods shall be listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
 3. Hoods shall be designed, fabricated, and installed according to NFPA 96.
 4. Include access panels as required for access to fire dampers and fusible links.
 5. Duct Collars: Minimum 0.0598-inch- thick steel at least 3 inches long, continuously welded to top of hood and at corners. Fabricate a collar with a 0.5-inch- wide duct flange.
 6. Duct-Collar Fire Dampers: Collar and damper shall comply with UL 710 testing and listing required for the entire hood.
 7. Makeup Air Fire Dampers: Labeled, according to UL 555, by a testing agency acceptable to authorities having jurisdiction.

- C. Hood Configuration: Exhaust and makeup air.
 - 1. Makeup air shall be introduced through laminar-flow-type, perforated metal diffusers mounted in the ceiling in front of hood canopy. Furnish laminar-flow-type diffusers with baked white enamel finish and volume-control dampers.
 - 2. The hood supply duct shall be insulated below the roof level.
- D. Hood Style: See drawings.
- E. Filters/Baffles: Removable, stainless-steel. Fabricate stainless steel for filter frame and removable collection cup and pitched trough. Exposed surfaces shall be pitched to drain to collection cup. Filters/baffles shall be tested according to UL 1046, "Grease Filters for Exhaust Ducts," by an NRTL acceptable to authorities having jurisdiction.
- F. Lighting Fixtures: Surface-mounted, incandescent fixtures and lamps with lenses sealed vaportight. Wiring shall be installed in conduit on hood exterior. Number and location of fixtures shall provide a minimum of 70 fc at 30 inches above finished floor.
 - 1. Light switches shall be mounted on front panel of hood canopy, on wall adjacent to hood or in hood control panel.
 - 2. Lighting Fixtures: Fluorescent or Incandescent complying with UL 1598.
- G. Hood Controls:
 - 1. The hood supply and exhaust fans shall be complete with disconnects, starters, and contactors. Standard control panel shall be complete with "ON/OFF" switch and fan "ON" light. Wiring shall meet local and national codes. Incandescent lights shall be furnished. Automatic energy shut-off shall be provided for cooking equipment located under hoods. See Control Sequence or Diagram on Drawings.

2.04 TYPE II EXHAUST HOOD FABRICATION

- A. 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. Captive-Aire Systems.
 - 2. Greenheck.
 - 3. Kalthoff Fabricators.
- B. Fabricate hoods according to NSF 2, "Food Equipment."
- C. Fabricate hoods to comply with SMACNA's "HVAC Duct Construction Standards: Metal and Flexible."
- D. Hood Type: Heat and vapor or Condensate removal.
- E. Hood Style: See drawings.
- F. Condensate Hood Baffles: Removable, stainless-steel baffles to drain into a hood drain trough, and stainless-steel drain piping.
- G. Lighting Fixtures: Surface-mounted, incandescent fixtures and lamps with lenses sealed vaportight. Wiring shall be installed in stainless-steel conduit on hood exterior. Number and location of fixtures shall provide a minimum of 70 fc at 30 inches above finished floor.
 - 1. Light switches shall be mounted on front panel of hood canopy, on wall adjacent to hood or in hood control panel.
 - 2. Lighting Fixtures: Fluorescent or Incandescent complying with UL 1598.

2.05 WET-CHEMICAL FIRE-SUPPRESSION SYSTEM

- A. 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. Ansul Incorporated; a Tyco International Ltd. Company.
 - 2. Badger Fire Protection.
 - 3. Kidde Fire Systems.

4. Pyro Chem.
 5. Kalthoff Fabricators.
- B. Description: Engineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be listed and labeled for complying with NFPA 17A, "Wet Chemical Extinguishing Systems," by a qualified testing agency acceptable to authorities having jurisdiction.
1. Steel Pipe, NPS 2 and Smaller: ASTM A 53/A 53M, Type S, Grade A, Schedule 40, plain ends.
 2. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
 3. Piping, fusible links and release mechanism, tank containing the suppression agent, and controls shall be factory installed. Controls shall be in stainless-steel control cabinet mounted on hood or wall. Furnish manual pull station for wall mounting. Exposed piping shall be covered with chrome-plated aluminum tubing. Exposed fittings shall be chrome plated.
 4. Liquid Extinguishing Agent: Noncorrosive, low-pH liquid.
 5. Furnish electric-operated gas shutoff valve with clearly marked open and closed indicator for field installation.
 6. Fire-suppression system controls shall be integrated with controls for fans, lights, and fuel supply and located in a single cabinet for each group of hoods immediately adjacent.
 7. Wiring shall have color-coded, numbered terminal blocks and grounding bar. Spare terminals for fire alarm, optional wiring to start fan with fire alarm, red pilot light to indicate fan operation, and control switches shall all be factory wired in control cabinet with relays or starters. Include spare terminals for fire alarm, and wiring to start fan with fire alarm.

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.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Complete field assembly of hoods where required.
 1. Make closed butt and contact joints that do not require filler.
 2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in Part 2 "General Hood Fabrication Requirements" Article.
- B. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.
- C. Make cutouts in hoods where required to run service lines and to make final connections, and seal openings according to UL 1978.
- D. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.
- E. Install hoods to operate free from vibration.
- F. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches o.c. maximum.

- G. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.
- H. Install lamps, with maximum recommended wattage, in equipment with integral lighting.
- I. Set initial temperatures, and calibrate sensors.
- J. Set field-adjustable switches.

3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping with clearance to allow service and maintenance.
- C. Connect ducts according to requirements in Division 23 Section "Air Duct Accessories." Install flexible connectors on makeup air supply duct. Weld exhaust-duct connections with continuous liquidtight joint.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- 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. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Test water, drain, gas, and liquid-carrying components for leaks. Repair or replace leaking components.
 - 4. Perform hood performance tests required by authorities having jurisdiction.
 - 5. Perform fire-suppression system performance tests required by authorities having jurisdiction.
- E. Prepare test and inspection reports.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial kitchen hoods. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 23.72.10 - 100% OUTSIDE AIR PACKAGE ROOF TOP UNITS

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION

- A. This section includes the design, controls and installation requirements for packaged outdoor air handling units.

1.02 QUALITY ASSURANCE

- A. Packaged air-cooled condenser units shall be certified in accordance with ANSI/AHRI Standard 340/360 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.
- B. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
- C. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
- D. Unit shall be certified in accordance with ANSI Z21.47b/CSA 2.3b and ANSI Z83.8/CSA 2.6, Safety Standard Gas-Fired Furnaces.
- E. Unit Energy Efficiency Ratio (EER) shall be equal to or greater than prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
- F. Unit shall be safety certified by ETL and be ETL US and ETL Canada listed. Unit nameplate shall include the ETL/ETL Canada label.

OPTIONS

- A. Unit cabinet construction shall be designed and manufactured to meet IBC 2009/2012 seismic standards.
- B. Unit shall be IBC 2009/2012 seismically certified. Unit shall be certified through seismic analysis and shake testing in accordance with ASCE-7-05/7-10 and ICC-ES AC-156.

1.03 WARRANTY

- A. Manufacturer shall provide a "parts only" warranty for a period of 12 months from the date of equipment startup or 18 months from the date of shipment, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer's written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and air filters.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Products shall be provided by the following manufacturers:
 - 1. AAON
 - 2. Substitute equipment may be considered for approval that includes at a minimum:
 - a. R-410A refrigerant
 - b. Direct drive supply fans
 - c. Double wall cabinet construction
 - d. Insulation with a minimum R-value of 13
 - e. Stainless steel drain pans
 - f. Hinged access doors with lockable handles

- g. Variable capacity compressor with 10-100% capacity in both heating and cooling mode when heat pump options is specified.
- h. All other provisions of the specifications must be satisfactorily addressed.

2.02 PACKAGED UNITS

A. General Description:

- 1. Packaged unit shall include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, reheat coil, gas heaters, exhaust fans, energy recovery wheels, and unit controls.
- 2. Unit shall be factory assembled and tested including leak testing of the coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the controls compartment's literature pocket.
- 3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
- 4. Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.
- 5. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
- 6. Installation, Operation and Maintenance manual shall be supplied within the unit.
- 7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's access door.
- 8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's access door.

B. Construction:

- 1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
- 2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610°F.
- 3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.
- 4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Refrigerant piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
- 5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
- 6. Access to filters, dampers, cooling coils, reheat coil, heaters, exhaust fans, return fans, energy recovery wheels, compressors, water-cooled condensers, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
- 7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
- 8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
- 9. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.

10. Unit shall include lifting lugs on the top of the unit.
 11. Unit shall include factory installed, painted galvanized steel condenser coil guards on the face of the condenser coil.
- C. Electrical:
1. Unit shall be provided with standard power block for connecting power to the unit.
 2. Air-source heat pump shall include a defrost cycle to prevent frost accumulation on the outdoor coil during heat pump heating operation. Defrost cycle shall begin when outdoor coil temperature is below a fixed setpoint and have a fixed 10 minute run time, or end when the outdoor coil temperature is above a fixed setpoint. Defrost timer, with 30/60/90 minute selectable defrost cycle interval time, shall be factory installed in the controls compartment. During defrost cycle all compressors shall energize, reversing valve shall de-energize, and auxiliary heat shall energize.
 3. Unit shall be provided with factory installed and factory wired 115V, 13 amp GFI outlet with outlet disconnect switch in the unit control panel.
 4. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more that 10% out of balance on voltage, the voltage is more that 10% under design voltage, or on phase reversal.
- D. Supply Fans:
1. Unit shall include direct drive, unhused, backward curved, plenum supply fans.
 2. Blowers and motors shall be dynamically balanced and mounted on rubber isolators.
 3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
 4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.
- E. Exhaust Fans:
1. Exhaust dampers shall be sized for 100% relief.
 2. Fans and motors shall be dynamically balanced.
 3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
 4. Access to exhaust fans shall be through double wall, hinged access doors with quarter turn handles.
 5. Unit shall include belt driven, unhused, backward curved, plenum exhaust fans.
 6. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.
- F. Cooling Coils:
1. Evaporator Coils:
 - a. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
 - b. Coils shall have interlaced circuitry and shall be standard (6 row high) capacity.
 - c. Coils shall be helium leak tested.
 - d. Coils shall be furnished with a factory installed thermostatic expansion valves.
- G. Refrigeration System:
1. Unit shall be factory charged with R-410A refrigerant.
 2. Compressors shall be scroll type with thermal overload protection, independently circuited, and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.
 3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam insulated panels to prevent the transmission of noise outside the cabinet.

4. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
5. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.
6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides, and factory installed liquid line filter driers.
7. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.
8. Lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a dehumidification control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.
9. Unit shall be configured as an air-source heat pump. Each refrigeration circuit shall each be equipped with a factory installed liquid line filter drier with check valve, reversing valve, accumulator, and thermal expansion valves on both the indoor and outdoor coils. Reversing valve shall energize during the heat pump heating mode of operation.
10. Each capacity stage shall be equipped with a 5 minute off, delay timer to prevent compressor short cycling.
11. Each capacity stage shall be equipped with an adjustable, 20 second delay timer to prevent multiple capacity stages from starting all at once.
12. Each refrigeration circuit shall include adjustable compressor lockouts.
13. First capacity stage shall be provided with on/off condenser fan cycling and adjustable compressor lockout to allow cooling operation down to 35°F.

H. Condensers:

1. Air-Cooled Condenser:
 - a. Condenser fans shall be vertical discharge, axial flow, direct drive fans.
 - b. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.
 - c. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
 - d. Coils shall be helium leak tested.
 - e. Condenser fans shall be high efficiency electrically commutated motor driven with factory installed head pressure control module. Condenser airflow shall continuously modulate based on head pressure and cooling operation shall be allowed down to 35°F with adjustable compressor lockout.

I. Gas Heating:

1. Stainless steel heat exchanger furnace shall carry a 25 year non-prorated warranty, from the date of original equipment shipment from the factory.
2. Gas furnace shall consist of stainless steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.
3. Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
4. Unit shall include a single gas connection and have gas supply piping entrances in the unit base for through-the-curb gas piping and in the outside cabinet wall for across the roof gas piping.
5. Natural gas furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller

includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls compartment.

6. Emergency gas heating capacity shall be sized to meet heating leaving air temperature setpoint when heat pump heating is not in operation. Auxiliary gas heating capacity shall be equal in capacity to the emergency gas heating capacity. Auxiliary heating capacity shall be available for operation when heat pump heating is in operation. Unit shall include 2 stages of auxiliary gas heating capacity.

J. Filters:

Options:

1. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the cooling coil.

K. Outside Air/Economizer:

1. Unit shall include 100% motor operated outside air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 15 CFM of leakage per sq. ft. of damper area when subjected to 2 inches w.g. air pressure differential across the damper. Damper assembly shall be controlled by spring return, 2 position actuator. Unit shall include outside air opening bird screen and outside air hood. (6-25 and 30 ton units).

L. Energy Recovery:

1. Unit shall contain a factory mounted and tested energy recovery wheel(s). The energy recovery wheel(s) shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings. Frame shall slide out for service and removal from the cabinet.
2. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.
3. Wheels shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow and minimum pressure drop-to-efficiency ratios. The layers shall be effectively captured in stainless steel wheel frames or aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix.
4. Wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.
5. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.
6. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.
7. Energy recovery wheel cassette shall carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the

factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by Airxchange. The 5 year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the Airxchange written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the Airxchange Energy Recovery Cassette Limited Warranty Certificate.

8. Unit shall include 2 inch thick, pleated panel outside air filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the wheels.
9. Hinged service access door shall allow access to the wheel(s).

M. Controls:

1. See drawings for controls.

2.03 CURBS

- A. Curbs shall to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb gasket shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting of the rooftop unit.

PART 3 - EXECUTION

3.01 INSTALLATION, OPERATION, AND MAINTENANCE

- A. Installation, Operation and Maintenance manual shall be supplied with the unit.
- B. Installing contract sha install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.
- C. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

- 3.03** Provide full 12 months warranty on all parts and labor. Provide a four year extended warranty (parts only) on compressor, evaporator and condenser coils, fan motors and controls.

3.04 FILTER MEDIA FILL

- A. Provide initial filter media fill as described hereinbefore for each filter of each type installed for testing and adjusting AC system and left in place for Owner's immediate use.
- B. Provide one complete fill and each filter of each type for Owner's future use. Store all media on premises in factory sealed containers, at a location as directed by the Owner's authorized representative. Obtain a signed receipt for these filters and include in project close-out documents.

END OF SECTION

SECTION 23.73.39 - DIRECT GAS FIRED MAKE-UP AIR UNIT

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The work required under this section of the specification includes all work necessary for the complete installation of direct-fired make-up air unit.
- B. The work of this section is subject to the requirements of the Mechanical General Provisions and Basic Materials Specification.

PART 2 -PRODUCTS

2.01 DESCRIPTION

- A. A Direct-fired gas heating and ventilating unit(s), as indicated on the drawings shall be furnished. Unit(s) shall be tested in accordance with ANSI Standard Z83.4 and CSA 3.7 and shall bear the ETL label. Orientation shall be horizontal, down or side discharge. Unit(s) shall be factory assembled, tested and shipped as a complete packaged assembly, for indoor or outdoor mounting, consisting of the following:
 - 1. Gas burner
 - 2. Centrifugal blower (forward-curved double width/double inlet);
 - 3. Motor starter with thermal overload protection
 - 4. Motor and drive assembly
 - 5. Fuel burning and safety equipment
 - 6. Temperature control system
 - 7. Gas piping

2.02 HOUSING

- A. Unit housing shall be constructed of 20 Gauge G-90 galvanized steel. The wall panels and roof panels shall be fabricated by forming double-standing, self-locking seams that require no additional support. The floor and wall panels shall be caulked air tight with a silicone caulk. All casing panels shall be attached with sheet metal screws or rivets, which can be removed to field service large components. The unit base shall be suitable for curb or flat mount. Housing construction should be suitable for outdoor or indoor installation.
- B. An observation port shall be located on the exterior of the unit for observation of the main flame and pilot flame. All controls, gas valves, modulating controls and electrical components shall be mounted within the burner vestibule. The burner vestibule shall be an integral part of the unit and not extend outside the exterior casing of the unit and not exposed to the main air stream.
- C. The vestibule full-size door shall provide easy access to controls and gas-train components. Blower door shall provide easy access to blower, motor and drives. Access doors shall be provided on both front and backside of unit providing full access to every part of the unit.
- D. Internal ridged board 1" x 1.5" foil face insulation shall be installed on roof, walls and base of casing.

2.03 BASE

- A. The base shall be constructed of galvanized steel for improved rigidity. Base shall be structurally reinforced to accommodate the blower assembly and burner.

2.04 BLOWER

- A. Blower(s) shall be forward-curved, centrifugal, Class I or II (depending on application requirements), double width, double inlet, constructed G-90 galvanized steel. Unit shall have a heavy-duty, solid-steel shaft. Wheels shall be balanced in two planes and done in accordance with AMCA standard 204-96, Balance Quality and Vibration Levels for Fans. The wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency and reduce noise. The wheel blades shall be securely attached to the wheel inlet ring. The wheel shall be firmly attached to the fan shaft with setscrews and keys. The blower assembly shall be isolated from the fan structure with vibration isolators.

2.05 MOTOR & MOTOR COMPARTMENT

- A. Motors shall be heavy-duty ball bearing type and furnished at the specified voltage, phase and enclosure. Motor mounting plate shall be constructed of heavy gauge galvanized steel and shall be designed to provide easy adjustment of the belt tension.

2.06 SHAFT & BEARINGS

- A. Shafts shall be precision ground and polished. Heavy duty, pre-lubricated bearings shall be selected for a minimum (L50) life in excess of 200,000 hours of operation at maximum cataloged operating speed. They shall be designed for, and individually tested, specifically for use in air handling applications.

2.07 BELTS & DRIVES

- A. Belts shall be oil and heat resistant, non-static, grip-notch type. Drives shall be cast type, precision machined and keyed, and secured attached to the fan and motor shafts. Fan operating speed shall be factory set using adjustable pitch motor pulleys. All drives shall be a minimum of 2 grooves above 2 HP.

2.08 BURNER

- A. The gas burner shall be direct-fired, draw-through type, sized to provide an output as scheduled on drawings using natural or propane gas.
- B. The burner shall be capable of heating the entire air supply. The burner shall burn over its entire length at all times when the system is in operation.
- C. The burner shall have non-clogging, 4302B stainless-steel combustion baffles attached to a ductile aluminum gas-supply section with no moving parts to wear out or fail. The burner shall be capable of 92% combustion efficiency with a maximum turndown ratio of up to 30 to 1.
- D. The gas burner shall be furnished with a pilot package arranged so that the pilot flame lights the burner with instantaneous ignition. Pilot assembly includes a flame rod, spark rod and pilot, which is automatically ignited by ignition transformer. A flame-rod rectification system shall be used to prove pilot and main flame.
- E. Rear access doors will provide complete access to burner and pilot assembly.
- F. Burner profile plates shall be self-adjusting to operate across the complete CFM range of each model heater.

2.09 GAS EQUIPMENT

- A. STANDARD
 - 1. All gas equipment should conform to local code requirements. All gas manifold components shall be piped and wired at the factory.
- B. Components Include:
 - 1. Pilot-gas shut-off valve

2. Pilot-gas regulator
3. Pilot-gas valve
4. Main-gas shut-off valve
5. Main-gas regulator
6. Two solenoid valves
7. Modulating-gas valve
8. Burner

2.10 SAFETY CONTROLS

A. STANDARD

1. Motor starter with adjustable overloads
2. Air-flow safety switch
3. Electronic flame-safety relay
4. High-temperature limit switch
5. Main-gas regulator
6. Two safety shutoff valves
7. Modulating-gas valve
8. Burner
9. Adjustable burner ON/OFF inlet air duct-stat to shut off burner when inlet air is sufficiently warm to maintain space temperature.
10. Non-Fused Disconnect.
11. Casing insulation shall be 1" x 1.5" density with a foil face.

2.11 ACCESSORIES

- A. Inlet Dampers: Manufacturer shall provide and install on unit, when possible, a two-position, motor-operated damper with internal end switch to energize the blower-starter circuit, when damper is 80% open. Blades shall be a maximum of 6" wide 16-gauge G-90 galvanized steel and shall be made to guarantee the absence of noticeable vibration at design air velocities. Damper blades are to be mounted on friction-free synthetic bearings. Damper edges shall have PVC coated polyester fabric mechanically locked into blade edge. Jamb seals used are flexible metal, compression type.
- B. Filters: The filters shall be (2") thick, aluminum mesh coated with super-filter adhesive, aluminum mesh with polyester foam or pleated throw away. Aluminum-mesh filters shall have aluminum frames with media to be layers of slit and expanded aluminum, varying in pattern to obtain maximum depth loading. Washable 2" filters shall be enclosed in two-piece, die-cut frame with diagonal supports. Frame shall be constructed of heavy-duty beverage board. Filter media is supported on the air leaving side by a metal grid.
- C. Fresh-Air Inlet Hood: Shall be constructed of G-90 galvanized steel with bird screen.
- D. Fresh-Air Inlet Hood/Filter Combination: Shall be constructed of G-90 galvanized steel with bird screen and (2") cleanable filters supported by internal slides mounted in the inlet face of the hood.
- E. Curb: 20" curb shall be constructed of 18-gauge aluminized steel as a completed welded assembly.

2.12 TEMPERATURE CONTROL SYSTEMS

- A. Discharge Temperature Control: Use for building exhaust-air replacement to maintain a constant discharge temperature of supply air. The burner flame modulates to compensate for outdoor temperatures. The optional manual SUMMER-OFF/WINTER selector switch and exhaust system interlock controls the heater-blower operation. Supplied with optional remote-control panel with temperature selector dial and SUMMER-OFF/WINTER selector.

2.13 WIRING AND ELECTRICAL

- A. A single point electrical connection shall be supplied. The control circuit voltage shall be 115 volts. A control transformer shall be provided, when required. Wiring in control enclosures shall be in accordance with the National Electrical Code and the local code, as it may affect the installation. Motor starter shall be provided. Starter shall be line voltage, definite purpose type.
- B. Unit(s) shall be complete with all items such as relays, starters, switches, safety controls, conduit and wire as previously mentioned, and as required for proper operation. All factory-mounted controls shall be factory pre-wired to the unit control panel. A safety disconnect switch shall be standard on all units and shall be sized according to the unit.

PART 3 - EXECUTION

3.01 FACTORY TESTED

- A. Unit(s) shall be operated, tested and set at the factory using job-site conditions for electrical and gas input. All operating and safety controls shall be tested and set at the factory. Adjustable or fixed sheaves shall be set for proper RPM at specified conditions. Gas-pressure regulator shall be set for specified burning rate at specified inlet pressure.

3.02 SERVICE AND PARTS

- A. The supplier shall furnish as built wiring connection and control-circuit diagrams, dimension sheets and a full description of the unit(s). Service manuals, showing service and maintenance requirements, shall be provided with each unit.

END OF SECTION

SECTION 23.74.13 - PACKAGE ROOFTOP UNIT

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. The work included under this section includes all work necessary for the installation of package rooftop units.

PART 2 - PRODUCTS

2.01 PACKAGE ROOFTOP UNITS

- A. Furnish and install single zone rooftop units of size and capacity indicated on the drawings. Unit shall be low silhouette, completely assembled including piping and wiring, charged with refrigerant and fully run tested prior to shipment, see section 3.2 (sound). Approved manufacturers shall be Trane York and Aeon. However, the approved manufacturers must meet the requirements contained in this section of the specifications.
- B. General - Units shall be downflow or horizontal airflow as indicated on drawings. Operating cooling range shall be between 0°F and 115°F. Cooling performance shall be rated in accordance with ARI testing procedures. All units shall be factory assembled, internally wired, fully charged with R-410 and 100 percent run-tested before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Wiring shall be secured to housing of unit in protective raceways or conduit. Units shall be UL listed and labeled. Gas heating unit to be AGA approved.
- C. Casing - Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a weather-resistant baked enamel finish. Cabinet construction shall allow for all maintenance on one side of the unit. All panels to be sealed and gasketed. The downflow unit's base pan shall have no penetrations within the perimeter of the curb other than the raised supply/return openings to provide an added water integrity precaution, if the condensate drain backs up. The base of the unit shall have provisions for forklift and crane lifting. Insulate all interior surfaces with 1/2" thick foil faced fiberglass insulation. Insulate base of unit with 1/8" foil faced closed-cell insulation.
- D. To insure rainwater integrity of the unit, there shall be no electrical wiring penetrating any panel in the evaporator section or any panel of the base of the unit. Provide adequate access for power wiring within curb. Coordinate with electrical contractor.
- E. Unit Top - The top cover shall be one piece or where seams exist, it shall be double hemmed and gasket sealed to prevent water leakage and sloped to prevent water standing.
- F. Provide factory mounted hinged access doors to access filters, evaporator, supply fan, heat, compressor, and controls for all units. Doors shall have (2) quick release quarter turn door handles.
- G. Filters - Provide 2" thick, UL Class 1, FARR 30-30 filters for all units unless otherwise specified. Provide filter rack sized for 2" filters access and to permit easy filter removal. The filters shall have non-creased radial pleat design with media support grip and enclosing frame. Filters shall have 30% efficiency based on ASHRAE Test Standard 52-76. Initial resistance shall be 0.08"WG at 250 FPM.

- H. Compressors - All units shall be direct-drive hermetic scroll type compressor(s) with centrifugal oil pump providing positive lubrication to moving parts. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Crankcase heater, internal temperature and current-sensitive motor overloads shall be included for maximum protection. Compressor shall have spring or neoprene isolation and sound muffling to minimize vibration transmission and noise. Units over 6 tons shall have dual compressors.
- I. Refrigerant Circuits - Each refrigerant circuit shall have independent thermal expansion valve, service pressure ports and refrigerant line filter driers factory installed.
- J. Hot Gas Reheat – If scheduled, this option shall be factory-installed to provide demand dehumidification control independent from a call for cooling. This option shall consist of a hot-gas reheat coil located on the leaving airside of the evaporator coil pre-piped and circuited.
- K. Evaporator and Condenser Coils - Coils shall be internally finned 5/16" copper tubes mechanically bonded to configured aluminum plate fin. Aluminum construction Microchannel condenser coils shall be acceptable. Coils shall be leak tested at the factory to ensure pressure integrity. The evaporator and condenser coil shall be leak tested to 600 psig.
- L. Provide tooless condenser coil hail guards.
- M. Gas Heating Section - The heating section shall have a progressive tubular heat exchanger design using stainless steel burners and corrosion resistant steel components. A forced combustion blower shall supply premixed fuel to a single burner ignited by a pilotless hot surface ignition system. A negative pressure gas valve shall be used that requires blower operation to initiate gas flow. On an initial call for heat, the combustion blower shall purge the heat exchanger 20 seconds before ignition. After three unsuccessful ignition attempts, the entire heating system shall be locked out until manually reset at the thermostat. Units shall be suitable for use with natural gas or propane (field installed kit).
- N. Outdoor Fans - The outdoor fans shall be direct-drive, statically and dynamically balanced, draw through in the vertical discharge position. The fan motor(s) shall be permanently lubricated and have built-in thermal overload protection.
- O. Indoor Fan - Units shall have a direct or belt drive, FC centrifugal or plenum fan. Belt driven fans shall have an adjustable idler-arm assembly for quick-adjustment to fan belts and motor sheaves. All motors shall be thermally protected. Electronically commutated motors shall be acceptable. Oversized motors shall be used where high external static pressure is noted on drawings.
- P. Controls - Unit shall be completely factory wired with necessary controls and contact or pressure lugs or terminal block for power wiring. Units shall provide an external location for mounting fused disconnect device. Micro-processor controls shall be provided for all 24 volt control functions, to make all heating, cooling and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. A centralized Micro-processor shall provide anti-short cycle timing and time delay between compressors. Provide 120V amp 2 plug powered convenience outlet.
- Q. Phase Monitoring protection – Unit shall have factory mounted phase monitor to provide protection against phase loss, phase imbalance, and phase reversal.
- R. Roof curbs: All roof curbs shall be of galvanized steel construction with flashings, roof fastenings, and 1" thick fiberglass anti-sweat thermal insulation. Provide sloped curb if required by roof pitch. Roof curbs shall be selected to match the roof conditions. As a minimum, the rooftop air unit base pan must be 12" above the roof, with height of the curb to compensate for roof insulation thickness. Contractor should determine exact height of curb required at each unit location and shall verify roof construction with the architectural drawings and specifications

and existing conditions if warranted. Provide field fabricated sheet metal extension between duct from building thru curb to bottom of roof top unit. Do not use curb as plenum.

- S. Economizer - The assembly to include fully modulating 0-100 percent motor and dampers, barometric relief, minimum position setting, preset linkage, wiring harness with plug. Solid state enthalpy and differential enthalpy or dry bulb control shall be provided as indicated on drawings and factory-supplied and installed.
- T. Motorized Outside Air Dampers - Manually motorized set outdoor air dampers shall provide up to 50 percent outside air, see drawings for actual amount. Once set, outdoor air dampers shall open to set position on call for heating and cooling. The damper shall close to the full closed position when request is satisfied. Provide full economizer intake hood with insect screen.

PART 3 - EXECUTION

- 3.01** The manufacturer's authorized representative shall supervise the mounting, installation, power, start-up and control wiring (including interlocks) and upon job completion notify the Designer in writing that all are operating properly, and are complete and satisfactory in every respect. He shall be responsible for complete start-up and checkout.
- 3.02** Rooftop units are selected and located by the Designer to produce minimal sound and vibration to the space. Manufacturer to review drawings prior to bidding and notify the Designer if design revisions should be made to accept this unit.
- 3.03** Provide full 12 months warranty on all parts and labor. Provide a four year extended warranty (parts only) remainder of unit.
- 3.04** The weight of the unit shall be equal to or less than the unit scheduled on the drawing.
- 3.05** Verify prior to bidding that the units meet the electrical characteristics shown on the drawings. This includes voltage, full load amps and disconnect (as shown on electrical drawings). The successful manufacturer shall notify the contractor the size of his required disconnect.

3.06 FILTER MEDIA FILL

- A. Provide initial filter media fill as described hereinbefore for each filter of each type installed for testing and adjusting AC system and left in place for Owner's immediate use.
- B. Provide one complete fill and each filter of each type for Owner's future use. Store all media on premises in factory sealed containers, at a location as directed by the Owner's authorized representative. Obtain a signed receipt for these filters and include in project close-out documents.

END OF SECTION

SECTION 23.75.13 - SPLIT SYSTEM HEAT 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. Split System Heat Pumps.
 - 2. Condensing Units
- B. Related Sections:
 - 1. Division 23, Section "Testing, Adjusting and Balancing" for HVAC.
 - 2. Division 23, Section "Air Duct Accessories".
 - 3. Division 23, Section "Instrumentation and Controls" for HVAC.

PART 2 - PRODUCTS

2.01 SPLIT SYSTEM HEAT PUMP (INDOOR UNIT)

- A. The integral fan section shall consist of a belt-driven, centrifugal type blower mounted on a rigid steel frame secured to the blower housing by rubber mounts. Blower wheels shall be statically and dynamically balanced. Wheels shall be carried on rubber enclosed, self-aligning, solid bronze grooved, graphite filled bearings provided with grease cups for lubrication. Motor mount design shall permit both belt adjustment and pulley alignment.
- B. The cooling section shall consist of a DX coil, split face capacity mounted in a cabinet, matching the main blower cabinets. Refrigerant lines shall be factory piped to outside of the cabinet and the thermostatic expansion valve shall be factory installed. Condensate drain pan shall be 1-1/2" deep, coated on both sides with corrosion resistant material and shall have two 3/4" drain connections. Coil cabinet shall be factory insulated with foil covered insulation.
- C. The heating section shall be electric of the specified size shown on the drawings. The electric heating element shall be low watt density, open-wire type element designed for single zone application. The heating bank shall be equipped with automatic and manual reset high temperature safety cut-outs, contactors, and divided into not more than 48 amp circuits with 60-amp fuses all pre-wired to the main control panel. The heating element shall be circuited to prevent electric heating operation during the cooling cycle. Internal heating and cooling power wiring shall terminate at a single junction in the unit panel.
- D. Air Filters:
 - 1. Provide each air handling unit with a 1" thick pleated disposable filter, Farr 20-20 or approved equal. The filters shall be UL Class 2, with 20% efficiency based on ASHRAE Test 52-76. Each filter shall have a non-woven cotton and synthetic fabric media, with media support grid and enclosing frame. Initial air resistance to be 0.09" WG at 250 FPM.
 - 2. Provide an initial fill of filter media as described above installed for testing and adjusting of system, and left in place for Owner's immediate use. Additionally, provide one complete spare fill for each filter of each size for Owner's future use. Store all spare media on premises in original factory sealed containers, at a location as directed by the Owner's representative and obtain a signed and dated receipt for this spare media from the Owner's representative.

- E. Provide a low-voltage, two-stage heating, one or two stage cooling thermostat with automatic changeover. Provide clear plastic locking cover. All unit wiring and controls shall be in accordance with NFPA requirements. All controls shall be furnished with the equipment as described under controls.
- F. Each unit shall be suitable for air-to-air heat pump operation with a HSPF of not less than 9.0 at 47 degrees DB outside air, and a total unit cooling EER of 12.5 or greater when tested in accordance with ARI Standard 240. Each shall have an automatic defrost system, electric device to provide minimum of a 5 minute delay to prevent short cycling, emergency heat switch and indicator light to energize auxiliary heat if the compressor is inoperative due to a tripped safety device. Units shall bear UL and ARI labels. Units shall be covered by a 1-year warranty on all parts, including labor for replacement, plus an additional 4 year warranty on compressor.
- G. A unit electrical disconnect shall be integral and furnished with the unit.
- H. All units shall be of the same make and manufacturer.
- I. Provide 2" Farr 20-20 filters.

2.02 OUTDOOR AIR-COOLED CONDENSING UNIT

- A. Provide air to air electric heat pump condensing unit of cooling capacity noted on drawing and/or schedule.
- B. Compressor unit(s) shall be welded, fully hermetic with crankcase heater(s) and vibration isolators. Units shall be designed to operate at +10 degrees F ambient on heating. Compressors shall have 5-year warranty.
- C. Condenser fans and motors shall be direct drive fans with aluminum blades and zinc plated steel hubs. Motors with permanently lubricated ball bearings and built-in current and thermal overload protection. Vary condenser fan speed to provide low ambient cooling as called for on drawings.
- D. Condenser coils shall be air-cooled condenser coil, aluminum fin secondary surface mechanically bonded to primary surface of seamless copper tubing. Sub-cooling circuit with liquid accumulator. Factory tested at 425 psig air pressure under water. Vacuum dehydrated at 175° F.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install all units in strict accordance with manufacturer's installation and mounting instructions. Install units plumb and level, firmly anchored in locations indicated.
- B. Provide the services of a manufacturer's authorized representative to supervise the mounting, installation, power, and control wiring (including required interlocks) of all units. Upon completion of all work, notify the engineer in writing that all units are operating properly, and are complete and satisfactory in all respects.
- C. Verify prior to bidding that all units meet all electrical characteristics shown in the contract documents. This shall include voltage, phase, full load amps and overcurrent protection. Coordinate exact electrical requirements with electrical contractor prior to rough-in.
- D. Provide full twelve month warranty for all parts and labor. Provide an extended four year warranty (parts only) for compressors.
- E. Install full size type "M" copper condensate drain with 4" deep p-trap running to floor drain.

- F. All units shall have an auxiliary drain pan with a float switch wired to shut units down on water rise.

3.02 FILTER MEDIA FILL

- A. Provide initial filter media fill as described hereinbefore for each filter of each type installed for testing and adjusting AC system and left in place for Owner's immediate use.
- B. Provide one complete fill and each filter of each type for Owner's future use. Store all media on premises in factory sealed containers, at a location as directed by the Owner's authorized representative. Obtain a signed receipt for these filters and include in project close-out documents.

END OF SECTION

SECTION 23 .81.50 - DUCTLESS SPLIT SYSTEM HEAT PUMPS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. The work required under this section includes all work necessary for the complete installation of ductless split system units.
- B. The work of this section is subject to the requirements of the Mechanical General Provisions and Basic Materials Specifications.

1.02 SUBMITTALS

- A. Provide drawings indicating dimensions, rough-in connections, electrical characteristics, unit performance, agency listings, and connection requirements.
- B. Provide manufacturer's installation and start-up instructions.
- C. Provide manufacturer's color selection charts.
- D. At job closeout, provide manufacturer's installation, operation and maintenance data along with product warranty certificate.

1.03 WARRANTY

- A. Provide one-year warranty on all parts and five year warranty for refrigeration compressors.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Furnish and install where shown on plans, ductless split system units of sizes and capacities shown on the schedule. The units shall include the indoor evaporator section and the outdoor condenser section. Approved manufacturers shall be as follows:
 - 1. EMI
 - 2. Mitsubishi
 - 3. Lenox

2.02 WALL HUNG EVAPORATOR SECTION

- A. Provide wall hung heat pump units with back-up resistant heat as shown on schedule. Provide hanger brackets and or trim kits as applicable.
- B. Cabinet shall be constructed of cold roll steel, with structural stiffeners and powder coated finish. Inlet panel construction of high impact polystyrene with perforated steel inlet grille.
- C. Discharge grille shall be high temperature Noryl with adjustable vanes.
- D. Condensate drain pans shall be galvanized steel with anti-corrosion coating.
- E. Fan shall be tangential type, directly mounted to the motor shaft. Motor shall be PSC type with overload protection.
- F. Filter shall be permanent, washable and user accessible.
- G. Coil shall be seamless copper tubing, arranged in staggered configuration, with enhanced aluminum fins, tested to 460 PSIG. Tubes shall be mechanically expanded for secure bonding to fin shoulder. Connections are sweat type.
- H. Controls shall include relays and connections for condensing unit.

1. Unit mounted controls with thermostat, fan speed control, and heat/cool switch.
2. Wall mounted 24V thermostat with fan, and heat/cool switch.

2.03 CONDENSER SECTION

- A. Provide a single zone condensing unit with 4-way reversing valve, solenoid activated by 24V, energized for cooling operation. Provide unit with a TXV with internal check valve to provide proven operation through all temperature ranges in heat pump mode.
- B. Cabinet shall be constructed of G-60 galvanized steel, finished with corrosion inhibiting, high-gloss, powder coated. Fan guard shall be heavy-gauge, vinyl dipped wire, or stamped integral to cabinet.
- C. Compressor shall be hermetically sealed, high efficiency type. Motor shall be PSC type with internal overload protection. Compressor shall be installed on resilient mountings. Minimum unit SEER shall be 10.0 and minimum COP=2.8 in reverse cycle heating mode.
- D. The condensing unit and evaporator section shall be precharged with refrigerant. Unit refrigeration valves shall be solid brass for sweat connection.
- E. The condenser coil shall be seamless, copper tubing, arranged in staggered configuration, with enhanced aluminum fins. The tubes shall be mechanically expanded for secure bonding to fin shoulder.
- F. The condenser fan shall be high efficiency propeller type, directly connected to the totally enclosed PSC motor. The motor shall be internally and thermally protected. The condensing unit shall be draw-through design.
- G. System options shall include low ambient operation to 0 degrees F. Other system options shall be as noted on schedule.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install unit in accordance with manufacturer's recommendations.
- B. Verify prior to bidding that all units meet all electrical characteristics shown in the contract documents. This shall include voltage, phase, full load amps, and overcurrent protection. Coordinate exact electrical requirements with the electrical contractor prior to rough-in.

END OF SECTION

SECTION 26.05.00 - COMMON WORK RESULTS FOR ELECTRICAL

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, Division 26.

1.02 SUMMARY

- A. Section Includes:
 - 1. Electrical equipment coordination and installation.
 - 2. Common electrical installation requirements

1.03 SCOPE

- A. The work to be performed under this section shall require the contractor to provide all, labor, materials, equipment, and services proper to the installation of the work indicated on the electrical drawings, the principle features of which are as follows:
 - 1. A power wiring system for distribution of power throughout the building.
 - 2. Lighting fixtures, lamps and lighting controls.
 - 3. A system of conduit, outlets, cabinets for the installation of wiring and equipment for the communications facilities.
 - 4. Conduit, conductors, outlets and disconnect switches, and connections for the heating, ventilation, air conditioning and plumbing facilities.
 - 5. Temporary wiring.
 - 6. Fire alarm systems.
- B. The drawings indicate the general character, scope and arrangement of the electrical installation. Request for any change or departure from these drawings must be submitted to the Architect for approval.
- C. The contractor shall be governed by the present specifications together with the current recommendations and regulations of the following:
 - 1. City Electrical Code
 - 2. State Electrical Code
 - 3. Rules of the Electric Utility Company
 - 4. National Electrical Code
 - 5. International Energy Conservation Code
 - 6. International Building Code
 - 7. N.E.M.A. Standards
 - 8. N.F.P.A. Codes
 - 9. Underwriters Laboratory Standards
- D. Obtain all permits and inspections required for the work and pay all fees and costs thereof.
- E. No changes in contract price will be allowed for alternate work which requires approximately the same amount of material and labor. The owner reserves the right to relocate any equipment up to 10 feet in any direction prior to rough-in.

1.04 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.

3. To allow right of way for piping and conduit installed at required slope.
 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames" and shall be furnished as required.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- E. Before submitting bid, Contractor shall visit the job site for the purpose of examining the site and conditions under which the work must be performed. No adjustment to the contract will be allowed for situations arising from failure of Contractor to thoroughly familiarize himself with site and existing building conditions, including charges and requirements from utilities as shown for the project. Contractor shall verify that connections to existing equipment are as indicated on drawings and specifications. Any deviations shall be reported to the Engineer immediately. Any deviations shall be reported prior to bidding.
- F. Wiring for Mechanical Equipment:
1. All power wiring and conduit for items Furnished under Division 23 shall be furnished and installed under Division 26. See 6a. Verify the electrical characteristics of items to be connected with equipment nameplate data and drawings prior to rough-in.
 2. All disconnects shall be furnished and installed by Division 26.
 3. Manual motor starters for ½ HP motors and less shall be furnished and installed by Division 26.
 4. Wiring and conduit for solenoid valves, and control transformers including the transformers shall be furnished and installed by Division 23.
 5. Division 26 shall install all starters, toggle switches, disconnects, and all wiring to the respective motor or device. Wiring and conduit from starter to the controller or control device and any interlocked dampers shall be by Division 23.
 6. Definitions:
 - a. Power wiring: Line voltage circuitry rough-in including conduit, boxes, conductors, etc. between the overcurrent protection and the equipment including the connection of the starters by Division 26.
 - b. Control wiring: Any voltage circuitry rough-in including conduit, boxes, conductors, etc. between control activator and the controller or starter by Division 23.
 7. Conduit: All power wiring and line-voltage control wiring shall be in conduit.
 8. Smoke Detectors and Firestats:
 - a. Smoke detectors shall be furnished by Division 26. Upon activation of the fire alarm system the fire alarm control panel shall send a signal to the HVAC unit controls to cause immediate shutdown. Furnish all required fire alarm control modules. Coordinate HVAC unit shutdown with mechanical contractor. Wiring from the detector to fire alarm system shall be furnished and installed by Division 26.
 - b. All firestats shall be furnished, installed and wired by Division 23.
- G. Connect all motors with an 18" length of liquidtight flexible metal conduit. Use proper type connectors and anchors with this type conduit.
- H. Refer to architectural drawings for details such as finishes, dimensions, materials, etc. Refer to equipment plans for exact location of electrical connections, which are dimensioned prior to any rough-in of work. Confirm any dimensioned drawings with equipment rough-in drawings.

- I. Protection of Roof:
 - 1. Coordinate electrical work with roofing work in regard to any electrical items which may pierce or otherwise affect the roof.
 - 2. Arrange for any cutting or repairing to roofing which might already be installed when an electrical installation is made.
 - 3. Roof penetrations shall not void roofing warranty. Penetrations shall be coordinated with roofing supplier holding the warranty. Electrical contractor shall coordinate with roofing supplier for installation of pre-molded pipe seal or field fabricated pipe penetration as applicable. Electrical contractor to include all costs and coordination with and for roofing penetrations, new or existing.
 - 4. Routing of electrical wiring thru ductwork, and penetrations of ductwork or roof curbs is not allowed.
- J. Record Drawings:
 - 1. Furnish reproducible record drawings showing the changes and modifications that occurred during the construction period.
 - 2. The job supervisor shall maintain a set of prints in the job office to be used to illustrate and note the job changes as they occur. These drawings shall be kept current daily.
- K. Temporary Power Wiring: Throughout the building, provide one pigtail lampholder for every 100 square feet. Provide a 100-watt incandescent (or comparable compact fluorescent, HID, or LED) lamp in each pigtail; Provide a 120-volt GFCI duplex plug receptacle for every 500 square feet and with at least one in each room of 200 square feet or more. Wiring shall be with grounded type non-metallic sheath cable. Conform to the National Electrical Code and the requirements of OSHA. All temporary power wiring, devices, and supports shall be completely removed prior to project completion.
- L. Wiring to and connection of all kitchen equipment shall be included in the electrical contract work. Equipment shall be properly prepared to receive a single connection with all wiring internal to the equipment installed by the equipment supplier. Verify all connections and rough-in location with the equipment supplier and approved equipment submittal documents prior to start of work.
- M. Include in the bid price all utility company costs relative to the types of new or modified services planned. Before submitting bid, Contractor shall contact the Electric Utility Company, the Telephone Company, the Cable Television Company and any other utility or service providers to whose services the project shall be connected. The Contractor shall verify with each company the final service arrangements and all costs involved which are to be included in the bid price. The services illustrated on the drawings are based on information which was available at the time of releasing the project for bidding.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items. Where minimum clearances are indicated, measure to any protruding fasteners, supports, or other components.

- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements. Do not obstruct 7'-0" minimum clear headroom along service and egress paths. If project conditions require an installation below 7'-0" along such paths, notify the Architect prior to rough-in.
- D. Equipment: Install to facilitate service, maintenance, repair and/or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.02 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07, Section "Penetration Firestopping."

END OF SECTION

SECTION 26.05.10 - POWER SERVICE

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. Electrical power service shall be arranged with the local electric power distributor. Pay any and all charges as required by the power utility company.
- B. Provide grounding in accordance with the National Electrical Code and as shown on the drawings. Refer to Division 26, Section "Grounding and Bonding for Electrical Systems."
- C. The power service shall be as noted on drawings. Provide metering as required by the power utility company.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Refer to Division 26, Section 26 05 26 "Grounding and Bonding for Electrical Systems" for service grounding materials.
- B. Refer to Division 26, Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for service conductors.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Confirm with the power utility company the power service arrangements. Include in the bid price all costs relative to the type of service planned.
- B. Where service arrangements call for a new pad-mounted utility transformer, the contractor shall be responsible for providing a poured-in-place concrete pad for the transformer. Obtain a current copy of the power utility company's requirements for such pad and include all associated costs in the bid price.
- C. Unless detailed differently by the utility company, pad mount transformers shall have a ground rod placed at each corner of the pad a minimum of 10' apart and interconnected. Extend grounding electrode conductor through the pad window into the transformer enclosure for the termination by the utility company. Grounding conductors shall be of the same size as the service grounding electrode conductor. Refer to Division 26, section "Grounding and Bonding for Electrical Systems."
- D. Service entrance equipment shall bear the equipment grounding bus and the grounded conductor (neutral) bus bonded together at the first point of overcurrent protection. Bonding shall be per Article 250 of the National Electrical Code. Service entrance equipment shall be listed for such purpose by Underwriters Laboratory.

END OF SECTION

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.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. General Cable Technologies Corporation.
 - 2. Service Wire Co.
 - 3. Southwire Company.
- 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 UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable used in Variable Frequency Controller circuits.
- D. Conductors: Copper, complying with NEMA WC 70/ICEA S-95-658.
 - 1. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2 or Type XHHW-2.
 - 2. PV Conductor Insulation: Comply with UL 4703.

Option:

- E. Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.

2.02 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M Electrical Products.
 - 2. Hubbell Power Systems, Inc.
 - 3. ILSCO.
 - 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 5. Service Wire Co.
 - 6. Thomas & Betts Corporation, A Member of the ABB Group.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2 or Type XHHW-2, single conductors in raceway.
- B. Feeders: Type THHN/THWN-2 or Type XHHW-2, single conductors in raceway.
- C. Feeders in Cable Tray: Type XHHW-2, single conductors larger than No. 1/0 AWG, tray rated.
- D. Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and underground: Type THHN/THWN-2 or Type XHHW-2, single conductors in raceway.
- F. Cord Drops and Portable Appliance Connections: Type SOOW with ground, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- 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, which 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 and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to the "Identification for Electrical Systems" Section.
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor. Cap or tape spare conductors at each end.

3.06 FIRESTOPPING

- A. Apply fire stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.07 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test all conductors for compliance with requirements.
 - 2. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - c. Inspect compression applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor with respect to ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
- B. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 26.05.26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Ground bonding common with lightning protection system.
 - 3. Foundation steel electrodes.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Burndy; Part of Hubbell Electrical Systems.
 - 2. ERICO International Corporation.
 - 3. ILSCO.
 - 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 5. Thomas & Betts Corporation, a Member of the ABB Group.

2.02 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.

2.03 CONDUCTORS

- A. Insulated Conductors: 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. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 12 inches (in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.04 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.
- 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.

2.05 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum, unless noted otherwise on the drawing.
 - 1. Bury at least 24 inches (600 mm) below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow. Provide isolated ground bus in the panelboards and switchboards as required.
- D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated. Ground Bus shall be readily accessible and available for use by communications installers.
 - 1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated. Minimum length of bus shall be 12"
- E. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors or compression 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 or compression connectors.

3.02 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.04 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated

with substations by connecting them to underground cable and grounding electrodes. Install copper conductor not less than No. 2/0 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation. This is the minimum requirement; provide additional grounding per local codes and utility requirements.

3.05 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated. Provide separate isolated grounding bus in panelboards and switchboards with isolated ground requirements. Provide isolated ground conductor in feeders.
- C. 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.

3.06 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 Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. 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.
- 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. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

- F. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel corner column and every other steel column, extending around the perimeter of building.
 - 1. Install copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.
 - 2. Bury ground ring not less than 24 inches (600 mm) from building's foundation.
- G. Bond grounding conductor and grounding electrode conductor to reinforcing steel per National Electrical Code requirements.

3.07 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.
 - 3. Test completed grounding system at service disconnect enclosure grounding terminal and as required by the National Electrical Code. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
- B. Grounding system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.
- D. Report measured ground resistances that exceed 10 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Designer promptly and include recommendations to reduce ground resistance.

END OF SECTION

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. Section Includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. .-extinguishing according to ASTM D 635.

2.02 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. GS Metals Corp.
 - b. G-Strut.
 - c. Unistrut; Part of Atkore International.
 - 2. Material: Galvanized steel.
 - 3. Channel Width: 1-5/8 inches minimum, other dimensions as required.
 - 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 5. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored 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 made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. 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 where used. Plastic expansion anchors of any type shall not be used.
 - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.

3. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

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 unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter. Where conduit supported is 2-1/2" trade size or larger, minimum rod size shall be 3/8 inch (10mm) in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other 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.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening such 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, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to 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 (90 kg).
- 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. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 6. To Light Steel: Sheet metal screws.
 7. 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 the need for reinforcing bars. Anchoring in concrete with post tension cables not allowed unless noted otherwise.

3.03 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base. Bases shall be not less than 4 inches (100 mm) thick.
- B. Use 4000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03, Section "Miscellaneous Cast-in-Place Concrete".
- C. Anchor equipment to concrete base as follows:
 - 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.

3.04 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 (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

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. Surface raceways.
 - 5. Boxes, enclosures, and cabinets.
 - 6. Handholes and boxes for exterior underground cabling.

1.03 DEFINITIONS

- A. RMC: Galvanized rigid steel conduit/Rigid Metal Conduit.
- B. GRS: See RMC.

1.04 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by but not limited to one of the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. Western Tube and Conduit Corporation.
 - 3. Wheatland Tube 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. RMC: Comply with ANSI C80.1 and UL 6.
- D. EMT: Comply with ANSI C80.3 and UL 797 – steel or aluminum.
- E. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- G. 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 shall be steel, set screw or compression type.
 - 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.

- H. Joint Compound for RMC: 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, provide products by one of the following:
 - 1. CANTEX INC.
 - 2. Carlton: 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-40-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. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Metal wireways are **not allowed** unless shown on the drawings. Refer to Part 3.2.
- B. Manufacturers: Subject to compliance with requirements, provide products by but not limited to one of the following:
 - 1. B-line, an Eaton business.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. Square D.
- C. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R, Type 4, or Type 12 as required for application, 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.
- D. 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.
- E. Wireway Covers: Hinged type or Flanged-and-gasketed type unless otherwise indicated.
- F. 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, provide products by but not limited to one of the following:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - 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, provide products by one of the following:
 - a. Hubbell Incorporated.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.
- D. Tele-Power Poles:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by but not limited to one of the following:
 - a. Panduit Corp.
 - b. Wiremold / Legrand.
 - 2. Material: Steel with baked-enamel finish, color as noted by designer.
 - 3. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.
 - 4. For dual service (poser and communication) Tele-Power Poles, refer also to Division 27, Section "Pathways for Communication Systems".

2.05 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by but not limited to one of the following:
 - 1. Crouse-Hinds, an Eaton business.
 - 2. EGS/Appleton Electric.
 - 3. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 4. RACO; Hubbell.
- 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. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Metal Floor Boxes:
 - 1. Material: Cast metal or sheet metal. Provide fusion-bonded epoxy paint for sheet metal boxes installed on-grade.
 - 2. Type: Fully adjustable after pour. Recessed service/activation type.
 - 3. Shape: Rectangular.
 - 4. Size: 2 gang minimum. Size as noted on drawing, or as required for application.
 - 5. Cover: Solid or Plated Finish, confirm with Architect.
 - 6. Listing and Labeling: Shall comply with UL 514C. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.
- J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- L. Gangable boxes are allowed where multiple wiring devices require it.
- M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, Type 3R, Type 4, or Type 12 as required by location with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- N. Cabinets:
 - 1. NEMA 250, Type 1, Type 3R, or Type 12 as required by location. Galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.06 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 - 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. Oldcastle Precast, Inc.
 - b. Quazite: Hubbell Power Systems, Inc.
 - 2. Standard: Comply with SCTE 77.
 - 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 - 4. Cover: Weatherproof, secured by tamper-resistant bolts and having structural load rating consistent with enclosure and handhole location.
 - 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 6. Cover Legend: Molded lettering, "ELECTRIC" or as noted.
 - 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 - 8. Handholes 24 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.07 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

- A. Above-ground Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: RMC, unless noted otherwise.
 - 2. Concealed Conduit, Aboveground: RMC, unless noted otherwise.
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Above-ground Indoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Severe Physical Damage: EMT.
 - 2. Exposed and Subject to Severe Physical Damage: RMC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 4. Encased in concrete or mortar: RNC.
 - 5. Damp or Wet Locations: RMC.
 - 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment):
 - a. Dry Locations: FMC.
 - b. Dusty, Damp, or Wet Locations: LFMC.
 - 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 in institutional and commercial kitchens and damp or wet locations.
- C. Underground: Apply raceway products as specified below unless otherwise indicated:
 - 1. Below slab, within the building footprint: RNC, Type EPC-40-PVC.
 - 2. Underground, beyond the building footprint: RNC, Type EPC-40-PVC.
 - 3. Underground, within 5 feet (1.5 m) of roadways, driveways, or parking areas: RNC, Type EPC-80-PVC.
 - 4. Underground, intended for use by wiring exceeding 600 volts to ground: RNC, Type EPC-80-PVC, unless specifically noted to be Schedule 40.
- D. Minimum Raceway Size:
 - 1. Indoors, outdoors above grade, or below slab within the building footprint: 3/4-inch (21-mm) trade size 21.
 - 2. Underground, beyond the building footprint: 1-inch (25-mm) trade size 27.
- E. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use set-screw or compression type 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.

F. 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 section 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 (150 mm) 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 "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 (300 mm) of changes in direction.
- G. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and site involved. Open flame shall not be used.
- H. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- I. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- J. Raceways Underground, beyond the building footprint:
 1. Minimum cover depth, measured from finished grade to top of raceway, shall comply with NFPA 70 Article 300 and the following:
 - a. Wiring over 600 volts: 42 inches (1065 mm) with warning tape.
 - b. Secondary wiring, between utility transformer and service entrance equipment: 24 inches (610 mm) with warning tape.
 - c. Within 5 feet (1.5 m) of roadways, driveways, and parking areas: 24 inches (610 mm) with warning tape.
 - d. Branch and feeder wiring: 18 inches (460 mm) with warning tape.
 2. Where raceways cross between areas with different minimum cover depth requirements, such as at the edge of a parking area or leaving the building footprint, the transition shall occur in the less-strict area.
 3. Arrange raceways to avoid areas planned for trees or large landscaping.
 4. Where routed parallel with other underground system structures, maintain 5 feet (1.5 m) separation between raceway and foreign system structure.
- K. Raceways Embedded in Slabs, within the building footprint:
 1. Run conduit below reinforcement. Arrange raceways to cross building expansion joints at right angles with expansion fittings. In no case shall conduit be run in such a manner as to be exposed to saw cutting.
 2. Transition from RNC to RMC before rising above floor.

- a. Exception: Where raceway turns up concealed in masonry block walls and terminates at a flush-mounted device box not more than 48 inches (1220 mm) above finished floor, elbow fitting and vertical raceway shall be permitted to be Type EPC-80-PVC. Protect such installations from damage or obstruction by debris during installation of masonry.
- L. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or at enclosures.
- M. 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.
- N. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings.
- O. 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 (35mm) trade size and insulated throat bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- P. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- Q. 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.
- R. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- S. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire and secure each end to adjacent structure. Cap underground raceways designated as spare above grade alongside raceways in use.
- T. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape, glue, and plastic expansion anchors are not acceptable support methods.
- U. 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.
- V. 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.
- W. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

- X. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 - 2. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Y. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
 - 3. Use FMC for recessed and semi-recessed luminaires.
 - 4. Arrange flexible conduit to minimize torque force and strain on fittings.
- Z. 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.
- AA. 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 and plumb. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel. Reference drawing for additional information. Provide appropriately rated fire stopping and sound barrier for each box.
- CC. Locate boxes so that cover or plate will not span different building finishes or interfere with trim installation.
- DD. 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.
- EE. Fasten junction and pull boxes to, or support from building structure. Do not support boxes by conduits.
- FF. Junction and/or pull boxes, and wireways, shall not contain conductors from more than six line-to-neutral branch circuits (or an equivalent number of line-to-line circuits) unless indicated on the drawings or approved via written Request for Information (RFI).
 - 1. Requests shall detail locations and sizes of all such large junction or pull boxes and wireways proposed and include the following:
 - a. Explain the construction advantage which would be provided by use of such enclosures instead of individual raceways.
 - b. Proposed conduits to be connected and circuits to be contained in each enclosure.
 - c. Enclosure size, enclosure fill, and applicable ampacity adjustment factor calculations, all per NEC based on planned conduit and conductors.
 - d. Note: Submit RFI prior to rough-in or ordering materials. RFI may not be approved even if calculations are compliant with Code.
 - 2. Where wireways and large junction or pull boxes are installed, ensure the following:
 - a. Branch circuits routed through a common junction or pull box shall not originate from more than one panelboard.

- b. Conductors shall be routed neatly and orderly, and associated ungrounded (hot) and grounded (neutral) on the same circuit shall be grouped per NEC 200.4 (exceptions to this Section shall not be utilized in this application).
- c. Conductors shall be clearly labeled, indicating panel and circuit number.
- d. Provide a typed directory affixed in a plastic sleeve to the outside of the enclosure indicating circuits present within the enclosure.

GG. Set metal floor boxes level and flush with finished floor surface.

HH. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Cover Requirements – Comply with the greatest requirements of NEC 300.5 and the following. Cover is to be measured from the top of the raceway to finished grade. Where not otherwise noted, minimum cover requirements shall be:
 - a. Branch and Feeder Circuits Under Interior Building Slab: Fully below planned concrete thickness.
 - b. Branch and Feeder Circuits under Driveways and Parking Areas: 24 inches (600 mm) with warning tape.
 - c. Branch and Feeder Circuits at locations not specified above: 18 inches (450 mm) with warning tape.
 - d. Secondary Service Entrance Circuits: 24 inches (600 mm) with warning tape.
 - e. Primary Circuits over 600 volts: 42 inches (1050 mm) or as directed by Utility Provider, whichever is greater, with warning tape.
2. Sleeve conduits where they pass through foundation walls above footings. Do not route through footings. Coordinate lowered footings with General Contractor where required to maintain minimum cover requirements throughout.
3. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
4. Install backfill as specified in Division 31, Section "Earth Moving."
5. 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 (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31, Section "Earth Moving."
6. 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.
7. 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 (75 mm) of concrete for a minimum of 12 inches (300 mm) 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 (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
8. Underground Warning Tape: Comply with requirements in Division 26, Section "Identification for Electrical Systems." Where required, install at least 6 inches (150 mm) below finished grade, directly above conduit, with at least 12 inches (300 mm) of fill between tape and top of conduit.

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes with bottom not less than 4" (100 mm) below frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.06 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.07 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, galvanized finishes, or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26.05.36 - CABLE TRAYS 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. Wire basket cable trays.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include data indicating dimensions and finishes for each type of cable tray indicated.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes in cable tray installed outdoors.

2.02 GENERAL REQUIREMENTS FOR CABLE TRAYS

- A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.
 - 1. Source Limitations: Obtain cable trays and components from single manufacturer.
- B. Sizes and Configurations: Refer to the Drawings for specific requirements for types, materials, sizes, and configurations.

2.03 MATERIALS AND FINISHES

- A. Aluminum:
 - 1. Materials: Alloy 6063-T6 according to ANSI H35.1/H 35.1M for extruded components, and Alloy 5052-H32 or Alloy 6061-T6 according to ANSI H35.1/H 35.1M for fabricated parts.
 - 2. Hardware: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.
 - 3. Hardware for Aluminum Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.

2.04 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
- B. Covers: Solid type made of same materials and with same finishes as cable tray. Where noted on drawings.
- C. Barrier Strips: Same materials and finishes as for cable tray.
- D. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.05 WARNING SIGNS

- A. Lettering: 1-1/2-inch- (40-mm-) high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."

- B. Comply with requirements for fasteners in Section 260553 "Identification for Electrical Systems."

2.06 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect cable trays according to NEMA VE 1.

2.07 WIRE BASKET CABLE TRAY

- A. Manufacturers: Subject to compliance with requirements, provide products by but not limited to one of the following:
1. Cooper B-Line.
 2. Legrand Cablofil
 3. MP Husky
 4. Hubbell
- B. Description:
1. Provide wire basket cable tray of types and sizes indicated with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards.
 2. All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be kinked and T-welded on all tray sizes.
 3. Wire basket cable tray shall be made of high strength steel wires and formed into a standard 2 inch (50 mm) by 4 inch (100 mm) wire mesh pattern with intersecting wires welded together. All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.
 4. Wire cross section shall be flat profile.
 5. Wire basket cable tray sizes shall conform to the following nominal criteria:
 - a. Straight sections shall be furnished in standard lengths.
 - b. Wire diameter shall be 0.196" (5mm) minimum on all mesh sections.
 - c. Wire tray shall have width and depth as noted on drawings.
 6. Width: 18 inches (450 mm) unless otherwise noted on drawings.
 7. Minimum Useable Loading Depth: 6 inches (100 mm) unless otherwise noted on drawings.
 8. Tray system shall be electrically continuous. Provide binding jumpers where required to maintain continuity.
- C. Material and Finishes: Material and finish specifications for Carbon Steel Wire are as follows.
1. Electro Plated Zinc: Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A510 Grade 1008, Electro Plated Zinc. ASTM B633.
- D. All fittings shall be field formed from straight sections in accordance with manufacturer's instructions.
- E. Wire basket cable tray supports shall be center support hangers, trapeze hangers or wall brackets.
- F. Trapeze hangers or center support hangers shall be supported by 1/4" inch or 3/8" inch diameter rods.
- G. Special accessories shall be furnished as required to protect, support and install a wire basket cable tray system.

PART 3 - EXECUTION

3.01 CABLE TRAY INSTALLATION

- A. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
- B. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.
- C. Remove burrs and sharp edges from cable trays.
- D. Join aluminum cable tray with splice plates; use four square-neck carriage bolts and locknuts.
- E. Fasten cable tray supports to building structure and install seismic restraints.
- F. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb (90 kg).
- G. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
- H. Support tray assembly to prevent twisting from eccentric loading.
- I. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.
- J. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.
- K. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.
- L. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.
- M. Make changes in direction and elevation using manufacturer's recommended fittings.
- N. Make cable tray connections using manufacturer's recommended fittings.
- O. Seal penetrations through fire and smoke barriers, walls, or partitions. If cable trays are intended for use with data and other low voltage cabling, terminate cable tray within 12 inches (30 mm) of wall and provide re-enterable fire- and smoke-rated speed sleeve products in line with tray ends. Such products shall be 4 inch (100 mm) nominal diameter. Provide one sleeve per 18 square inches (0.01 sq m) of tray cross section; not less than two, or as noted on the drawings.
- P. Install cable trays with enough workspace to permit access for installing cables.
- Q. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V. Do not route power and communications or data processing cable in a common tray, unless specifically noted on the drawings.
- R. Install permanent covers, if used, after installing cable. Install cover clamps according to NEMA VE 2.
- S. Clamp covers on cable trays installed outdoors with heavy-duty clamps.

- T. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.02 CABLE TRAY GROUNDING

- A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Division 26, Section "Grounding and Bonding for Electrical Systems."
- B. Cable trays with electrical power conductors shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- C. Cable trays with single-conductor power conductors shall be bonded together with a grounding conductor run in the tray along with the power conductors and bonded to the tray at 72-inch (1800-mm) intervals. The grounding conductor shall be sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors," and Article 392, "Cable Trays."
- D. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding-bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.
- E. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

3.03 CABLE INSTALLATION

- A. Install cables only when each cable tray run has been completed and inspected.
- B. Fasten cables on horizontal runs with cable clamps or cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.
- C. Fasten cables on vertical runs to cable trays every 18 inches (450 mm).
- D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches (1800 mm).
- E. In existing construction, remove inactive or dead cables from cable trays.

3.04 CONNECTIONS

- A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.
- B. Connect raceways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1. Use appropriate fittings and tray accessories for connection.

3.05 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. After installing cable trays and before electrical circuitry has been energized, survey for compliance with requirements.
 - 2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
 - 3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.

4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
7. Check for improperly sized or installed bonding jumpers.
8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

3.06 PROTECTION

- A. Protect installed cable trays and cables.
 1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
 2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
 3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION

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. This Section includes the following:
 - 1. Identification for raceway and metal-clad cable.
 - 2. Identification for conductors and communication and control cable.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.03 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with 29 CFR 1910.145.

1.05 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, 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 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- C. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.02 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend shall indicate type of underground line.

2.03 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

2.04 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.05 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.06 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength: 50 lb, minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black, except where used for color-coding.
- 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 APPLICATION

- A. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands or snap-around, color-coding bands:
 - 1. Fire Alarm System: Red.
 - 2. Fire-Suppression Supervisory and Control System: Red and yellow.
 - 3. Combined Fire Alarm and Security System: Red and blue.
 - 4. Security System: Blue and yellow.
 - 5. Mechanical and Electrical Supervisory System: Green and blue.
 - 6. Telecommunication System: Green and yellow.
 - 7. Control Wiring: Green and red.
- B. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

- C. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.
- D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data 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 Operation and Maintenance Manual.
- F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
 - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
 - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- H. Instruction Signs:
 - 1. Operating Instructions: 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.
 - 2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.
- I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and 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 2 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.
 - 2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Access doors and panels for concealed electrical items.
 - c. Emergency system boxes and enclosures.

- d. Disconnect switches.
- e. Enclosed circuit breakers.
- f. Motor starters.
- g. Push-button stations.
- h. Power transfer equipment.
- i. Contactors.
- j. Remote-controlled switches, dimmer modules, and control devices.
- k. Battery inverter units.
- l. Battery racks.
- m. Voice and data cable terminal equipment.
- n. Intercommunication and call system master and staff stations.
- o. Television/audio components, racks, and controls.
- p. Fire-alarm control panel and annunciators.
- q. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
- r. Monitoring and control equipment.
- s. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

3.02 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service feeder branch-circuit service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- 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 or concrete envelope exceeds 16 inches overall.
- J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION

SECTION 26.09.23 - LIGHTING CONTROL 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. Time switches.
 - 2. Photoelectric switches.
 - 3. Standalone daylight-harvesting switching controls.
 - 4. Indoor occupancy sensors.
 - 5. Outdoor motion sensors.
 - 6. Lighting contactors.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Interconnection diagrams showing field-installed wiring.
 - 2. 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 each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 TIME SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Intermatic, Inc.
 - 2. NSi Industries LLC.
- B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Contact Configuration: DPST.
 - 3. Contact Rating: 20-A ballast load, 20-A LED rating, 120-/240-V ac.
 - 4. Programs: Eight on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
 - 5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
 - 6. Astronomic Time: Selected channels.
 - 7. Automatic daylight savings time changeover.
 - 8. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

- C. Electromechanical-Dial Time Switches: Comply with UL 917.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Contact Configuration: DPST.
 - 3. Contact Rating: 20-A ballast load, 20-A LED rating, 120/240/277-V ac.
 - 4. Circuitry: Allows connection of a photoelectric relay as a substitute for the on-off function of a program.
 - 5. Astronomic time dial.
 - 6. Eight-Day Program: Uniquely programmable for each weekday and holidays.
 - 7. Skip-a-day mode.
 - 8. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.02 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Industries, Inc.
 - 2. Intermatic, Inc.
 - 3. NSi Industries LLC.
- B. Description: Solid state, with DPST dry contacts rated for 4625-VA tungsten or 1800-VA inductive, 20-A LED rating, to operate connected load, complying with UL 773.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range.
 - 3. Time Delay: Thirty-second minimum, to prevent false operation.
 - 4. Lightning Arrester: Air-gap type.
 - 5. Mounting: Twist lock complying with NEMA C136.10, with base.

2.03 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Industries, Inc.
 - 2. Lithonia Lighting: Acuity Brands Lighting, Inc.
 - 3. Lutron Electronics Co., Inc.
 - 4. Philips Lighting Controls.
 - 5. Sensor Switch, Inc.
 - 6. Watt Stopper.
- B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 - 4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, 20-A LED rating, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 - 5. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.

- b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
- 6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
- 7. Bypass Switch: Override the "on" function in case of sensor failure.
- 8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.
- C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
 - 1. Sensitivity Adjustment: Separate for each sensing technology.
 - 2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.04 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Lithonia Lighting; Acuity Brands Lighting, Inc.
 - 2. Lutron Electronics Co., Inc.
 - 3. Sensor Switch, Inc.
 - 4. Watt Stopper.
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
 - 3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent, 600VA LED rating.
- C. Wall-Switch Sensor Tag WS1:
 - 1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft (196 sq. m).
 - 2. Sensing Technology: Dual technology - PIR and ultrasonic.
 - 3. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off."
 - 4. Voltage: Match the circuit voltage; dual-technology type.
 - 5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
 - 6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
 - 7. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
 - 8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

2.05 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Corporation.
 2. Siemens.
 3. Square D.
- B. Description: Electrically operated and electrically held, combination-type lighting contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current). Minimum 30 amperes, match circuit voltage.
 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 3. Enclosure: Comply with NEMA 250.
 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.06 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG. Compatible with manufacturers requirement
- C. Class 1 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 16 AWG. Compatible with manufacturers requirement

PART 3 - EXECUTION

3.01 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.03 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 3/4 inch (13 mm).
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.04 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.05 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.06 ADJUSTING

- A. Occupancy Adjustments: When requested within 3 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
 - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.07 DEMONSTRATION

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."
- B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

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. Panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.03 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
 - 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
 - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

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. Keys: Two spares for each type of panelboard cabinet lock.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

1.08 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
 - 1. Panelboard Warranty Period: 12 months from date of Substantial Completion.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.
 - 1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PANELBOARDS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces at project location.
- 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.
- F. Enclosures: Flush and Surface-mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 2. Height: 84 inches (2.13 m) maximum. Enclosures up to 90 inches (2.3 m) may be utilized if space permits.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
 - 4. Finishes:
 - a. Panels and Trim: Steel and galvanized 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.
- G. Incoming Mains:
 - 1. Location: Top or Bottom per installation requirements.
 - 2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- H. Phase, Neutral, and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - a. Bus shall be fully rated the entire length.
 - 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
 - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
 - 5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
- I. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Terminations shall allow use of 75 deg C rated conductors without derating.

3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
 4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
 5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
 6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- J. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment where noted on drawing or required by code with one or more main service disconnecting and overcurrent protective devices.
- K. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
1. Percentage of Future Space Capacity: 20 percent minimum include spaces and spares as noted on drawing.
- L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity. Series rated not allowed.

2.02 PERFORMANCE REQUIREMENTS

- A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 current edition.

2.03 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
 2. Siemens Energy.
 3. Square D; by Schneider Electric.
 4. ABB/General Electric.
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.
1. Doors: Concealed hinges secured with multipoint latch with tumbler lock; keyed alike.
- D. Mains: Circuit breaker or Lugs only as noted on drawing.
- E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- F. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
 2. External Control-Power Source: as required.

2.04 OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. Siemens Energy.
 - 3. Square D; by Schneider Electric.
 - 4. ABB/General Electric.
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
 - 3. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 4. Subfeed Circuit Breakers: Vertically mounted.
 - 5. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
 - f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - g. Shunt Trip: Voltage as required trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.05 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.
 - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.06 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- 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. Comply with NECA 1.
- C. Install panelboards and accessories according to NEMA PB 1.1.
- D. Equipment Mounting:
 - 1. Install floor mounted panelboards on cast-in-place concrete equipment base(s) nominal 4". Concrete compressive strength equal to floor concrete.
 - 2. Attach panelboard to the vertical finished or structural surface behind the panelboard. Provide support backing for gypsum board walls.
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- F. Mount top of trim 72 inches above finished floor unless otherwise indicated.
- G. Mount panelboard cabinet plumb and rigid without distortion of box.
- H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- I. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection. Mount panelboards to steel slotted supports 5/8 inch (16 mm) in depth. Orient steel slotted supports vertically.
- J. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
 - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- K. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- L. Install filler plates in unused spaces.
- M. Stub four 1-inch (27-EMT) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-EMT) empty conduits into raised floor space or below slab not on grade.
- N. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- O. Mount spare fuse cabinet in accessible location.

3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a black with white lettering laminated nameplate.
- D. Device Nameplates: Label each branch circuit device in power panelboards with a black with white lettering laminated nameplate.
- E. Install warning signs complying with requirements in National Electrical Code and local codes.

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 for low-voltage air circuit breakers stated in NEMA PB 1.1-2013, "General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less" prior to energizing.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Panelboards will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform.
 - 1. Measure loads during period of normal facility operations.
 - 2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Owner. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
 - 4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.06 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

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 and associated device plates.
 - 2. Receptacles with integral SPDs.
 - 3. Receptacles with integral GFCI protection.
 - 4. Receptacles with integral USB charging ports.
 - 5. Isolated-ground receptacles.
 - 6. Tamper-resistant receptacles.
 - 7. Weather-resistant receptacles.
 - 8. Twist-locking receptacles.
 - 9. Pendant cord-connector devices.
 - 10. Toggle switches.
 - 11. Floor poke-through assemblies, service poles, and multioutlet assemblies.

1.03 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- C. SPD: Surge Protective Device.
- D. TVSS: Transient voltage surge suppressor. See SPD.
- E. USB: Universal Serial Bus

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: Physical samples of all standard device and trim plate finishes.

1.05 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

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. SPD, USB, and GFCI enabled Receptacles: One for every 25 of each type and color installed, but no fewer than two of each.
 - 2. Wiring devices utilizing modular plug-in connectors: One for every 25 of each type and color installed, but no fewer than two of each.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton (Wiring Devices - Arrow Hart).
 - 2. Leviton Manufacturing Co., Inc.
 - 3. Pass & Seymour; Legrand North America, LLC.
 - 4. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
- 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. All wiring devices shall be minimum specification grade. Commercial grade not allowed.
- B. Construction of thermoplastic polymer body with brass current-carrying and grounding contacts and parts. Structural parts and terminal screws shall be plated steel unless indicated otherwise. Wiring terminals shall accept No. 14-10 AWG solid conductors.
- C. Comply with NFPA 70.
- D. 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 stranded building wire.
 - 2. Devices shall comply with the requirements in this Section.
- E. Devices for Owner-Furnished Equipment:
 - 1. Receptacles: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

2.03 STRAIGHT-BLADE RECEPTACLES

- A. Specification Grade Convenience Receptacles, 125 V, 20 A, two-pole, three-wire: Duplex configuration except where indicated to be single configuration. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596. Federal Specification grade. Commercial grade not allowed.
- B. Equipment Connection Receptacles: Voltage, amperage, poles, and configurations as indicated on the drawings. Match plug configuration. Grounding type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and FS W-C-596 where applicable.
- C. Specialty Device Types and Functions: Where indicated on the drawings, specification or hospital grade straight-blade receptacles shall be provided with a combination of one or more of the following integral features, compliant with the additional standards listed:
 - 1. Tamper Resistant: Equipped with internal shutters that operate only when a compatible plug is inserted in the receptacle. Comply with UL 498 Supplement SD and marked TR.
 - 2. Decorator Style: Smooth face configured for use with a single-opening wall plate.
 - 3. Weather Resistant: Equipped with corrosion resistant metal parts and suitable nylon parts for use in damp or wet locations and exposed to sunlight. Comply with UL 498 Supplement SE and marked WR.
 - 4. Isolated-Ground: Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

5. USB: Equipped with dual USB ports, one Type A and one Type C, 5 V dc, 5.1 A per receptacle (minimum), 15 W per port, 25 W total minimum, in addition to duplex 125 V, 20 A line-voltage receptacles. Comply with UL 1310, USB 3.1 compatible.
6. GFCI: Equipped with 4-6mA trip GFCI protection. Comply with UL 943 Class A. Include self-testing function with LED indicator light to show when device has malfunctioned and no longer provides proper GFCI protection. Device shall fail 'off.' Non-feed thru type, except where indicated to provide protection to downstream devices. Shall also be Weather Resistant type when utilized outdoors or in damp or wet locations.
7. SPD or TVSS: Equipped with integral SPD in line to ground, line to neutral, and neutral to ground. LED indicator light and audible indication. Metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45. Comply with UL 1449.
8. Controlled: Split-circuit duplex receptacle. One outlet shall be marked with the word "Controlled" and the "controlled receptacle marking symbol" defined by NFPA 70 and connected to the control system. The second outlet shall not be marked and be connected to normal power.

2.04 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles. Comply with NEMA WD1 and UL 498.
 1. 125 V, 20 A, two-pole, three-wire: NEMA WD 6 Configuration L5-20R.
 2. 125 V, 30 A, two-pole, three-wire: NEMA WD 6 Configuration L5-30R.
 3. 250 V, 20 A, three-pole, four-wire: NEMA WD 6 Configuration L14-20R.
 4. 250 V, 30 A, three-pole, four-wire: NEMA WD 6 Configuration L14-30R.
- B. Only where indicated, twist-locking receptacles shall be provided as Isolated-Ground Type. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.05 PENDANT CORD-CONNECTOR DEVICES

- A. Description:
 1. Matching, locking-type plug and receptacle body connector, heavy-duty grade.
 2. NEMA WD 6 Configurations L5-20P and L5-20R.
 3. Comply with UL 498 and FS W-C-596.
 4. Body: Thermoplastic polymer with screw-open, cable-gripping jaws and provision for attaching external cable grip.
 5. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.06 CORD AND PLUG SETS

- A. Description:
 1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
 3. Plug: Thermoplastic polymer body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.07 TOGGLE SWITCHES

- A. 120/277 V, 20 A, grounding type, rated for 1 HP load at 120 V, 2 HP load at 277 V. 1500 V withstand rating. Comply with NEMA WD 1, UL 20, and FS W-S-896. Federal Specification

grade. Commercial grade not allowed. Single-Pole, Two-Pole, Three-Way, and Four-Way function configurations as required.

- B. Specialty Device Types and Functions: Where indicated on the drawings, switches shall be provided with a combination of one or more of the following integral features:
1. Pilot-Light: Single-Pole, with LED-lighted handle, function as indicated on drawings.
 2. Key-Operated: Single pole, with factory-supplied key in lieu of switch handle. Key all alike. Furnish two keys per switch location to the owner, not less than ten (10) keys.
 3. Decorator Style: Smooth face configured for use with a single-opening wall plate.

2.08 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices and be obtained from the same manufacturer as the associated wiring device.
1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: 0.035-inch (1-mm-) thick, satin finished, Type 302 stainless steel, unless directed by the Architect to be smooth, high-impact thermoplastic.
 3. Material for Unfinished Spaces: Galvanized steel suitable for application.
 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 UL 514D "Weatherproof While-In-Use Extra-Duty" Type 3R, weather-resistant, die-cast aluminum hood with gasket and lockable cover. Plastic or thermoplastic products are not acceptable.

2.09 SERVICE POLES

- A. Description:
1. Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
 2. Poles: Nominal 2.5-inch- (65-mm-) square cross section, with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling, and with separate channels for power wiring and voice and data communication cabling.
 3. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
 4. Aluminum. Finish as selected by Architect.
 5. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, four-pair, Category 6A cables.
 6. Power Receptacles: Two duplex, 125 V, 20 A, straight-blade convenience receptacles complying with requirements in this Section.
 7. Voice and Data Communication Outlets: Blank insert with bushed cable opening.

2.10 FLOOR SERVICE OUTLETS

- A. Refer to Section 26 05 33, "Raceways and Boxes for Electrical Systems" for requirements.

2.11 POKE-THROUGH ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Wiremold; Legrand North America, LLC.
 2. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
- B. Description:
1. Factory-fabricated and -wired assembly of below-floor junction box with multichannel, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
 2. Comply with UL 514 scrub water exclusion requirements.

3. Service-Outlet Assembly: Recessed type with services indicated.
4. Size: Selected to fit nominal 4-inch (100-mm) cored holes in floor and matched to floor thickness.
5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
6. Cover: Cast aluminum cover with 180-degree opening "lay-flat" cover with cable egress door. ADA Compliant. Plated finish.
7. Closure Plug: Arranged to close unused 4-inch (100-mm) cored openings and reestablish fire rating of floor.
8. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair Category 6A cables.

2.12 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.
 2. Wiring Devices Connected to Emergency Power System: Red.
 3. SPD Devices: Blue.
 4. Isolated-Ground Receptacles: As specified above, with orange triangle on face.
 5. Poke-through Assemblies Cover: As selected by Architect
- B. Wall Plate Color: For thermoplastic 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 (152 mm) 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. 10 AWG are installed, splice No. 10 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. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
 2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- F. 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.
- 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. Coordinate with Architect. Install poke-through assemblies by core-drill after walls are framed. Do not cast in place. Provide access panel in ceiling below where ceiling does not provide access to the poke-through assembly.

3.02 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.03 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use machine printed label 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. In health care facilities, prepare reports that comply with NFPA 99.
 2. Test Instruments: Use instruments that comply with UL 1436.
 3. 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 higher than 5 percent 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.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 26.28.13 - FUSES

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. Cartridge fuses rated 600 V and less for use in switches.

1.03 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
 - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 2. Let-through current curves for fuses with current-limiting characteristics.
 - 3. Time-current curves, coordination charts and tables, and related data.
 - 4. Fuse size for elevator feeders and elevator disconnect switches.
- B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - 1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - 2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA FU 1.
- D. Comply with NFPA 70.

1.05 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.06 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

1.07 EXTRA MATERIALS

- 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. Fuses: Quantity equal to 10 percent of each fuse type and size, but no fewer than three of each type and size.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussman, Inc.
 - 2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.02 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

2.03 SPARE-FUSE CABINET

- A. Cabinet: Wall-mounted, 0.05-inch- thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
 - 4. Fuse Pullers: For each size of fuse.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FUSE APPLICATIONS

- A. Service Entrance: Class L, time delay RK1, time delay or J, time delay. Voltage rating consistent with circuit voltage.
- B. Feeders: Class L, time delay RK1, time delay J, time delay or RK5, time delay. Voltage rating consistent with circuit voltage.
- C. Motor Branch Circuits: Class RK1 or RK5, time delay. Voltage rating consistent with circuit voltage.
- D. Other Branch Circuits: Class RK1, time delay, RK5, time delay or J, time delay. Voltage rating consistent with circuit voltage.

3.03 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

3.04 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION

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. This Section includes the following individually mounted, enclosed switches and circuit breakers:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Enclosed molded case circuit breakers.
 - 4. Enclosures.

1.03 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. HD: Heavy duty.
- C. RMS: Root mean square.
- D. SPDT: Single pole, double throw.

1.04 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, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current rating.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Qualification Data: For testing agency.
- D. Field quality-control test reports including the following:
 - 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 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.06 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.

1.07 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

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, provide products by one of the following:
 - a. Eaton Corporation; Cutler-Hammer Products.
 - b. ABB/General Electric.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D/Group Schneider.

2.02 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Fusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- B. 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; and labeled for copper and aluminum neutral conductors.
 3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.03 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
 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. GFCI Circuit Breakers: Single- and two-pole configurations with 5 or 30-mA trip sensitivity. 30-mA for heat trace, 5-mA for personnel protection.
- B. Molded-Case Circuit-Breaker Features and Accessories:
 1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 4. Shunt Trip: Trip coil energized from separate circuit, set to trip at 55 percent of rated voltage. Voltage and requirement as noted on drawings.
 5. Auxiliary Switch: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

2.04 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

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.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 03.

3.03 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.04 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
 - 1. Inspect mechanical and electrical connections.
 - 2. Verify switch and relay type and labeling verification.
 - 3. Verify rating of installed fuses.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. 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.

3.06 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.07 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION

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.
- B. Related Requirements:
 - 1. Section 262413 "Switchboards" for factory-installed SPDs.
 - 2. Section 262416 "Panelboards" for factory-installed SPDs.

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 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For SPDs to include in maintenance manuals.

1.06 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: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers:
 - 1. Manufacturers requesting product approval must meet or exceed the written specification contained herein.
 - 2. The registered service mark (brand) must be owned by the Manufacturer. No private label accepted.
 - 3. Manufacturer shall be ISO 9001 certified: Quality Systems – Model for Quality Assurance in Design, development, Production, Installation, and Servings.
 - 4. The Manufacturer must be regularly engaged in the manufacture of surge protection device products of the specified categories for no less than 10 (10) years.

2.02 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 4th Edition.
- D. MCOV of the SPD shall be at least 125% the nominal system voltage.

2.03 SERVICE ENTRANCE AND TRANSFER SWITCH SUPPRESSOR

- A. SPDs: Listed, and complying with UL 1449 4th Edition, 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. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
 - d. Surge counter.
- B. Comply with UL 1283.
- C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 250kA for equipment rated less than 1600A, 250kA for equipment 1600A and larger. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V and 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 1500 V for 480Y/277 V and 800 V for 208Y/120 V.
 - 2. Line to Ground: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
 - 3. Line to Line: 2500 V for 480Y/277 V and 1200V for 208Y/120 V.
- E. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 700 V.
 - 2. Line to Ground: 900V.
 - 3. Line to Line: 1200V.
- F. SCCR: Equal or exceed 200 kA.
- G. Nominal Discharge Current Rating: 20 kA.

2.04 PANEL SUPPRESSORS

- A. SPDs: Comply with UL 1449 4th Edition, Type 2.
 - 1. Include LED indicator lights for power and protection status.
 - 2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 - 3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
- B. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 120 kA . The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- C. Comply with UL 1283.
- D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V and 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 1500 V for 480Y/277 V and 800 V for 208Y/120 V.
 - 2. Line to Ground: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
 - 3. Line to Line: 2500 V for 480Y/277 V and 1200V for 208Y/120 V.
- E. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 700 V.
 - 2. Line to Ground: 900V.
 - 3. Line to Line: 1200V.
- F. SCCR: Equal or exceed 100 kA.
- G. Nominal Discharge Current Rating: 20 kA.

2.05 ENCLOSURES

- A. Shall be side-mounted, NEMA 250, Type 1, or internal to the protected equipment enclosure in the following conditions as noted on drawings:
 - 1. At panelboards or transfer switches which are surface mounted indoors in a dry location.
 - 2. At switchgear which is floor mounted.
- B. Shall be mounted internal to the protected equipment enclosure in the following conditions:
 - 1. At panelboards which are flush mounted.
 - 2. At panelboards, transfer switches, or switchgear which are specified with enclosures other than NEMA 250, Type 1.
 - 3. Where noted on the drawings to be integral to the equipment.
- C. Shall be side mounted, NEMA 250, Type 3R or 4X in the following conditions:
 - 1. At equipment which is located outdoors or in a damp or wet location and is not standardly available in the industry with internal SPDs.

2.06 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. All SPDs shall be connected through a disconnecting means. Direct connection to the bus is not acceptable.
- 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

SECTION 26.51.19 - LED 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 solid-state luminaires that use LED technology.
 - 2. Lighting fixture supports.
- B. Related Requirements:
 - 1. Section "Wiring Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 - 2. Section "Wiring Devices" for line voltage controls and wall-box dimmers.

1.03 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete, manufactured lighting unit, including lamp, reflector, and housing.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaires.
 - 4. Include emergency lighting units, including batteries and chargers.
 - 5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
 - 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project IES LM-79 and IES LM-80.
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of luminaire 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.
- C. Qualification Data: For testing laboratory providing photometric data for luminaires.

- D. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and 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. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.
 - 3. Any other components or accessories which are excluded from warranty coverage: One for every 20 of each type, finish and rating installed. Furnish at least one of each type.

1.06 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.08 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 LUMINAIRE REQUIREMENTS

- A. Refer to architectural reflected ceiling plan for exact ceiling conditions planned. Fixture shall be designed for the ceiling intended, including ceiling material, presence of insulation or sound batting, and fire rating.
 - 1. Where ceilings are fire rated, recessed luminaires shall be fire rated, or shall be provided with a UL Listed fire rated cover, or a field-constructed "hat" or "box," which shall maintain the fire rating requirement and be acceptable to the AHJ.
 - 2. Where ceilings are indicated to have thermal insulation or sound batting installed on top of the ceiling, within 6 inches of the luminaire location, recessed luminaire shall be rated for Insulation-Contact (IC-Rated).
 - 3. Where ceilings are indicated to be of gyp construction, provide manufacturer's modular flange kit for lay-in troffer type luminaires. Flange kits shall be separate from the luminaire for field installation. Integral flange adapters are not acceptable.
- B. Comply with UL 8750.
- 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. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

- E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- F. Recessed Fixtures: Comply with NEMA LE 4.
- G. CRI of minimum 80. CCT as selected by the architect from 2700 K, 3000 K, 3500 K, or 4000 K.
- H. Rated luminaire life of 50,000 hours, or as specified on the drawings.
- I. Minimum efficacy of 80 lumens per watt, or as specified on the drawings.
- J. Lamps dimmable from 100 percent to 10 percent of maximum light output, unless specified otherwise.
 - 1. Where used on the drawings, "1 percent" or "0.1 percent" dimming shall indicate dimming ranges from 100 percent to 1 percent, or 100 percent to 0.1 percent. Provide dim-to-black where specified.
- K. Internal driver.
- L. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- M. Housings: Powder-coat or painted finish, applied after fabrication.

2.02 DRIVER REQUIREMENTS

- A. Comply with UL 8750.
- B. Comply with NEMA 410.
- C. Built-in surge protection (in accordance with IEEE /ANSI C82.77-5 Transient Surge Requirements). Additional surge protection as specified.
- D. Dimming: Standard dimming shall utilize 0-10 volt, direct-current interface. Drivers shall be source-type, approximately 150 microamps.
 - 1. 0-10 volt dimming shall be provided unless specified to be without dimming or to utilize a different dimming protocol.

2.03 EMERGENCY POWER UNIT

- A. Internal Type: Self-contained, modular, battery unit, factory mounted within luminaire body and compatible with supplied driver and diode(s). Comply with UL 924.
 - 1. Emergency Connection: Operate at least two diodes or diode strings in parallel at an output of 1000 lumens each. Connect unswitched circuit conductor to battery unit and switched circuit conductor to fixture driver.
 - 2. Night-Light Connection: Wire to operate luminaire continuously and connect emergency battery unit.
 - 3. Test Push Button and Indicator Light: Visible and accessible without entering ceiling space. Where test push button is located concealed behind a lens or diffuser, such lens or diffuser shall require no tools to remove and gain access to the test push button. Where indicator light is located concealed behind a lens or diffuser, it shall be located such that the glow is visible through the installed lens or diffuser.
 - a. Test Push Button: Push-to-test type, simulates loss of normal power and demonstrates operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - c. Where specified, or where a luminaire meeting other specification requirements is not available with an integrated test push button and indicator light, such button and light may be remote mounted. Furnish and install a manufactured one-gang wall/ceiling plate in a one-gang junction box, flush mounted within 36 inches of fixture location. Such a device shall be located as directed by the architect.

4. Battery: Sealed, high-temperature, maintenance-free, nickel-cadmium type.
 5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay. 24 hour maximum recharge time from full discharge.
 6. Ambient Temperature rating of 32F to 131F. Where located outdoors or otherwise specified "low temp" rating shall be suitable for 0F locations without use of a heater.
 7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of emergency unit operation at code-specified intervals. Test failure is annunciated by an integral audible alarm and flashing red LED indicator light.
- B. External Type: Self-contained, modular, battery unit, remote mounted and field-wired to the fixture. Shall be compatible with supplied driver and diode(s). Comply with UL 924.
1. Emergency Connection: Operate at least two diodes or diode strings in parallel at an output of 1000 lumens each. Connect unswitched circuit conductor to battery unit and switched circuit conductor to fixture driver.
 2. Night-Light Connection: Wire to operate luminaire continuously and connect emergency battery unit.
 3. Test Push Button and Indicator Light: Visible and accessible on the unit housing.
 - a. Test Push Button: Push-to-test type, simulates loss of normal power and demonstrates operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 4. Housing: NEMA 250, Type 1 enclosure.
 5. Battery: Sealed, high-temperature, maintenance-free, nickel-cadmium type.
 6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay. 24 hour maximum recharge time from full discharge.
 7. Ambient Temperature rating of 32F to 131F. Where located outdoors or otherwise specified "low temp" rating shall be suitable for 0F locations without use of a heater.
 8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of emergency unit operation at code-specified intervals. Test failure is annunciated by an integral audible alarm and flashing red LED indicator light.

2.04 MATERIALS

- A. Metal Parts:
1. Free of burrs and sharp corners and edges.
 2. Sheet metal components shall be steel unless otherwise indicated.
 3. Form and support to prevent warping and sagging.
- B. 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 servicing and when secured in operating position.
- C. Exposed Metal Hardware: Where fixture is exposed to damp or wet environments. Grade 316 Stainless Steel.
- D. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 2. Glass: Annealed crystal glass unless otherwise indicated.
 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

2.05 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Comply with requirements in Section 26 05 29 "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 luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

2.06 EXIT SIGNS

- A. Description: 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, 70,000 hours minimum rated lamp life.
 - 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 - g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.07 EMERGENCY LIGHTING UNITS

- A. Description: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
 - 7. Integral Time-Delay Relay: Where specified, holds unit on for fixed interval of 15 minutes when power is restored after an outage.
 - 8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Refer to architectural reflected ceiling plan for exact location of lighting fixtures. Coordinate installation with ceiling rating. Provide fire rated cover for fixture where required. This may be a manufactured U.L. Listed cover, "hat" or box; or a site fabricated cover. The cover shall meet or exceed the fire rating requirement and meet requirements of Local AHJ. The cover shall be compatible with the IC or Non IC rating of the fixture.
- D. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
 - 1. Install a minimum of four ceiling support system rods or wires 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. Provide support for luminaire without causing deflection of ceiling or wall.
- E. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.
- F. Adjust aimable lighting fixtures to provide required light intensities.
- G. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- H. Provide additional conductors as required for dimming and control systems.

3.02 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.03 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation including controls.
 - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal. Test using both the test push button, and separately using the associated branch circuit breaker.

3.04 STARTUP SERVICE

- A. Comply with requirements for startup specified in Section 26 09 43.16 "Addressable-Fixture Lighting Controls."
- B. Comply with requirements for startup specified in Section 26 09 43.23 "Relay-Based Lighting Controls."

3.05 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 26.56.00 – LED 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. This Section includes the following:
 - 1. Exterior luminaires with lamps and ballasts.
 - 2. Luminaire-mounted photoelectric relays.
 - 3. Poles and accessories.
- B. Related Sections include the following:
 - 1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.03 DEFINITIONS

- A. CRI: Color-rendering index.
- B. LED: Light-emitting diode
- C. IP: International Protection or Ingress Protection Rating.
- D. CCT: Correlated color temperature.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting fixture, including driver.
- G. Pole: Luminaire support structure, including tower used for large area illumination.
- H. 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.
- B. Ice Load: Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4.
- C. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.
 - 1. Wind speed for calculating wind load for poles exceeding 50 feet in height is 110 mph.
 - 2. Wind speed for calculating wind load for poles 50 feet or less in height is 110 mph.
- D. Seismic: Shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. "Withstand" means that "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

1.05 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component:
 - 1. Arranged in order of lighting unit designation.
 - 2. Include data on features, accessories, finishes.
 - 3. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 - 4. Details of attaching luminaires and accessories.
 - 5. Details of installation and construction.

6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project IES LM-79 and IES LM-80.
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 7. Photoelectric relays.
 8. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
 9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
 10. Anchor bolts for poles.
- B. Shop Drawings:
1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
 2. Wiring Diagrams: Power and control wiring.
- C. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.
- D. Qualification Data: For agencies providing photometric data for lighting fixtures.
- E. Field quality-control test reports.
- F. Warranty: Special warranty specified in this Section.

1.06 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, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with IEEE C2, "National Electrical Safety Code."
- D. Comply with NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package aluminum poles for shipping according to ASTM B 660.
- B. 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 and positive drainage.
- C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch deep. Do not apply tools to section of pole to be installed below ground line.
- D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.
- E. Remove factory-applied pole wrappings on metal poles immediately upon delivery to the site. Handle poles with web fabric straps.

1.08 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.
 - 2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
 - 4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

1.09 EXTRA MATERIALS

- 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. Glass and Plastic Lenses, Covers, and Other Optical Parts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Drivers: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Globes and Guards: 10 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In the Lighting Fixture Schedule where titles below are column or row headings that 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.

2.02 LUMINAIRES, GENERAL REQUIREMENTS

- 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. 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: Grade 316 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.

2.03 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
 - 1. Relay with locking-type receptacle shall comply with NEMA C136.10.
 - 2. Adjustable window slide for adjusting on-off set points.
 - 3. Relay shall be suitable for LED sources, including consideration for inrush.

2.04 DRIVER REQUIREMENTS

- A. Comply with UL 8750.
- B. Comply with NEMA 410.
- C. Built-in surge protection (in accordance with IEEE /ANSI C82.77-5 Transient Surge Requirements). Additional surge protection as specified.

2.05 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4.
 - 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 Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
 - 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 stainless-steel items are indicated.
 - 3. Anchor-Bolt Template: Plywood or steel.

- D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."
- E. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4.
- F. Base Covers: Manufacturer's standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

2.06 STEEL POLES

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; 1-piece construction up to 40 feet in height with access handhole in pole wall.
 - 1. Shape: Per Fixture Schedule
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- B. Steel Mast Arms: Per fixture Schedule, continuously welded to pole attachment plate. Material and finish same as pole.
- C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - 1. Adapter fitting welded to pole and bracket, 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.
- D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- E. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 26 Section "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.
- F. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- G. Platform for Lamp and Ballast Servicing: Factory fabricated of steel with finish matching that of pole.
- H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- I. 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 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 selected by Architect from manufacturer's full range.

2.07 ALUMINUM POLES

- A. Poles: Seamless, extruded structural tube complying with ASTM B 429, Alloy 6063-T6 with access handhole in pole wall.
- B. Poles: ASTM B 209, 5052-H34 marine sheet alloy with access handhole in pole wall.
 - 1. Shape: As indicated on drawings
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- 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 Division 26 Section "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. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
 - 1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
 - 2. Finish: Same as pole.
- F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- G. Aluminum Finish: 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.
 - 4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - a. Color: As selected by Architect from manufacturer's full range.

2.08 FIBERGLASS POLES

- A. Poles: Comply with ANSI C136.20, with access handhole in pole wall.
 - 1. Mounting: Embedded.
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- B. Resin Color: As selected by Architect from manufacturer's full range; provide uniform coloration throughout entire wall thickness.
- C. Surface Finish: Pigmented polyurethane, with a minimum dry film thickness of 1.5 mils.

PART 3 - EXECUTION

3.01 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. 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.
- C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

3.02 POLE INSTALLATION

- A. 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.
- 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 Division 03 Section "Cast-in-Place Concrete."

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 Division 26 Section "Raceway 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 Division 26 Section "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.
- B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 1. Install grounding electrode for each pole.
 2. Install grounding conductor and conductor protector.
 3. Ground metallic components of pole accessories and foundations.

3.05 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
 1. Verify operation of photoelectric controls.
- C. Illumination Tests:
 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):
 - a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting."
 - b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
 - c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
 - d. IESNA LM-64, "Photometric Measurements of Parking Areas."
 - e. IESNA LM-72, "Directional Positioning of Photometric Data."

- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 27.05.00 - COMMON WORK RESULTS FOR COMMUNICATIONS

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. Communications equipment coordination and installation.
 - 2. Sleeves for pathways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common communications installation requirements.

1.03 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

- A. Product Data: For sleeve seals.

1.05 COORDINATION

- A. Coordinate arrangement, mounting, and support of communications equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.01 SLEEVES FOR PATHWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.

- b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE SEALS

2.03 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.01 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.02 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable

penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

- K. Protection of Roof:
 - 1. Coordinate electrical work with roofing work in regard to any electrical items which may pierce or otherwise affect the roof.
 - 2. Arrange for any cutting or repairing to roofing which might already be installed when an electrical installation is made.
 - 3. Roof penetrations shall not void roofing warranty. Penetrations shall be coordinated with roofing supplier holding the warranty. Electrical contractor shall coordinate with roofing supplier for installation of pre-molded pipe seal or field fabricated pipe penetration as applicable. Electrical contractor to include all costs and coordination with and for roofing penetrations, new or existing.
 - 4. Routing of electrical wiring thru ductwork, and penetrations of ductwork or roof curbs is not allowed.
- L. 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.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.03 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.04 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 27.05.28 - PATHWAYS FOR COMMUNICATIONS 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 and fittings.
 - 2. Nonmetallic conduits and fittings.
 - 3. Metallic surface pathways.
 - 4. Tele-power poles.
 - 5. Hooks.
 - 6. Boxes, enclosures, and cabinets.

1.03 DEFINITIONS

- A. GRS: Galvanized rigid steel conduit.
- B. IMC: Intermediate metal conduit.

1.04 ACTION SUBMITTALS

- A. Product data for the following:
 - 1. Surface pathways
 - 2. Wireways and fittings.
 - 3. Tele-power poles.

PART 2 - PRODUCTS

2.01 METAL CONDUITS AND FITTINGS

- A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.
- B. General Requirements for Metal Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
 - 2. Comply with TIA-569-D.
- C. GRS: 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. Steel.
- F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B. Fittings for EMT shall be steel, set screw type.

2.02 NONMETALLIC CONDUITS AND FITTINGS

- A. Description: Nonmetallic raceway of circular section with manufacturer-fabricated fittings.
- B. General Requirements for Nonmetallic Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 - 2. Comply with TIA-569-D.

- C. RNC: Type EPC-40-PVC except where noted to be Schedule 80. Then Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Rigid HDPE: Comply with UL 651A.
- E. Continuous HDPE: Comply with UL 651A.
- F. RTRC: Comply with UL 2515A and NEMA TC 14.
- G. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.
- H. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 SURFACE METAL PATHWAYS

- A. Description: Galvanized steel with snap-on covers, complying with UL 5.
- B. Finish: Manufacturer's standard enamel finish in color selected by Architect.
- C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.
- E. Comply with TIA-569-D.

2.04 HOOKS

- A. Description: Prefabricated sheet metal cable supports for telecommunications cable.
- B. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- C. Comply with TIA-569-D.
- D. Galvanized steel.
- E. J shape.

2.05 BOXES, ENCLOSURES, AND CABINETS

- A. Description: Enclosures for communications.
- B. General Requirements for Boxes, Enclosures, and Cabinets:
 - 1. Comply with TIA-569-D.
 - 2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
 - 3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
 - 4. Device Box Dimensions: 4-11/16 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) with at least two 1 inch knock-out openings on each of two opposite sides.
- 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, aluminum, Type FD, with gasketed cover.
- E. Dual Service Floor Boxes: Refer to Division 26 Section "Wiring Devices" for requirements.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

- G. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- H. Cabinets:
 - 1. NEMA 250 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.01 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRS or IMC.
 - 2. Concealed Conduit, Aboveground: EMT with compression type fittings.
 - 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 - 4. Boxes and Enclosures, Aboveground: NEMA 250. Type 3R.
- B. Indoors: Apply pathway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Severe Physical Damage: EMT.
 - 2. Exposed and Subject to Severe Physical Damage: IMC. Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 4. Damp or Wet Locations: GRS or IMC.
 - 5. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
 - 6. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: EMT.
 - 7. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: EMT.
 - 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel units in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: 3/4-inch (21-mm) trade size.
- D. Pathway Fittings: Compatible with pathways 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. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 3. EMT: Use set-screw, steel fittings. Use compression fittings where Type EMT is permitted outdoors. Comply with NEMA FB 2.10.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface pathways only where indicated on Drawings.

- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.02 INSTALLATION

- A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
1. NECA 1.
 2. NECA/BICSI 568.
 3. TIA-569-D.
 4. NECA 101
 5. NECA 102.
 6. NECA 105.
 7. NECA 111.
- B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- C. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- D. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Comply with requirements in Division 27 Section 270544 "Common Work Results for Communications" for sleeves and sleeve seals for communications.
- F. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- G. Complete pathway installation before starting conductor installation.
- H. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- I. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical-fiber cables.
- J. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- L. Pathways Embedded in Slabs:
1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
 3. Arrange pathways to keep a minimum of 2 inches (50 mm) 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 nonmetallic conduit and fittings to metal conduit and fittings before rising above floor.
- M. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for pathways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

- N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- O. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- Q. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.
- R. 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.
- S. Cut conduit perpendicular to the length. For conduits of 2-inch (50-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- T. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.
- U. Surface Pathways:
 - 1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
 - 2. Install surface pathway with a minimum 2-inch (50-mm) radius control at bend points.
 - 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- V. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
 - 1. 3/4-Inch (21-mm) Trade Size and Smaller: Install pathways in maximum lengths of 50 feet (15 m).
 - 2. 1-Inch (25-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
 - 3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- W. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, 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 pathway-sealing fittings according to NFPA 70.
- X. Install devices to seal pathway 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 pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- Y. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

Z. Expansion-Joint Fittings:

1. Install in each run of aboveground RMC and EMT that is located where environmental temperature change may exceed 100 deg F (55 deg C), and that has straight-run length that exceeds 100 feet (30 m).
2. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

AA. Hooks:

1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
3. Hook spacing shall allow no more than 6 inches (150 mm) of slack. The lowest point of the cables shall be no less than 6 inches (150 mm) adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
4. Space hooks no more than 5 feet (1.5 m) o.c.
5. Provide a hook at each change in direction.

BB. 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.

CC. 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 and plumb. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

DD. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

EE. 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.

FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

GG. Set metal floor boxes level and flush with finished floor surface.

HH. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated.
2. **Underground Warning Tape:** Comply with requirements in Division 26 Section "Identification for Electrical Systems."

3.04 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.** Comply with requirements in Division 27 Section "Common Work Results for Communication."

3.05 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.06 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or 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

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. Backboards.
 - 3. Telecommunications equipment racks and cabinets.
 - 4. Telecommunications service entrance pathways.
 - 5. Grounding.

1.03 DEFINITIONS

- A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- B. BICSI: Building Industry Consulting Service International.
- C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel not exceeding 6 inches in width.
- D. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- E. LAN: Local area network.
- F. RCDD: Registered Communications Distribution Designer.
- G. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of a bottom without ventilation openings within integral or separate longitudinal side rails.
- H. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

1.04 PERFORMANCE REQUIREMENTS

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. 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.

- C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.06 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, RCDD/NTS, or Commercial Installer, Level 2.
 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician or Level 2 Installer, 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 or Commercial Installer, Level 2 to perform the on-site inspection.
- 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. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.08 COORDINATION

- A. 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.
- B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.01 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
 2. Support brackets with cable tie slots for fastening cable ties to brackets.
 3. Lacing bars, spools, J-hooks, and D-rings.

4. Straps and other devices.
- C. Cable Trays:
 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. Cable Management Solutions, Inc.
 - b. Cablofil Inc.
 - c. Cooper B-Line, Inc.
 - d. Cope - Tyco/Allied Tube & Conduit.
 - e. GS Metals Corp.
 2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch thick.
 - a. Basket Cable Trays: 18 inches wide and 6 inches deep are minimum dimensions supply as indicated on drawings. Wire mesh spacing shall not exceed 2 by 4 inches.
- D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.02 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

2.03 EQUIPMENT FRAMES

- 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. ADC.
 2. Aim Electronics; a brand of Emerson Electric Co.
 3. AMP; a Tyco International Ltd. company.
 4. Cooper B-Line, Inc.
 5. Hubbell Premise Wiring.
 6. KRONE Incorporated.
 7. Leviton Voice & Data Division.
 8. Middle Atlantic Products, Inc.
 9. Nordex/CDT; a subsidiary of Cable Design Technologies.
 10. Ortronics, Inc.
 11. Panduit Corp.
 12. Siemon Co. (The).
- B. General Frame Requirements:
 1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
 2. Module Dimension: Width compatible with EIA 310 standard, 19-inch panel mounting.
 3. Finish: Manufacturer's standard, baked-polyester powder coat.
- C. Floor-Mounted Racks: Modular-type, steel or aluminum construction.
 1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
 2. Baked-polyester powder coat finish.
- D. Modular Freestanding Cabinets:

1. Removable and lockable side panels.
 2. Hinged and lockable front and rear doors.
 3. Adjustable feet for leveling.
 4. Screened ventilation openings in the roof and rear door.
 5. Cable access provisions in the roof and base.
 6. Grounding bus bar.
 7. Rack or roof-mounted, 550-cfm fan with filter.
 8. Power strip.
 9. Baked-polyester powder coat finish.
 10. All cabinets keyed alike.
- E. Modular Wall Cabinets:
1. Wall mounting.
 2. Steel or aluminum construction.
 3. Treated to resist corrosion.
 4. Lockable front and rear doors.
 5. Louvered side panels.
 6. Cable access provisions top and bottom.
 7. Grounding lug.
 8. Rack or roof-mounted, 250-cfm fan.
 9. Power strip.
 10. All cabinets keyed alike.
- F. Cable Management for Equipment Frames:
1. Metal, with integral wire retaining fingers.
 2. Baked-polyester powder coat finish.
 3. Vertical cable management panels shall have front and rear channels, with covers.
 4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.04 POWER STRIPS

- A. Power Strips: Comply with UL 1363.
1. Rack mounting.
 2. Six, 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
 3. LED indicator lights for power and protection status.
 4. LED indicator lights for reverse polarity and open outlet ground.
 5. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
 6. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
 7. Cord connected with 15-foot line cord.
 8. Rocker-type on-off switch, illuminated when in on position.
 9. Peak Single-Impulse Surge Current Rating: 26 kA per phase.
 10. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

2.05 GROUNDING

- A. Comply with requirements in Division 26 Section "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 or exothermic-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 ANSI-J-STD-607-A.

2.06 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 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Install underground pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.
- C. Install underground entrance pathway complying with Division 26 Section "Raceway and Boxes for Electrical Systems."

3.02 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.03 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping." Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- B. 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 ANSI-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.

3.05 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems." Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- B. Labels shall be preprinted or computer-printed type.

END OF SECTION

SECTION 28.05.00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

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. Electronic safety and security equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electronic safety and security installation requirements.

1.03 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

- A. Product Data: For sleeve seals.

1.05 COORDINATION

- A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.01 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.

- b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE SEALS

- 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 Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.03 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.02 SLEEVE INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

- A. Electronic safety and security penetrations occur when raceways, pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Protection of Roof:
 - 1. Coordinate electrical work with roofing work in regard to any electrical items which may pierce or otherwise affect the roof.
 - 2. Arrange for any cutting or repairing to roofing which might already be installed when an electrical installation is made.
 - 3. Roof penetrations shall not void roofing warranty. Penetrations shall be coordinated with roofing supplier holding the warranty. Electrical contractor shall coordinate with roofing supplier for installation of pre-molded pipe seal or field fabricated pipe penetration as applicable. Electrical contractor to include all costs and coordination with and for roofing penetrations, new or existing.
 - 4. Routing of electrical wiring thru ductwork, and penetrations of ductwork or roof curbs is not allowed.
- L. 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.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.03 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use 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.

3.04 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

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. Nonsystem smoke detectors.
 - 5. Heat detectors.
 - 6. Notification appliances.
 - 7. Firefighters' two-way telephone communication service.
 - 8. Magnetic door holders.
 - 9. Remote annunciator.
 - 10. Addressable interface device.
 - 11. Digital alarm communicator transmitter.
 - 12. Radio alarm transmitter.
 - 13. System printer.

1.03 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.04 SYSTEM DESCRIPTION

- A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only. System shall be a voice evacuation fire alarm system.

1.05 PERFORMANCE REQUIREMENTS

1.06 SUBMITTALS

- A. 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.
 - b. NICET-certified fire-alarm technician, Level IV minimum.
 - c. Licensed or certified by authorities having jurisdiction.
- B. Product Data: For each type of product indicated.
- C. 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 voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
 7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
- D. Delegated-Design Submittal: For smoke and heat detectors 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. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.
- E. Qualification Data: For qualified Installer.
- F. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- G. Field quality-control reports.
- H. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "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.
 7. Copy of NFPA 25.
- I. 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.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
- C. 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.
- D. 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.
- E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL, or
- F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.08 PROJECT CONDITIONS

- A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 1. Notify Architect or Owner no fewer than two days in advance of proposed interruption of fire-alarm service.
 2. Do not proceed with interruption of fire-alarm service without Architect's or Owner's written permission.

1.09 SEQUENCING AND SCHEDULING

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.10 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.

1.11 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.

2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
3. Smoke Detectors, Fire Detectors, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
5. Keys and Tools: One extra set for access to locked and tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- 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. Faraday; Siemens Building Technologies, Inc.
 2. Fire Control Instruments, Inc.; a Honeywell company.
 3. Fire Lite Alarms; a Honeywell company.
 4. Gamewell; a Honeywell company.
 5. GE Infrastructure; a unit of General Electric Company.
 6. Gentex Corporation.
 7. NOTIFIER; a Honeywell company.
 8. Siemens Building Technologies, Inc.; Fire Safety Division.
 9. Fahrenheit; a Honeywell company.
 10. SimplexGrinnell LP; a Tyco International company.

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. Flame detectors.
 4. Smoke detectors.
 5. Duct smoke detectors.
 6. Verified automatic alarm operation of smoke detectors.
 7. Automatic sprinkler system water flow.
 8. Heat detectors in elevator shaft and pit.
 9. Fire-extinguishing system operation.
 10. Fire standpipe system.
- 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. Release fire and smoke doors held open by magnetic door holders.
 6. Activate voice/alarm communication system.
 7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 8. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
 9. Activate stairwell and elevator-shaft pressurization systems.
 10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 11. Recall elevators to primary or alternate recall floors.
 12. Activate emergency lighting control.

13. Activate emergency shutoffs for gas and fuel supplies.
 14. Record events in the system memory.
 15. Record events by the system printer.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
 2. Low-air-pressure switch of a dry-pipe sprinkler system.
 3. 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.
 9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
 10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

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, 2 line(s) of 40 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.
 - a. Initiating Device Circuits: Style B.
 - b. Notification Appliance Circuits: Style X.

- c. Signaling Line Circuits: Style 3.
 - d. Install no more than 50 addressable devices on each signaling line circuit.
- 2. Serial Interfaces: Two RS-232 ports for printers.
- D. Stairwell Pressurization: Provide an output signal using an addressable relay to start the stairwell pressurization system. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.
 - 1. Pressurization starts when any alarm is received at fire-alarm control unit.
 - 2. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.
- E. Smoke-Alarm Verification:
 - 1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 - 2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
 - 3. Record events by the system printer.
 - 4. Sound general alarm if the alarm is verified.
 - 5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- F. Notification Appliance Circuit: Voice evacuation.
- G. 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.
- H. 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.
- I. 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.
- J. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- K. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire-alarm control unit.
 - 1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.
 - a. Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.

- b. Programmable tone and message sequence selection.
 - c. Standard digitally recorded messages for "Evacuation" and "All Clear."
 - d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.
- 2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
- 3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- L. 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 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.
- M. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed lead calcium.
- N. 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. Single-action mechanism, 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.
 - 3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 - 4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

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. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
 4. Each sensor shall have multiple levels of detection sensitivity.
 5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 6. 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.
- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.
 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.
- D. Continuous Linear Heat-Detector System:
 1. Detector Cable: Rated detection temperature 155 deg F. NRTL listed for "regular" service and a standard environment. Cable includes two steel actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow the cable twist pressure to short-circuit wires at the location of elevated temperature.
 2. Control Unit: Two-zone or multizone unit as indicated. Provide same system power supply, supervision, and alarm features as specified for fire-alarm control unit.
 3. Signals to Fire-Alarm Control Unit: Any type of local system trouble shall be reported to fire-alarm control unit as a composite "trouble" signal. Alarms on each detection zone shall be individually reported to central fire-alarm control unit as separately identified zones.
 4. 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. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- C. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- D. 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.
- E. 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.
- F. Voice/Tone Notification Appliances:
 1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
 2. High-Range Units: Rated 2 to 15 W.

3. Low-Range Units: Rated 1 to 2 W.
4. Mounting: semirecessed or surface mounted and bidirectional.
5. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.08 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
 1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
 2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 3. Rating: 24-V ac or dc.
 4. Rating: 120-V ac.
- B. Material and Finish: Match door hardware.

2.09 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.

2.10 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 and to circuit-breaker shunt trip for power shutdown.

2.11 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.

2.12 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
1. Factory fabricated and furnished by manufacturer of device.
 2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
1. Connect new equipment to existing control panel in existing part of the building.
 2. Connect new equipment to existing monitoring equipment at the supervising station.
 3. Expand, modify, and supplement existing control or monitoring equipment as necessary to extend existing control or monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- 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 A or Appendix B in NFPA 72.
 5. HVAC: Locate detectors not closer than 5 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. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- G. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

- H. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- I. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.
- J. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- K. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.
- L. 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 Division 08 Section "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 Division 26 Section "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 Architect or authorities having jurisdiction as required by local code.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

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.
- C. 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 audible appliances for the private operating mode according to manufacturer's written instructions.
 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 6. 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.
- D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- H. 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

SECTION 31.05.19
GEOSYNTHETICS FOR EARTHWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Geotextile for filtration.
- B. Geocomposite for drainage.

1.02 RELATED REQUIREMENTS

- A. Section 31.10.00 - Site Clearing.
- B. Section 31.22.00 - Grading.
- C. Section 31.23.16 - Excavation.
- D. Section 31.23.18 - Trenching.
- E. Section 31.23.23 - Fill.
- F. Section 33.41.00 - Subdrainage.

1.03 REFERENCE STANDARDS

- A. AASHTO M 288 - Standard Specification for Geosynthetic Specification for Highway Applications; 2017.
- B. ASTM D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics; 2016.
- C. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus; 2014.
- D. ASTM D4491/D4491M - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 2020.
- E. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a.
- F. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2012.
- G. ASTM D4833/D4833M - Standard Test Method for Index Puncture Resistance of Geomembranes, and Related Products; 2007 (Reapproved 2020).
- H. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2017.
- I. ASTM D4886 - Standard Test Method for Abrasion Resistance of Geotextiles (Sandpaper/Sliding Block Method); 2018.
- J. ASTM D5199 - Standard Test Method for Measuring the Nominal Thickness of Geosynthetics; 2012 (Reapproved 2019).
- K. ASTM D6241 - Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile- Related Products Using a 50-mm Probe; 2014.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data on each product to be used, including physical properties, seaming materials, and installation instructions.
- C. Shop Drawings:
 - 1. Indicate overall layout, dimensions, geotextile sheet and seam layout.
- D. Manufacturer's Certification: Indicating the proposed geosynthetic function meets design requirements supported by applicable testing results.
- E. Manufacturer's Instructions: Indicate seaming method.
- F. Manufacturer's qualification statement.

- G. Installer's qualification statement.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01.60.00 - Product Requirements for additional requirements.
- B. Identify, store, and handle geosynthetic rolls and samples according to ASTM D4873/D4873M.
- C. Protect materials from sunlight and other ultraviolet light sources during storage.
- D. Handle geosynthetics with care and prevent dragging, dropping, or imbalanced lifting.

1.07 FIELD CONDITIONS

- A. Temperature Requirements: Do not place geosynthetic when ambient air or base surface temperature is less than 40 degrees F or above 140 degrees F (60 degrees C).
- B. Surface Requirements: Do not place geosynthetic when the receiving surface is saturated or has ponded water.
- C. Follow recommendations of geosynthetic manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. SKAPS Industries: www.skaps.com/#sle.
- B. Solmax: www.solmax.com/#sle.
- C. US Fabrics Inc: www.usfabricsinc.com/#sle.

2.02 GEOSYNTHETIC

- A. Provide geosynthetic in largest size sheets as possible to minimize field joining.
- B. Uniform thickness according to ASTM D5199.
- C. Resistant to mildew, chemicals in soil, stable under freeze-thaw cycles, will not shrink or expand under wet conditions, and will not unravel or become clogged during use.
- D. Abrasion Resistance: 80 percent loss for 250 cycles, when tested in accordance with ASTM D4886.

2.03 GEOTEXTILE

- A. General:
1. Material: Polyethylene consisting of 5 percent maximum regrind and free of contaminants.
 2. Survivability: Class 1, when tested in accordance with AASHTO M 288.
- B. Geotextile for Filtration: Capable of allowing liquid passage while restricting solids.
1. Type: Nonwoven.
 2. Seams: Mechanically sewn.
 - a. Overlap: According to manufacturer.
 - b. Stitch: Flat; continuous; tied off at ends.
 3. Grab Strength: 300 lb (1.3 kN), minimum, when tested in accordance with ASTM D4632/D4632M.
 4. Permittivity: 0.5 per second, minimum, ASTM D4491/D4491M.
 5. Apparent Opening Size: No.40 (0.425 mm), maximum, when tested in accordance with ASTM D4751.
 6. Sewn Seam Strength: 275 lb (1.25kN), minimum, when tested in accordance with ASTM D4632/D4632M.

7. Puncture Strength: 450 lb (2.0 kN), minimum, when tested in accordance with ASTM D4833/D4833M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify the receiving surface is smooth, without ruts or protrusions, and grades are according to design drawings.
- B. Verify the receiving surface is unsaturated and free of ponded water.
- C. Verify the geosynthetic is free of defects or flaws that may degrade physical performance.

3.02 PREPARATION

- A. Remove vegetation, boulders, and rocks larger than 3/4 inch in size and other sharp objects in accordance with Section 31.10.00.
- B. Remove unsuitable materials in accordance with Section 31.23.16.
- C. Fill in holes, including stake holes, backfill, and fill in accordance with Section 31.23.23.
- D. Grade as indicated on drawings in accordance with Section 31.22.00.
- E. Compact smooth as indicated on drawings in accordance with Section 31.23.23.

3.03 INSTALLATION

- A. General:
 1. Prevent surface drainage from eroding under geosynthetic. Repair undermined areas prior to backfill.
 2. Position geosynthetic smooth and wrinkle free on prepared surface; unroll or unfold carefully, avoiding stretching.
 3. Secure geosynthetic to prevent movement or damage during installation.
 4. Perform seaming in adequate lighting. Seam each geosynthetic member immediately after final placement. Clean sheets of dust, dirt, and other foreign matter prior to seaming.
 5. Follow manufacturer's recommended installation procedures.
- B. Filtration:
 1. Install geotextile according to manufacturer's recommendations.
 2. Lay sheets in the direction of construction.
 3. Place adjacent geotextile and loosely fasten until seamed.
 4. Protect geotextile from surface runoff contamination prior to backfill.
 5. Repairs: Remove damaged portion of geotextile and seam an additional layer to cover the affected area in all directions. Replace geotextile where surface runoff contamination has occurred.

3.04 BACKFILL

- A. Obtain approval for geosynthetic sheet installation from Architect before placing fill.
- B. Backfill in a manner to prevent damage to geosynthetic. Repair geosynthetic damaged during backfill operations.
- C. Cover geosynthetic in the installed direction in accordance with Section 31.23.23.
 1. Cover geosynthetic within time limits specified by manufacturer.
 2. Lift Thickness: 12 inches.

3.05 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements for additional requirements.
- B. Provide manufacturer's field representative at all times during geosynthetic installation.
- C. Inspect completed liner for pinholes, punctures, and tears; inspect seams and joints for unbonded areas. Repair any defects or damages found.

3.06 PROTECTION

- A. Do not exceed geosynthetic manufacturer's recommended exposure to UV radiation.

- B. Prevent surface water runoff from contaminating geosynthetic.
- C. Do not use pins or staples where risk of damaging underlying geosynthetic layer is present.
- D. Erect barricades to prevent traffic over geosynthetic before it is filled.

END OF SECTION

SECTION 31.10.00 - SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clearing and protection of vegetation.
- B. Removal of existing debris.

1.02 RELATED REQUIREMENTS

- A. Section 01.10.00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01.50.00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 01.57.13 - Temporary Erosion and Sediment Control.
- D. Section 01.70.00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.
- E. Section 31.22.00 - Grading: Topsoil removal.
- F. Section 31.22.00 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fill Material: As specified in Section 31.22.00 - Grading

PART 3 EXECUTION

3.01 SITE CLEARING

- A. Comply with other requirements specified in Section 01.70.00.
- B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

3.02 EXISTING UTILITIES AND BUILT ELEMENTS

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Protect existing structures and other elements that are not to be removed.

3.03 VEGETATION

- A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, playing fields, lawns, and planting beds.
- B. Do not remove or damage vegetation beyond the limits indicated on drawings.
- C. Install substantial, highly visible fences at least 3 feet high to prevent inadvertent damage to vegetation to remain:
 - 1. At vegetation removal limits.
- D. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.

- E. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
 - 1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
 - 2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
 - 3. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.
 - 4. Fill holes left by removal of stumps and roots, using suitable fill material, with top surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.
- F. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.04 DEBRIS

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 31.22.00 - GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal of topsoil.
- B. Rough grading the site for site structures, building pads.
- C. Finish grading.

1.02 RELATED REQUIREMENTS

- A. Section 31.23.16 - Excavation.
- B. Section 31.23.23 - Fill: Filling and compaction.
- C. Section 31.23.16 - Trenching.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with TDOT standards.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Topsoil: See Section 31.23.23.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.
- C. Locate, identify, and protect from damage above- and below-grade utilities to remain.
- D. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.
- E. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.

3.03 ROUGH GRADING

- A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
- B. Do not remove topsoil when wet.
- C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- D. Do not remove wet subsoil unless it is subsequently processed to obtain optimum moisture content.
- E. When excavating through roots, perform work by hand and cut roots with sharp axe.
- F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL

- A. Stockpile topsoil to be re-used on site; remove remainder from site.
- B. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

3.05 FINISH GRADING

- A. Before Finish Grading:
 - 1. Verify building and trench backfilling have been inspected.
 - 2. Verify subgrade has been contoured and compacted.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.
- C. Where topsoil is to be placed, scarify surface to depth of 3 inches.
- D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.
- E. Place topsoil in areas where seeding and sodding are indicated.
- F. Place topsoil during dry weather.
- G. Remove roots, weeds, rocks, and foreign material while spreading.
- H. Near plants spread topsoil manually to prevent damage.
- I. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
- J. Lightly compact placed topsoil.

3.06 REPAIR AND RESTORATION

- A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

3.07 FIELD QUALITY CONTROL

- A. See Section 31.23.23 for compaction density testing.

3.08 CLEANING

- A. Remove unused stockpiled topsoil. Grade stockpile area to prevent standing water.
- B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 31.23.16 - EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavating for building volume below grade, footings, pile caps, slabs-on-grade, paving, site structures, and utilities within the building.
- B. Trenching for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

- A. Section 31.22.00 - Grading: Grading.
- B. Section 31.23.23 - Fill: Fill materials, filling, and compacting.
- C. Section 31.23.16 - Trenching.

1.03 PRICE AND PAYMENT PROCEDURES

- A. See Section 01.22.00 - Unit Prices, for general requirements applicable to unit prices for excavation.

PART 2 PRODUCTS

2.01 PRODUCTS

There are no products associated with this specification.

PART 3 EXECUTION

3.01 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31.22.00 for additional requirements.

3.02 EXCAVATING

- A. Excavate to accommodate new structures and construction operations.
- B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Cut utility trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31.23.23.
- G. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- H. Remove excavated material that is unsuitable for re-use from site.
- I. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31.22.00.
- J. Remove excess excavated material from site.

3.03 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements, for general requirements for field inspection and testing.

- B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

3.04 PROTECTION

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 31.23.17 - ROCK REMOVAL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal of discovered rock during excavation.

1.02 RELATED REQUIREMENTS

- A. Section 31.23.23 - Fill: Fill materials.

1.03 PRICE AND PAYMENT PROCEDURES

- A. See Section 01.22.00 - Unit Prices, for additional unit price requirements.
- B. Site Rock Removal: By the cubic yard measured before disintegration. Includes preparation of rock for removal, removal from position, loading and removing from site. For over excavation, payment will not be made for over excavated work nor for replacement materials.
- C. Trench Rock Removal: By the cubic yard measured before disintegration. Includes preparation of rock for removal, removal from position, loading and removing from site. For over excavation, payment will not be made for over excavated work nor for replacement materials.

1.04 DEFINITIONS

- A. Site Rock: Solid mineral material with a volume in excess of 1/3 cubic yard or solid material that cannot be removed with a 3/4 cubic yard capacity power shovel without drilling.
- B. Trench Rock: Solid mineral material with a volume in excess of 1/6 cubic yard or solid material that cannot be removed with a 2 cubic yard capacity power shovel without drilling.

PART 2 PRODUCTS

2.01 PRODUCTS

There are no products associated with this section.

PART 3 EXECUTION

3.01 ROCK REMOVAL

- A. Excavate and remove rock by mechanical methods only; use of explosives is prohibited.
- B. Mechanical Methods: Drill holes and utilize expansive tools to fracture rock.
- C. If rock is uncovered requiring the explosives method for rock disintegration, notify the engineer.
- D. Form level bearing at bottom of excavations.
- E. Remove shale layers to provide sound and unshattered base for footings.
- F. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
- G. Remove excavated materials from site.
- H. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 31.23.23.

3.02 FIELD QUALITY CONTROL

- A. Independent agency field inspection will be provided under provisions of Section 01.40.00 - Quality Requirements.

END OF SECTION

SECTION 31.23.18 - TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

- A. Section 31.22.00 - Grading: Site grading.
- B. Section 31.23.16 - Excavation: Building and foundation excavating.
- C. Section 31.23.23 - Fill: Backfilling at building and foundations.
- D. Section 31.23.17 - Rock Removal: Removal of rock during excavating.

1.03 REFERENCES

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2001 (2004).
- B. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2007.
- C. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- D. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2007.
- E. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- F. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- G. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

PART 2 PRODUCTS

2.01 PRODUCTS

There are no products associated with this section.

PART 3 EXECUTION

3.01 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31.22.00 for additional requirements.

3.02 TRENCHING

- A. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.

- D. Cut trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Remove excavated material that is unsuitable for re-use from site.
- G. Remove excess excavated material from site.

3.03 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.04 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- F. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.
- G. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- H. Correct areas that are over-excavated.
 - 1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
- I. Compaction Density Unless Otherwise Specified or Indicated:
- J. Reshape and re-compact fills subjected to vehicular traffic.

3.05 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Use general fill unless otherwise specified or indicated.
- B. Utility Piping, Conduits, and Duct Bank:
 - 1. Bedding: Use general fill.
 - 2. Cover with general fill.
 - 3. Fill up to subgrade elevation.
 - 4. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.
- C. At French Drains:
 - 1. Use granular fill.
 - 2. Compact to 95 percent of maximum dry density.

3.06 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements, for general requirements for field inspection and testing.

- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.07 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 31.23.23 - FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Filling, backfilling, and compacting for building volume below grade.
- B. Backfilling and compacting for utilities outside the building to utility main connections.
- C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

- A. Section 31.23.16 - Excavation: Removal and handling of soil to be re-used.
- B. Section 31.23.18 - Trenching.

1.03 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.

1.04 REFERENCE STANDARDS

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2001 (2004).
- B. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2007.
- C. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- D. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2007.
- E. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- F. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- G. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Materials Sources: Submit name of imported materials source.
- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill: Conforming to TDOT standard.
- B. Structural Fill: Conforming to TDOT standard.
- C. Granular Fill: Coarse aggregate, conforming to TDOT standard.

2.02 ACCESSORIES

- A. Geotextile Fabric: Non-biodegradable, non-woven.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31.22.00 for additional requirements.

3.02 PREPARATION

- A. Scarify subgrade surface to a depth of 6 inches to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- F. Correct areas that are over-excavated.
 - 1. Load-bearing foundation surfaces: Use structural fill, flush to required elevation, compacted to 100 percent of maximum dry density.
 - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 98 percent of maximum dry density.
- G. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 98 percent of maximum dry density.
- H. Reshape and re-compact fills subjected to vehicular traffic.

3.04 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Frequency of Tests: 1 test per 1,000 cubic yards of fill placed.

END OF SECTION

SECTION 31.31.16
TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Chemical soil treatment.
- B. Site-applied termiticide for wood, steel, and concrete.

1.02 RELATED REQUIREMENTS

- A. Section 03.30.00 - Cast-in-Place Concrete: Vapor barrier placement under concrete slab-on-grade.

1.03 REFERENCE STANDARDS

- A. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011.
- B. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 2006.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.
- C. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.
- D. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.
- E. Manufacturer's Instructions: Indicate caution requirement.
- F. Record and document moisture content of soil before application.
- G. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three (3) years of documented experience.
- H. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing this type of work and:
 - 1. Having minimum of three (3) years documented experience.
 - 2. Approved by manufacturer of treatment materials.
 - 3. Licensed in the State in which the Project is located.

1.06 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year installer's warranty against damage to building caused by termites.
 - 1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.
 - 2. Inspect annually and report in writing to Owner. Provide inspection service for 3 years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

- A. Toxicant Chemical: EPA (Title 7, United States Code, 136 through 136y) approved; synthetically color dyed to permit visual identification of treated soil.
- B. Diluent: Recommended by toxicant manufacturer.
- C. Manufacturers:
 - 1. Bayer Environmental Science Corp: www.backedbybayer.com/pest-management/#sle.
 - 2. FMC Professional Solutions: www.fmcprosolutions.com/#sle.
 - 3. Syngenta Professional Products: www.syngentaprofessionalproducts.com/#sle.

- D. Mixes: Mix toxicant to manufacturer's instructions.

2.02 SITE-APPLIED TERMITICIDE

- A. Site Applied Termiticide for Wood, Steel and Concrete: Borate mineral salt based, spray applied termiticide formulated for use on wood, steel, concrete and other building materials.
1. Active Ingredient: 40% minimum disodium octaborate tetrahydrate (DOT).
 2. Carrier and Penetrant: Proprietary glycol solution.
 3. Products:
 - a. Nisus Corporation; Bora-Care: www.nisuscorp.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

- A. Comply with requirements of U.S. EPA and applicable state and local codes.
- B. Spray apply toxicant in accordance with manufacturer's instructions.
- C. Apply toxicant at following locations:
1. Under Slabs-on-Grade.
 2. At Both Sides of Foundation Surface.
 3. Soil Within 10 feet of Building Perimeter For a Depth of 5 feet.
- D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.
- E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.
- F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
- G. Re-treat disturbed treated soil with same toxicant as original treatment.
- H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 INSTALLATION - SITE-APPLIED TERMITICIDE

- A. Comply with manufacturer's written instructions.

3.04 PROTECTION

- A. Do not permit soil grading over treated work.
- B. Protect sheet materials from damage after completed installation. Repair damage with manufacturer's recommended products and according to the manufacturer's written instructions.

END OF SECTION

SECTION 32.11.23 - AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base course.
- B. Paving aggregates.

1.02 RELATED REQUIREMENTS

- A. Section 31.22.00 - Grading: Preparation of site for base course.
- B. Section 31.23.23 - Fill: Compacted fill under base course.
- C. Section 31.23.18 - Trenching: Compacted fill over utility trenches under base course.
- D. Section 33.05.13 - Manholes and Structures: Manholes including frames.
- E. Section 32.12.16 - Asphalt Paving: Binder and finish asphalt courses.
- F. Section 32.13.13 - Concrete Paving: Finish concrete surface course.

1.03 REFERENCE STANDARDS

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; American Association of State Highway and Transportation Officials; 1965 (2004).
- B. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2001 (2004).
- C. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.
- D. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2007.
- E. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- F. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2007.
- G. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- H. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2006.
- I. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- J. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
- K. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2005.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Coarse Aggregate: Coarse aggregate, conforming to State of Tennessee Highway Department standard.
- B. Blended Aggregate: Pit run washed stone; free of shale, clay, friable material and debris.
- C. Fine Aggregate: Sand; conforming to State of Tennessee Highway Department standard.
- D. Geotextile Fabric: Non-biodegradable, non-woven.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.
- B. Where aggregate materials are specified using ASTM D 2487 classification, test and analyze samples for compliance before delivery to site.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.
- B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

- A. Place aggregate in maximum 4 inch layers and roller compact to specified density.
- B. Level and contour surfaces to elevations and gradients indicated.
- C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.
- C. Variation From Design Elevation: Within 1/2 inch.

3.05 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556.
- C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor").

- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.06 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 32.11.23 - AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base course.
- B. Paving aggregates.

1.02 RELATED REQUIREMENTS

- A. Section 31.22.00 - Grading: Preparation of site for base course.
- B. Section 31.23.23 - Fill: Compacted fill under base course.
- C. Section 31.23.18 - Trenching: Compacted fill over utility trenches under base course.
- D. Section 33.05.13 - Manholes and Structures: Manholes including frames.
- E. Section 32.12.16 - Asphalt Paving: Binder and finish asphalt courses.
- F. Section 32.13.13 - Concrete Paving: Finish concrete surface course.

1.03 REFERENCE STANDARDS

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; American Association of State Highway and Transportation Officials; 1965 (2004).
- B. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2001 (2004).
- C. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.
- D. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2007.
- E. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- F. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2007.
- G. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- H. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2006.
- I. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- J. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
- K. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2005.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.

- B. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Coarse Aggregate: Coarse aggregate, conforming to State of Tennessee Highway Department standard.
- B. Blended Aggregate: Pit run washed stone; free of shale, clay, friable material and debris.
- C. Fine Aggregate: Sand; conforming to State of Tennessee Highway Department standard.
- D. Geotextile Fabric: Non-biodegradable, non-woven.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.
- B. Where aggregate materials are specified using ASTM D 2487 classification, test and analyze samples for compliance before delivery to site.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.
- B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

- A. Place aggregate in maximum 4 inch layers and roller compact to specified density.
- B. Level and contour surfaces to elevations and gradients indicated.
- C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.
- C. Variation From Design Elevation: Within 1/2 inch.

3.05 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements, for general requirements for field inspection and testing.

- B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556.
- C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor").
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.06 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 32.12.16 - ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base course.
- B. Single course bituminous concrete paving.
- C. Double course bituminous concrete paving.
- D. Surface sealer.

1.02 RELATED REQUIREMENTS

- A. Section 31.22.00 - Grading: Preparation of site for paving and base.
- B. Section 31.23.23 - Fill: Compacted subgrade for paving.
- C. Section 32.11.23 - Aggregate Base Courses: Aggregate base course.

1.03 REFERENCE STANDARDS

- A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; The Asphalt Institute; 1994.
- B. AI MS-19 - A Basic Asphalt Emulsion Manual; The Asphalt Institute; Third Edition.
- C. ASTM D 946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 1982 (Reapproved 2005).

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with Tennessee Department of Transportation standard.
- B. Mixing Plant: Conform to Tennessee Department of Transportation standard.
- C. Obtain materials from same source throughout.

1.05 FIELD CONDITIONS

- A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Asphalt Cement: ASTM D 946.
- B. Aggregate for Base Course: In accordance with TDOT standards.
- C. Aggregate for Binder Course: In accordance with TDOT standards.
- D. Aggregate for Wearing Course: In accordance with TDOT standards.
- E. Fine Aggregate: In accordance with TDOT standards.
- F. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.
- G. Primer: In accordance with TDOT standards.
- H. Tack Coat: Homogeneous, medium curing, liquid asphalt.
- I. Seal Coat: AI MS-19, sand type.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

- A. Base Course: 3.0 to 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2.
- B. Binder Course: 4.5 to 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2.
- C. Wearing Course: 5 to 7 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 BASE COURSE

- A. Place and compact base course.

3.03 PREPARATION - PRIMER

- A. Apply primer in accordance with manufacturer's instructions.
- B. Apply primer on aggregate base or subbase at uniform rate of 1/3 gal/sq yd.
- C. Use clean sand to blot excess primer.

3.04 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with manufacturer's instructions.
- B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 1/3 gal/sq yd.

3.05 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Install Work in accordance with TDOT standards.
- B. Place asphalt within 24 hours of applying primer or tack coat.
- C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- D. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.06 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Place asphalt binder course within 24 hours of applying primer or tack coat.
- B. Place wearing course within two hours of placing and compacting binder course.
- C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- D. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.07 SEAL COAT

- A. Apply seal coat to surface course and asphalt curbs in accordance with AI MS-19.

3.08 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.
- C. Variation from True Elevation: Within 1/2 inch.

3.09 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements, for general requirements for quality control.
- B. Provide field inspection and testing. Take samples and perform tests in accordance with AI MS-2.

END OF SECTION

SECTION 32.13.13 - CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete sidewalks, stair steps, integral curbs, gutters, median barriers, parking areas, and roads.

1.02 RELATED REQUIREMENTS

- A. Section 31.22.00 - Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.
- B. Section 31.23.23 - Fill: Compacted subbase for paving.
- C. Section 32.11.23 - Aggregate Base.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).
- B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2005.
- C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
- D. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 1999.
- E. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 1988 (Reapproved 2002).
- F. ASTM A 185/A 185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- G. ASTM A 497/A 497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.
- H. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2007.
- I. ASTM C 33 - Standard Specification for Concrete Aggregates; 2007.
- J. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2005.
- K. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete; 2007.
- L. ASTM C 150 - Standard Specification for Portland Cement; 2007.
- M. ASTM C 173/C 173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2008a.
- N. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete; 2006.
- O. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2007.
- P. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete; 2008a.
- Q. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2008a.
- R. ASTM C 685/C 685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2007.

- S. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (non-extruding and Resilient Bituminous Types); 2004 (Reapproved 2008).
- T. ASTM D 1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2004a (Reapproved 2008).

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on joint filler, admixtures, and curing compound.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Form Materials: Conform to ACI 301.
- B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D 1751) or sponge rubber or cork (ASTM D 1752).
 - 1. Thickness: 1/2 inch.

2.02 REINFORCEMENT

- A. Reinforcing Steel and Welded Wire Reinforcement: Types specified on plans.

2.03 CONCRETE MATERIALS

- A. Concrete Materials: As specified in Section 03.30.00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

- A. See Section 32.11.23 for construction of base course for work of this Section.

3.03 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.

3.04 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT

- A. Place reinforcement at midheight of slabs-on-grade.
- B. Interrupt reinforcement at contraction joints.
- C. Place dowels to achieve pavement and curb alignment as detailed.

3.06 COLD AND HOT WEATHER CONCRETING

- A. Follow recommendations of ACI 305R when concreting during hot weather.

- B. Follow recommendations of ACI 306R when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.07 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.08 JOINTS

- A. Align curb, gutter, and sidewalk joints.
- B. Place 3/8 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.
- C. Provide keyed joints as indicated.

3.09 FINISHING

- A. Area Paving: Light broom, texture perpendicular to pavement direction.
- B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.
- C. Curbs and Gutters: Light broom, texture parallel to pavement direction.

3.10 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01.40.00.
 - 1. Provide free access to concrete operations at project site and cooperate with appointed firm.
 - 2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
 - 3. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- B. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.
 - 1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

3.11 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION

SECTION 32.92.19
SEEDING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preparation of subsoil.
- B. Placing topsoil.
- C. Seeding, mulching and fertilizer.
- D. Maintenance.

1.02 RELATED REQUIREMENTS

- A. Section 31.22.00 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.
- B. Section 31.23.23 - Fill: Topsoil material.

1.03 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.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Topsoil samples.
- C. Certificate: Certify seed mixture approval by authority having jurisdiction.
- D. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer; and _____.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.

2.02 SEED MIXTURE

- A. Seed Mixture:
 - 1. Kentucky Blue Grass: 100 percent.

2.03 SOIL MATERIALS

- A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0.

2.04 ACCESSORIES

- A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
- B. Fertilizer: Recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated by analysis.

- C. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.
- D. Erosion Fabric: Jute matting, open weave.
- E. Stakes: Softwood lumber, chisel pointed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this Section.

3.02 PREPARATION

- A. Prepare subgrade in accordance with Section 31.22.00.
- B. Place topsoil in accordance with Section 31.22.00.

3.03 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after smooth raking of topsoil and prior to roller compaction.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.04 SEEDING

- A. Apply seed at a rate of 5 lbs per 1000 sq ft evenly in two intersecting directions. Rake in lightly.
- 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 during windy periods.
- D. Immediately following seeding and compacting, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.
- E. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.
- F. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.05 PROTECTION

- A. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.
- B. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Provide 12 inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.
- C. Secure outside edges and overlaps at 36 inch intervals with stakes.
- D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.06 MAINTENANCE

- A. Provide maintenance at no extra cost to Owner; Owner will pay for water.
- B. See Section 01.70.00 - Execution Requirements, for additional requirements relating to maintenance service.
- C. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.
- D. Neatly trim edges and hand clip where necessary.
- E. Immediately remove clippings after mowing and trimming.

- F. Water to prevent grass and soil from drying out.
- G. Roll surface to remove minor depressions or irregularities.
- H. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.
Remedy damage resulting from improper use of herbicides.
- I. Immediately reseed areas that show bare spots.
- J. Protect seeded areas with warning signs during maintenance period.

END OF SECTION

SECTION 33.11.16 - UNDERGROUND POTABLE WATER/FIRE PROTECTION WATER

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Ductile iron piping systems (3 inches and larger) for underground potable water/fire protection water service fed from public water system with 140 degree f design temperature and 150 psig design pressure.
- B. Copper piping systems (2 inches and smaller) for underground potable water service fed from public water system with 140 degree f design temperature and 150 psi design pressure.

1.02 RELATED REQUIREMENTS

- A. Section 31 20 00, Earthmoving.

1.03 REFERENCES

National Codes and Standards incorporated by reference in this specification shall be by revision number/date in effect at the time this specification is invoked, unless otherwise noted.

- A. ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings.
- B. ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- C. ASME B16.21, Nonmetallic Flat Gaskets for Pipe Flanges.
- D. ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- E. ASTM A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
- F. ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
- G. ASTM A563, Standard Specification for Carbon and Alloy Steel Nuts.
- H. ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
- I. ASTM B88, Standard Specification for Seamless Copper Water Tube.
- J. ASTM D2000, Standard Classification System for Rubber Products in Automotive Applications.
- K. AWWA C104/A21.4, Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
- L. AWWA C110/A21.10, Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water.
- M. AWWA C111/A21.11, Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
- N. AWWA C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast, for Water.
- O. ANSI/AWWA C210, AWWA Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
- P. AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.
- Q. NFPA 24-10, Private Fire Service Mains.

- R. International Plumbing Code, International Code Council (2012).
- S. ANSI/NSF Standard 61, Drinking Water System Components – Health Effects.

1.04 SUBMITTALS

- A. When Alternate joint restraints are used, submit for approval (prior to use) the manufacturer's installation instructions and engineering guide for the alternate joint restraints. Include in the submittals calculations supporting the use of alternate joint restraints.
- B. Test records for each piping system prepared during pressure/leak testing, indicating date of test, identification of piping system tested, test media, test pressure, length of time pressure test held, and certification of results.
- C. Certificate of Compliance for NRTL and NSF properties.

PART 2 PRODUCTS

2.01 MATERIALS

- A. For underground potable water/fire protection water systems (3 inches and larger), use materials selected from list below (except where specified otherwise). Use materials and components that are tested and listed for fire protection service by an OSHA recognized Nationally Recognized Testing Laboratory (NRTL) or approved in writing by the Engineer. All products in contact with potable water shall comply with ANSI/NSF Standard 61. Components listed as "Not for use in America" shall not be used. Components (i.e. Pipe, fittings, valves, etc.) shall be procured with all required accessories (i.e. Glands, gaskets, hardware, etc.). Accessories purchased separately shall be certified compatible by component manufacturer.
- B. For underground potable water systems (2 inches and smaller), use materials selected from list below (except where specified otherwise). All products in contact with potable water shall comply with ANSI/NSF Standard 61. Components (i.e. Tubing, fittings, valves, etc.) shall be procured with all required accessories. Accessories purchased separately shall be certified compatible by component manufacturer.
- C. Pipe (3 in. to 12 in.): ductile iron, AWWA C151/A21.51, Grade 60-42-10, Pressure Class 350; mechanical joint, AWWA C111/A21.11; cement-lined and bituminous seal-coated inside and outside, AWWA C104/A21.4.
- D. Pipe (14 in. to 24 in.): ductile iron, AWWA C151/A21.51, Grade 60-42-10, Pressure Class 25; mechanical joint, AWWA C111/A21.11; cement-lined and bituminous seal-coated inside and outside, AWWA C104/A21.4.
- E. Fittings (3 in. to 12 in.): ductile iron, AWWA C110/A21.10, 70/50 strength; mechanical joint, AWWA C111/A21.11; 250-psig working pressure; cement-lined and bituminous seal-coated inside and outside, AWWA C104/A21.4.
- F. Fittings (14 in. to 24 in.): ductile iron, AWWA C110/A21.10, 70/50 strength; mechanical joint, AWWA C111/A21.11; 150-psig working pressure, cement-lined and bituminous seal-coated inside and outside, AWWA C104/A21.4.
- G. Gaskets (mechanical joint): nonasbestos, vulcanized natural rubber AWWA C111/A21.11, James B. Clow & Sons Incorporated Figure F-915.
- H. Gaskets: nonasbestos, red rubber sheet, ASTM D2000 M2AA 507 A13, 1/16 in. thick, full face, ASME B16.21; SEPCO Style 20.

- I. Bolts (mechanical joint): cast iron, tee head, high strength, heat treated.
- J. Nuts (mechanical joint): cast iron, mating hex, high strength, heat treated.
- K. Bolts: steel, heavy hex head, ASTM A307 Grade B.
- L. Nuts: steel, heavy hex, ASTM A563 Grade A or Grade B.
- M. Joint compound: Tyte Unyte, J.C. Whitlam Manufacturing Company or PTFE thread seal tape, SEPCO, SEPCO Tetracord II.
- N. Threaded Rods: steel, ASTM A307 Grade B or ASTM A108 with 1018 carbon cold rolled steel with minimum tension strength of 60,000 psi.
- O. Protective Coating: coal-tar epoxy, waterproofing, bitumen, AWWA C210, Carboline, Bitumastic 300M or PPG Coal Cat.
- P. Tubing (1 in. to 2 in. nominal): copper, UNS C12200, ASTM B88, Type K, Temper H, seamless, water tube, furnished straight.
- Q. Tube Fittings (1 in. to 2 in. nominal): copper, solder joint, ASME B16.22.
- R. Tube Fittings (1 in. to 2 in. nominal): brass, UNS C 83600, ASTM B62 solder joint, ASME B16.18.
- S. Soldering materials: see Section 400501.00.
- T. Indicator Posts (Yard): UL-approved tag, target indicating valve position set to display words "open" or "shut" in full view when valve is fully opened or closed, adjustable indicator, counterclockwise to open, 1 ¼ in. square wrench nut: to fit V-1103. V-6202, and V6406.
- U. Valve boxes (valves 3 in. and larger): cast iron, three-piece adjustable slip type, 5 ¼ in. shaft, lid marked "water".
- V. Curb Boxes (valves to 2 in.): cast iron, three-piece adjustable slip type, 5 ¼ in. shaft, lid marked "water".
- W. Fire Hydrants: UL-listed per AWWA, 175 psig working pressure, 300 psig test pressure, frostproof, compression-type valve, 6 in. mechanical joint inlet, 5 ¼ in. valve opening, two 2 ½ in. hose nozzels, 4 ¼ in. steamer connection with national standard fire hose threads, counterclockwise to open, pentagon-shaped operating nut with 1 ½ in. point to flat, Mueller Company Super 200 Centurion No. A-423.
- X. Tapping Sleeves: ductile iron or cast iron, mechanical joint, AWWA C111/A21.11, flanged outlet, ASME B16.1 Class 125, 200 psig maximum working pressure, plain end gaskets or duck tipped end gaskets, suitable for use with AWWA C151 pipe; Mueller Company No. H-616 or H-615.
- Y. Alternate Joint Restraint: Upon Engineer approval, mechanical type joint restraint systems that are approved by the engineer may be used in lieu of concrete thrust blocks. Joint restraint system shall be compatible with the specific pipe material and fitting requirements shown on the drawings contained within this package. Joint restraint system shall be rated for a min. 250 psig pressure.
- Z. Cut in Sleeves: ductile iron, 200 psig maximum working pressure, plain rubber end gaskets or duck-tipped end gaskets, spigot end corresponding to pipe; Mueller Company No. H-840 or No. H-841.
- AA. Solid Sleeve: Mechanical joint long pattern.
- BB. Air Vent Valve: ¾ in., ball-float type, 150-psig working pressure. (Suggested Manufacturer: Valmatic).
- CC. Valves:

Shutoff for Potable Water/Fire Protection Water Lines

Service	Size:	Number:	End Type:
Gate	4 to 12	V-6406 (tapping line valve for indicator post)	Flange and Mech. unit
Gate	3 to 14	V-1103 (line valve for indicator post)	Mechanical Joint
Gate	4 to 14	V-6202 (line valve for indicator post)	Hub
Gate	3 to 24 Hub	V-844	
Gate	3 to 24	V-1102 (line valve)	Mechanical Joint
Butterfly	3 to 24	V-6431	Flanged
Butterfly	3 to 24	V-6403 (line valve)	Mechanical Joint
Check(swing)	3 to 12	V-6432	Flanged (Flat Face)

Shutoff for Potable Water Lines

Service	Size:	Number:	End Type:
Corporation Stop	½ to 2	V-415	Thread Inlet Outlet
Curb Stop w/Drain	¾ to 2	V-6151	Screwed
Curb Stop w/Drain	¾ to 2	V-6402	Flared

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install underground potable water/fire protection water piping systems per AWWA C600 and NFPA 24.
- B. Install underground potable water piping systems per AWWA C600 and International Plumbing Code.
- C. Provide hub end valves for replacement of only hub end valves in existing systems.

- D. Provide flat-face flanges for connections to Valves V-6404(Flanged Ends), V-6431, and 6432.
- E. Cover underground piping a minimum of 3 ft. to top of pipe(except where specified otherwise). Provide sleeves on underground pipe passing under roads or railroads. At points where lines cross, maintain clearance of 1 ft. between outside surfaces of lines except where specified otherwise.
- F. Anchor hydrants, tees, plugs, caps, and bends in ductile iron lines by rodding in accordance with the design drawings. Provide anchors with concrete thrust blocks per NFPA 24 in accordance with the design drawings.
- G. Alternate Joint Restraint Installation: Based on Engineer approval and manufacturer's recommendation for buried pipe restraint lengths. Installation will be in accordance with the manufacturer's installation instructions, and substitution of alternate joint restraints for thrust blocks will be in accordance with the manufacturer's engineering guide. The manufacturer's installation instructions and engineering guide shall be submitted for Approval (include in the submittal calculations supporting the use of alternate joint restraints).
- H. Paint valve box covers with two coats of traffic yellow paint for visibility. Locate valve boxes in grassed or graveled areas if possible. Surround valve boxes with a ring of reinforced concrete 22 in. in diameter and 6" thick. Install top of concrete and valve box level with grade.
- I. Make solder-type joints per International Plumbing Code.
- J. For hydrant to be installed with mechanical joint pipe, provide hydrant with mechanical joint inlet connection complete with joint accessories.
- K. Apply protective coating to external surface of underground fittings, valves, anchor rods, bolts, nuts, and piping not already coated.
- L. Trenching: Section 312000.
- M. Maintain joints in exposed condition until completion of pressure/leak test.

3.02 FIELD QUALITY CONTROL

- A. Test system conveying potable water with dedicated and controlled test equipment that is used only on systems conveying potable water. Equipment includes pumps, pressure gages, hoses, pipes, caps, and other test equipment that contacts potable water.
- B. Notify the Engineer a minimum of 24 hours prior to witnessing performance testing and removal of the test media.
- C. Perform hydrostatic pressure/leak test on newly installed underground lines as follows:
 - 1. Test Pressure: 225 psig.
 - 2. Maintain test pressure for 2 hours.
- D. Perform hydrostatic pressure/leak test on tapping sleeves and tapping valves before tapping into existing underground mains as follows:
 - 1. Test pressure: 225 psig.
 - 2. Maintain test pressure for 2 hours.
 - 3. Provide coupon removed by tapping machine to engineer who witnesses test.

- E. Measure amount of leakage at test pressure by pumping from a calibrated container. Maximum allowable leakage rate: no detectable leakage.
- F. Submit test records for each piping system.

3.03 CLEANING

- A. Cleanness Class shall be Class D.
- B. Clean underground potable water/fire protection water lines per NFPA 24.
- C. Clean underground potable water lines by flushing with water at the system pressure and flow rate for a sufficient time to ensure thorough cleaning as evidenced by clear water discharge.
- D. Notify engineer minimum 72 hours prior to flushing.
- E. Disposal: Dispose of cleaning media per requirements of applicable state and federal regulations.
- F. Disinfect all underground water lines within this specification section per TDEC requirements.

END SECTION

SECTION 33.31.00 - SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Sanitary sewer pipe and fittings.
2. Connection to existing manholes.
3. Wye branches and tees.
4. Sanitary laterals.

1.02 RELATED REQUIREMENTS

A. 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 C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
4. ASTM C425 – Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
5. ASTM C443 – Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
6. ASTM C564 – Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
7. ASTM C923 – Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
8. ASTM C1479 – Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations.
9. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
10. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
11. ASTM D2564 – Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems.
12. ASTM D2729 - Standard Specification for Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.
13. ASTM D2751 – Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
14. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings.
15. ASTM D3034 – Standard Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.
16. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Jointing Plastic Pipe.

B. American Water Works Association:

1. AWWA C110 – American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. Through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
2. AWWA C111 – American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C153 – American National Standard for Ductile-Iron Compact Fittings for Water Service.
4. AWWA C600 – Installation of Ductile-Iron Water Mains and Their Appurtenances.

1.03 SUBMITTALS

- A. Section 01.33.00 – Submittal Procedures: Requirements for Submittals.
- B. Permits: Submit copies of construction permits obtained for this Work.
- C. Product Data: Submit catalog cuts and other pertinent data indicating proposed materials, accessories, details, and construction information.
- D. Submit reports indicating field tests made and results obtained.
- E. Manufacturer's installation instructions:
 1. Indicate special procedures required to install Products specified.
 2. Submit detailed description of procedures for connecting new sewer to existing sewer line and directional drilling, or pip jacking installation.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

- A. Section 01.70.00 – Execution and Closeout Requirements: Requirements for Submittals
- B. Project Record Documents: Record Location of pipe runs, connections, manholes, cleanouts, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with TDOT Standard Specifications.
- B. Maintain one copy of document on site.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum 3 years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Section 01.60.00 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver and store valves in shipping containers with labeling in place.
- C. Block individual and stockpiled pipe lengths to prevent moving.
- D. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.

- E. Do not place pipe flat on ground. Cradle to prevent point stress.
- F. Store UV sensitive materials out of direct sunlight.

1.08 FIELD MEASUREMENTS

- A. Verify field measurements and elevations are as indicated.

1.09 COORDINATION

- A. Section 01.30.00 – Administrative Requirements: Requirements for coordination.
- B. Coordinate Work with local sewerage authority. Convene pre-installation meeting minimum of one week prior to starting Work of this Section.
- C. Notify affected utility companies minimum of 72 hours prior to construction.

PART 2 PRODUCTS

2.01 SANITARY SEWER PIPE AND FITTINGS

- A. PVC Flexible Joint Plastic Pipe: ASTM D3034, Type PSM, Poly Vinyl Chloride (PVC) material; bell and spigot style rubber ring sealed gasket joint.
 - 1. Pipe Class: SDR 26.
 - 2. Fittings: PVC conforming to pipe specifications.
 - 3. Joints: ASTM D3212, elastomeric gaskets.
- B. Ductile Iron Gravity Sewer Pipe: ANSI/AWWA C150, bell and spigot ends. Conforming to ASTM A-377.
 - 1. Pipe Class: 8" through 12" pressure class 350 psi, 14" and larger class 250 psi.
 - 2. Fittings: Ductile Iron, AWWA C110. Compact fittings, AWWA C153.
 - 3. Joints: Rubber gaskets per AWWA C111.

2.02 FLEXIBLE PIPE BOOT FOR MANHOLE PIPE ENTRANCES

- A. Furnish materials in accordance with authority having jurisdiction.
- B. Flexible Pipe Boot: ASTM C923, ethylene propylene rubber (EPDM), Series 300 stainless steel clamp and stainless steel hardware.

2.03 MANHOLES

- A. Manholes: Precast Concrete Manholes as indicated on Drawings; cover inscribed with "SANITARY SEWER" or as directed by utility.

2.04 CONCRETE AND GROUT

- A. Concrete: Class A Concrete conforming to TDOT standard specifications.
 - 1. Compressive strength of 3,000 psi at 28 days.
 - 2. Air Entrained.
 - 3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
 - 4. Maximum slump of 3.5 inch for vibrated concrete and 4 inch for non-vibrated concrete.
 - 5. Minimum cement content of 564 pounds per cubic yard for vibrated concrete and 602 pounds per cubic yard for non-vibrated concrete.

- B. Grout: Non-shrink, non-metallic in accordance with TDOT standard specifications with a compressive strength of at least 5,000 psi at 3 days.

2.05 BEDDING and COVER MATERIALS

- A. General: Conform to Section 31.23.17 for bedding and backfill around and on top of pipe.
- B. Bedding for Rigid Pipe (DIP and RCP): Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SP, SP-SM, or SP-SC.
- C. Bedding for Flexible Pipe (PVC, ABS): Clean course aggregate Gradation No. 57 conforming to TDOT Standard Specifications.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Section 01.30.00 – Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify existing sanitary sewer utility main size, location, and inverts are as indicated on Drawings.

3.02 EXCAVATION AND BEDDING

- A. Excavate pipe trench in accordance with Section 31.23.17.
- B. Excavate to lines and grades shown on Drawings or required to accommodate installation of encasement.
- C. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.
- D. Provide sheeting and shoring in accordance with Section 31.23.17.
- E. Place bedding material at trench bottom, level continuous layer not exceeding 8-inch compacted depth; compact to 95 percent per section 31.23.17.

3.03 INSTALLATION – PIPE

- A. Install in accordance with manufacturers instructions and as indicated on the Drawings.
- B. Install plastic pipe, fittings, and accessories in accordance with ASTM D2321.
- C. Install VCP, fittings, and accessories in accordance with ASTM C12.
- D. Install RCP, fittings, and accessories in accordance with ASTM1479.
- E. Install CIP and DIP, fittings, and accessories in accordance with applicable portions of AWWA C600.
- F. Seal joints watertight.
- G. Lay pipe to slope gradients indicated on Drawings with maximum variation from indicated slope of 1/8 inch in 10 feet. Begin at downstream end and progress upstream.
- H. Ensure entire pipe is supported by bedding.
- I. Assemble and handle pipe in accordance with manufacturer's instructions except as modified by the Drawings or by Engineer.
- J. Keep pipe and fittings clean until work is completed and accepted by Engineer. Cap open ends during periods of work stoppage.
- K. Lay bell and spigot pipe with bells upstream.

- L. Connect pipe to existing sewer system as indicated on Drawings at existing manhole or using doghouse manhole connection.
- M. Place haunching material, rod, and tamp to eliminate voids.

3.04 CONNECTION TO EXISTING MANHOLE

- A. Core drill existing manhole to clean opening. Using pneumatic hammers, chipping guns, and sledge hammers is not permitted.
- B. Install watertight neoprene gasket and seal with non-shrink concrete grout.
- C. Concrete encase new sewer pipe minimum of 24 inches to nearest pipe joint, Use epoxy binder between new and existing concrete.
- D. Prevent construction debris from entering existing sewer line when making connection.

3.05 MANHOLE INSTALLATION

- A. Install manhole at locations indicated on Drawings. Install manholes plumb and true.

3.06 INSTALLATION – WYE BRANCHES AND TEES

- A. Install wye branches or pipe tees at locations indicated on Drawings concurrent with pipe laying operations. Use standard fittings of same material and joint type as sewer main.
- B. Maintain minimum 5 feet separation distance between wye connection and manhole.
- C. Use saddle wye or tee with stainless steel clamps for taps into existing piping. Mount saddles with solvent cement or gasket and secure with metal bands. Layout holes with template and cut holes with mechanical cutter.

3.07 INSTALLATION – SANITARY LATERALS

- A. Construct laterals from wye branch to terminal point at right-of-way or as indicated on Drawings.
- B. Where depth of main pipeline warrants, construct riser type laterals from wye branch.
- C. Maintain 3-foot minimum depth of cover over pipe.
- D. Maintain minimum 5-foot separation distance between laterals.
- E. Install watertight plug, braced to withstand pipeline test pressure thrust, at termination of lateral. Install temporary marker stake extending from end of lateral to 24 inches above finished grade. Paint top 6 inches of stake with fluorescent orange paint.

3.08 BACKFILLING

- A. Backfill around sides and to top of pipe in accordance with Section 31.23.17.
- B. Maintain optimum moisture content of backfill material to attain required compaction density.

3.09 FIELD QUALITY CONTROL

- A. Section 01.40.00 – Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Request inspection prior to and immediately after placing bedding.
- C. Perform test on sanitary sewage system in accordance with local code. Perform the following tests:
 - 1. Gravity Sewer Testing:
 - a. Low pressure air test.
 - b. Infiltration test

2. Deflection Testing of Plastic Piping.
 3. Manhole testing: Vacuum test
 4. Notify Engineer and Owner 72 hours in advance of test and have witness test.
- D. Compaction Testing: in accordance with Section 31.23.17.
- E. When tests indicate Work does not meet specified requirements, remove work, replace, and retest.

3.10 PROTECTION OF FINISHED WORK

- A. Section 01.70.00 – Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33.41.00
SUBDRAINAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Building Perimeter and Retaining Wall Drainage Systems.
- B. Filter aggregate and fabric and bedding.

1.02 RELATED REQUIREMENTS

- A. Section 31.05.19 - Geosynthetics for Earthwork.
- B. Section 31.23.16 - Excavation: Excavating for subdrainage system piping and surrounding filter aggregate.
- C. Section 31.23.18 - Trenching: Excavating and backfilling for site subdrainage systems.
- D. Section 31.23.23 - Fill: Backfilling over filter aggregate, up to subgrade elevation.

1.03 REFERENCE STANDARDS

- A. ASTM D1603 - Standard Test Method for Carbon Black Content in Olefin Plastics; 2020.
- B. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2017.
- C. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus; 2014.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe drainage products, pipe accessories, and filter fabric.
- C. Shop Drawings: Indicate dimensions, layout of piping, high and low points of pipe inverts, gradient of slope between corners and intersections, and details at fittings.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Project Record Documents: Record location of pipe runs, connections, cleanouts and principal invert elevations.

PART 2 PRODUCTS

2.01 PIPE MATERIALS

- A. Corrugated Plastic Tubing: Flexible type; 4 inch diameter, with required fittings.
- B. Use perforated pipe at subdrainage system; unperforated through sleeved walls.

2.02 AGGREGATE AND BEDDING

- A. Filter Aggregate and Bedding Material: Granular fill as specified in Section 31.23.23.

2.03 ACCESSORIES

- A. Pipe Couplings: Solid plastic.
- B. Geotextile Fabric: As specified in Section 31.05.19.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

3.02 PREPARATION

- A. Hand trim excavations to required elevations. Correct over-excavation with _____.

- B. Remove large stones or other hard matter that could damage drainage piping or impede consistent backfilling or compaction.

3.03 INSTALLATION

- A. Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.
- B. Place drainage pipe on clean cut subsoil.
- C. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- D. Loosely butt pipe ends. Place joint cover strip 12 inches wide, around pipe diameter centered over joint.
- E. Place pipe with perforations facing down. Mechanically join pipe ends.
- F. Install pipe couplings.
- G. Install filter aggregate at sides, over joint covers and top of pipe. Provide top cover compacted thickness of 12 inches.
- H. Place filter fabric over levelled top surface of aggregate cover prior to subsequent backfilling operations.
- I. Place aggregate in maximum 4 inch lifts, consolidating each lift.
- J. Refer to Section 31.23.23 for compaction requirements. Do not displace or damage pipe when compacting.
- K. Place impervious fill over drainage pipe aggregate cover and compact.
- L. Connect to storm sewer system with unperforated pipe, through installed sleeves.
- M. Coordinate the Work with connection to municipal sewer utility service, and trenching.

3.04 FIELD QUALITY CONTROL

- A. Section 01.40.00 - Quality Requirements: Field inspection and testing.
- B. Request inspection prior to and immediately after placing aggregate cover over pipe.

3.05 PROTECTION

- A. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION

SECTION 33.41.11 - SITE STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Storm drainage piping, fittings, and accessories.
- B. Connection of drainage system to municipal sewers.
- C. Catch basins, Plant area drains, Paved area drainage, Site surface drainage, and Detention basin.

1.02 RELATED REQUIREMENTS

- A. Section 31.23.16 - Excavation.
- B. Section 31.23.23 - Fill: Bedding and backfilling.

1.03 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 REFERENCE STANDARDS

- A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains; American Association of State Highway and Transportation Officials; 2003.
- B. ASTM A 74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2006.
- C. ASTM C 12 - Standard Practice for Installing Vitrified Clay Pipe Lines; 2008.
- D. ASTM C 14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe; 2007.
- E. ASTM C 14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe [Metric]; 2007.
- F. ASTM C 76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2008.
- G. ASTM C 76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe [Metric]; 2008a.
- H. ASTM C 425 - Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings; 2004 (Reapproved 2009).
- I. ASTM C 443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2005a.
- J. ASTM C 443M - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric); 2007.
- K. ASTM C 564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2003a.
- L. ASTM C 700 - Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated; 2007a.
- M. ASTM D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2006.

- N. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2008.
- O. ASTM D 2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2003.
- P. ASTM D 2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings; 2005.
- Q. ASTM D 3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2006.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating pipe, pipe accessories, storm inlets, and construction castings.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Project Record Documents:
 - 1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this section.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Concrete Pipe Joint Devices: ASTM C 443 (ASTM C 443M) rubber compression gasket joint.
- B. Concrete Pipe: Reinforced, ASTM C 76 (ASTM C 76M), Class II with Wall type A; mesh reinforcement; inside nominal diameter as indicated on plans, bell and spigot end joints.
- C. Reinforced Concrete Pipe Joint Device: ASTM C 443 (ASTM C 443M) rubber compression gasket joint.
- D. Plastic Pipe: Poly Vinyl Chloride (PVC) material; inside nominal diameter as indicated on plans, bell and spigot style solvent sealed joint end.
- E. Plastic Pipe: ASTM D 1785, Schedule 40, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter indicated on plans, bell and spigot style solvent sealed joint end.

2.02 PIPE ACCESSORIES

- A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.
- B. Filter Fabric: Non-biodegradable, non woven.

2.03 CATCH BASIN, CLEANOUT, AND AREA DRAIN COMPONENTS

- A. Lids and Drain Covers: Cast iron, hinged to cast iron frame.
 - 1. Catch Basin:

- a. Lid Design: Linear grill.
 - b. Nominal Lid and Frame Size: 26 inches diameter.
- 2. Cleanout:
 - a. Lid Design: Linear grill.
 - b. Nominal Lid and Frame Size: 6 inches diameter.
- 3. Area Drain:
 - a. Lid Design: Linear grill.
 - b. Nominal Lid and Frame Size: see plans.
- B. Shaft Construction and Concentric Cone Top Section: Reinforced precast concrete pipe sections, lipped male/female dry joints.
- C. Base Pad: Cast-in-place concrete of type specified in Section 03.30.00, leveled top surface to receive concrete shaft sections, sleeved to receive sanitary sewer pipe sections.

2.04 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31.23.16.
- B. Cover: As specified in Section 31.23.16.

PART 3 EXECUTION

3.01 TRENCHING

- A. See Section 31.23.16 for additional requirements.
- B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
 - 1. Plastic Pipe: Also comply with ASTM D 2321.
- B. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- C. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.

3.03 INSTALLATION - CATCH BASINS AND CLEANOUTS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.
- C. Establish elevations and pipe inverts for inlets and outlets as indicated.
- D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01.40.00.

3.05 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33.42.13 - PIPE CULVERTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe culvert, joints and accessories.
- B. Bedding and slope protection at pipe end.

1.02 RELATED REQUIREMENTS

- A. Section 31.23.18 – Trenching.
- B. Section 31.23.23 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

- A. ASTM A 929/A 929M - Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe; 2001 (Reapproved 2007).
- B. ASTM C 14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe; 2007.
- C. ASTM C 14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe [Metric]; 2007.
- D. ASTM C 76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2008.
- E. ASTM C 76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric); 2008a.
- F. ASTM C 443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2005a.
- G. ASTM C 443M - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric); 2007.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe, fittings and accessories.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the work of this section.

PART 2 PRODUCTS

2.01 HIGH DENSITY POLYETHYLENE CORRUGATED PLASTIC PIPE

- A. HDPE Pipe: Hancor or ADS double wall, smooth internal bore:
- B. Joints: Bell and spigot joints with gasketed joints.

2.02 CONCRETE CULVERT PIPE

- A. Concrete Pipe: Reinforced, ASTM C 76 (ASTM C 76M), Class I with Wall Type A; mesh reinforcement; bell and spigot end joints:
 - 1. Shape: Circular with a nominal diameter as indicated on the project plans.

2.03 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31.23.16.
- B. Cover: As specified in Section 31.23.16.

2.04 ACCESSORIES

- A. Filter Fabric: Non-biodegradable, non-woven.
- B. Fill at Pipe Ends: Riprap as indicated on the project plans.

PART 3 EXECUTION

3.01 EXCAVATING

- A. See Section 31.23.16 for additional requirements.
- B. Excavate culvert trench to 12 inches below pipe invert. Hand trim excavation for accurate placement of pipe to elevations indicated.

3.02 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Install pipe and accessories in accordance with manufacturer's instructions
- C. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.
- D. Shore pipe to required position; retain in place until after compaction of adjacent fills. Ensure pipe remains in correct position and to required slope.
- E. Repair surface damage to pipe protective coating with two coats of compatible bituminous paint coating.
- F. Install culvert end gratings.

3.03 PIPE ENDS

- A. Place fill at pipe ends, at embankment slopes.

3.04 TOLERANCES

- A. Lay pipe to alignment and slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- B. Maximum Variation From Intended Elevation of Culvert Invert: 1/2 inch.
- C. Maximum Offset of Pipe From True Alignment: 1 inch.
- D. Maximum Variation in Profile of Structure From Intended Position: 1 percent.

3.05 PROTECTION

- A. Protect pipe and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 00 21 13 - INSTRUCTIONS TO BIDDERS

SUMMARY

1.01 DOCUMENT INCLUDES

- A. Invitation
 - 1. Bid Submission
 - 2. Intent
 - 3. Work Identified in Contract Documents
 - 4. Contract Time
- B. Bid Documents and Contract Documents
 - 1. Definitions
 - 2. Contract Documents Identification
 - 3. Availability
 - 4. Examination
 - 5. Inquiries/Addenda
 - 6. Product/Assembly/System Substitutions
- C. Site Assessment
 - 1. Site Examination
 - 2. Prebid Conference
- D. Bid Submission
 - 1. Submission Procedure
 - 2. Bid Ineligibility
- E. Bid Enclosures/Requirements
 - 1. Performance Assurance
 - 2. Insurance
 - 3. Bid Form Requirements
 - 4. Bid Form Signature
 - 5. Additional Bid Information
 - 6. Selection and Award of Alternates
- F. Offer Acceptance/Rejection
 - 1. Duration of Offer
 - 2. Acceptance of Offer

1.02 RELATED DOCUMENTS

- A. Document 01 10 00 - Summary.
- B. Document 00 41 00 - Bid Form.
- C. Document 00 43 23 - Alternates Form.
- D. Document 00 43 25 - Substitution Request Form - During Procurement

INVITATION

2.01 INTENT

- A. The intent of this Bid request is to obtain an offer to perform work to complete Work located at KCDC's new Knoxville Head Start at Western Heights for a Stipulated Sum contract, in accordance with Contract Documents.

2.02 WORK IDENTIFIED IN THE CONTRACT DOCUMENTS

- A. Work of this proposed Contract comprises New Construction, including general construction and various trade Work.

BID DOCUMENTS AND CONTRACT DOCUMENTS

3.01 DEFINITIONS

- A. Bid Documents: Contract Documents supplemented with Invitation To Bid, Instructions to Bidders, Information Available to Bidders, Bid Form Supplements To Bid Forms and Appendices identified.
- B. Bid, Offer, or Bidding: Act of submitting an offer under seal.
- C. Bid Amount: Monetary sum identified by the Bidder in the Bid Form.

3.02 CONTRACT DOCUMENTS IDENTIFICATION

- A. Contract Documents are identified as Bid Number C22001, as prepared by Architect who is located at 550 West Main Street, Suite 300, Knoxville, TN 37902, and with contents as identified in the Table of Contents.

3.03 AVAILABILITY

- A. Bid Documents may be obtained online at the KCDC website.

3.04 EXAMINATION

- A. Upon receipt of Bid Documents verify that documents are complete. Notify Architect should the documents be incomplete.
- B. Immediately notify Procurement, procurementinfo@kcdc.org, upon finding discrepancies or omissions in the Bid Documents.

3.05 INQUIRIES/ADDENDA

- A. Direct questions to Procurement, procurementinfo@kcdc.org.
- B. Addenda may be issued during the bidding period. All Addenda become part of Contract Documents. Include resultant costs in the Bid Amount.
- C. Clarifications requested by bidders must be in writing not less than 5 days before date set for receipt of bids. The reply will be in the form of an Addendum, a copy of which will be posted to KCDC's webpage.

3.06 PRODUCT/ASSEMBLY/SYSTEM SUBSTITUTIONS

- A. Where the Bid Documents stipulate a particular product, substitutions will be considered up to 10 days before receipt of bids.
- B. Submit substitution requests by completing the form in Section 00 43 25 - Substitution Request Form - During Procurement; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- C. When a request to substitute a product is made, **Owner** may approve the substitution and will issue an Addendum to known bidders.
- D. The submission shall provide sufficient information to determine acceptability of such products.

- E. Provide complete information on required revisions to other work to accommodate each proposed substitution.
- F. Provide products as specified unless substitutions are submitted in this manner and accepted.
- G. See Section 01 60 00 - Product Requirements for additional requirements.

SITE ASSESSMENT

4.01 SITE EXAMINATION

- A. Examine the project site before submitting a bid.
- B. Refer to the cover sheet for times and dates that units will be made available for viewing by bidders.

QUALIFICATIONS

5.01 EVIDENCE OF QUALIFICATIONS

- A. To demonstrate qualification for performing the Work of this Contract, bidders may be requested to submit AIA A305.

5.02 SUBCONTRACTORS/SUPPLIERS/OTHERS

- A. Owner reserves the right to reject a proposed subcontractor for reasonable cause.
- B. Refer to General Conditions.

BID SUBMISSION

6.01 SUBMISSION PROCEDURE

- A. Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed.
- B. Improperly completed information, irregularities in security deposit, may be cause not to open the Bid Form envelope and declare the bid invalid or informal.

6.02 BID INELIGIBILITY

- A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, will be declared unacceptable.
- B. Bid Forms, Appendices, and enclosures that are improperly prepared may, will be declared unacceptable.

BID ENCLOSURES/REQUIREMENTS

7.01 PERFORMANCE ASSURANCE

- A. Include the cost of performance assurance bonds in the Bid Amount.

7.02 INSURANCE

- A. Check the appropriate box on Solicitation Document A stating their intention to provide insurance to the bidder in accordance with the insurance requirements of Contract Documents.

7.03 BID FORM REQUIREMENTS

- A. Complete all requested information in the Bid Form and Appendices.

7.04 ADDITIONAL BID INFORMATION

- A. Submit the following Supplements concurrent with bid submission:
 - 1. Solicitation Document A - General Information and Cost
 - 2. Document 00 43 25 - Substitution Request Form - During Procurement.

7.05 SELECTION AND AWARD OF ALTERNATES

- A. Indicate variation of bid price for Alternates listed on the Bid Form.
- B. Bids will be evaluated on the base bid price. After determination of a successful bidder, consideration will be given to Alternates and resulting bid price adjustments.

OFFER ACCEPTANCE/REJECTION

8.01 DURATION OF OFFER

- A. Bids shall remain open to acceptance and shall be irrevocable for a period of thirty (30) days after the bid closing date.

8.02 ACCEPTANCE OF OFFER

- A. Owner reserves the right to accept or reject any or all offers.
- B. After acceptance by Owner, a "Success Letter" will be issued. Upon review and acceptance of the Board of Commissioners, a formal contract will be issued.

END OF SECTION

Solicitation Document A: General Information about the Supplier**Note: Complete all cells even if the answer is “Does not apply”****Sign Your Name to the Right of the Arrow** 

If completing this document in Adobe, an electronic signature is acceptable to KCDC.

Your signature indicates you read and agree to “KCDC’s General Instructions to Suppliers” (www.kcdc.org) and that you are authorized to bind the supplier or are submitting the response on behalf of and at the direction of the suppliers’ representative authorized to contractually bind the supplier. I represent that the supplier or its applicable representative(s) has reviewed the information contained in this Solicitation Package and that the information submitted is accurate.

Printed Name and Title **Company Name** **Street Address** **City/State/Zip** **Contact Person (Please Print Clearly)** **Telephone Number** **Cell Number** **Supplier’s E-Mail Address (Please Print Clearly)** **Addenda**

Addenda are at www.kcdc.org. Click on “Procurement” and then on “Open Solicitations” to find addenda. Please check for addenda prior to submitting a proposal.

Acknowledge addenda have been issued by checking below as appropriate:None ☐ Addendum 1 ☐ Addendum 2 ☐ Addendum 3 ☐ Addendum 4 ☐ Addendum 5 ☐**Statistical Information (Check all the apply)****This business is at least 51% owned and operated by a woman**Yes ☐ No ☐**This business qualifies as a small business by the State of Tennessee**Yes ☐ No ☐*Total gross receipts of not more than \$10,000,000 average over a three-year period OR employs no more than 99 persons on a full-time basis***This business qualifies as a Section 3 business by defined herein**Yes ☐ No ☐**This business is owned & operated by persons at least 51% of the following ethnic background:**Asian/Pacific ☐ Black ☐ Hasidic Jew ☐ Hispanic ☐ Native American ☐ White ☐ Publicly Owned ☐**Prompt Payment Discount****A ____% prompt payment discount applies when KCDC makes payment in ____ days of accurate invoicing.****Insurance Statement****I have reviewed the insurance requirements and will comply with them without exception. Yes ☐ No ☐**

Solicitation Document B Bid Sheet

Pursuant to and in compliance with the solicitation documents, the supplier signing Solicitation Document A, having thoroughly examined the work to be performed, agrees to perform the work for the following total bid amount for the above referenced project. The prices quoted cover all the supplier's expenses including, but not limited to, overhead, profit, insurance, subcontractors, supplies and bonding. The cost offered here will be valid for a minimum of 30 days from the bid due date.

Complete all "blanks"-even if the amount is \$0.00

Do not change KCDC pricing schematics

Cost Information	
Total Project Cost	\$

Unit Prices		
Description	Cost	Unit of Measure
Unit Price 1: Undercut and off-site disposal of unsuitable soil in trenches and replace with crushed stone	\$	Cubic Yard
Unit Price 2: Undercut and off-site disposal of unsuitable soil in mass excavation and replace with compacted soil	\$	Cubic Yard
Unit Price 3: Removal and off-site disposal of trench rock	\$	Cubic Yard
Unit Price 4: Removal and disposal of mass rock	\$	Cubic Yard
Unit Price 5: Flowable fill	\$	Cubic Yard

Conflict of Interest:

1. No commissioner or officer of KCDC or other person whose duty it is to vote for, let out, overlook or in any manner superintend any of the work for KCDC has a known direct interest in the award or the supplier providing goods or services.
2. No employee, officer or agent of the grantee or sub-grantee will participate in selection, or in the award or administration of an award supported by federal funds if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when the employee, officer or agent, any member of his immediate family, his or her partner, or an organization, which employs, or is about to employ, any of the above, has a financial or other interest in the supplier selected for award.
3. The grantee's or sub-grantee's officers, employees or agents will neither solicit nor accept gratuities, favors or anything of monetary value from suppliers, potential suppliers, or parties to sub-agreements.
4. By submission of this form, the supplier is certifying that no conflicts of interest exist.

Drug Free Workplace Requirements:

5. Private employers with five or more employees desiring to contract for construction services attest that they have a drug free workplace program in effect in accordance with TCA 50-9-112.

Eligibility:

6. The supplier is eligible for employment on public contracts because no convictions or guilty pleas or pleas of nolo contendere to violations of the Sherman Anti-Trust Act, mail fraud or state criminal violations with an award from the State of Tennessee or any political subdivision thereof have occurred.

General:

7. Supplier fully understands the preparation and contents of the attached offer and of all pertinent circumstances respecting such offer.
8. Such offer is genuine and is not a sham offer.

Iran Divestment Act:

9. Concerning the Iran Divestment Act (TCA 12-12-101 et seq.), by submission of this bid/quote/quotes, each supplier and each person signing on behalf of any supplier certifies, and in the case of a joint bid/quote/quotes, each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief that each supplier is not on the list created pursuant to § 12-12-106.

Non-Collusion:

10. Neither the said supplier nor any of its officers, partners, KCDC, agents, representatives, employees or parties interest, including this affiant, has in any way colluded conspired, connived or agreed, directly or indirectly, with any other responder, supplier, or person to submit a collusive or sham offer in connection with the award or agreement for which the attached offer has been submitted or to refrain from making an offer in connection with such award or agreement, or collusion or communication or conference with any other supplier, or, to fix any overhead, profit, or cost element

of the offer price or the offer price of any other supplier, or to secure through any collusion, conspiracy, connivance, or unlawful agreement any advantage against KCDC or any person interested in the proposed award or agreement.

11. The price or prices quoted in the attached offer are fair, proper and not tainted by any collusion, conspiracy, connivance, or unlawful agreement on the part of the supplier or any of its agents, representatives, KCDC, employees, or parties in interest, including this affiant.






Accuracy of Electronic Copies:

12. If the supplier provides electronic copies of the bid/proposal/quote to KCDC, the supplier certifies that the information provided on paper and in the electronic format is identical unless specifically noted otherwise.

No Contact/No Advocacy Affidavit

13. After this solicitation is issued, any contact initiated by any supplier or proposer with any owner's representative concerning this proposal is strictly prohibited-except for communication with the Procurement Division. My signature signifies that no unauthorized contact occurred.
14. To ensure the integrity of the review and evaluation process, respondents to this solicitation nor any firm representing them, may not lobby or advocate to owner's staff or Board members. My signature signifies that no unauthorized advocacy occurred.

The undersigned hereby acknowledges receipt of these affidavits and certifies that the submittal in response to this solicitation is in full compliance with the listed requirements.

Signed by 	
Printed Name 	
Title 	
Subscribed and sworn to before me this date	
By (Notary Public) 	
My Commission Expires on 	
Notary Stamp	

Solicitation Document D Good Faith Compliance Affidavit

The supplier must demonstrate a good faith effort to utilize Minority Owned Businesses (MOB) and Woman Owned Businesses (WOB). To assist in this effort, KCDC posts the web links of organizations, which can provide suppliers with a list of minority and women owned businesses, on its web site. These lists are useful in preparing a response to this solicitation.

Place a checkmark in either Section One or Section Two of this form. Provide the information in Section One if you check that box.

Section One ☐ The following companies were asked for pricing for the attached bid. Provided the listed companies meet bid document requirements and their pricing is competitive, it is our intent to use the companies listed. Attached hereto or to be provided to KCDC within five calendar days of solicitation opening is our Form of Commitment/Statement of Effort (failure to submit the Form of Commitment/Statement of Effort may result in *rejection* of your bid

Company Name	Person	Product/Service	MOB	WOB

Section Two ☐ MOB/WOB's were not contacted because sub-suppliers/contractors will not be needed to complete the contract and all work will be completed by the supplier. Other MOB/WOB's not shown above, will be considered during the duration of the contract in the event the supplier decides additional subcontractors or supplier will be used (to complete all or part of the contract).

Signed by	
Print Name and Title	
Subscribed and Sworn to before me on this date	
By	
Notary Public (stamp/signature)	
My Commission Expires on	

Solicitation Document E: Form of Commitment: Minority Owned /Woman Owned Business

Place a checkmark in either Section One or Section Two of this form.

Section One Does not apply - MOB/WOB subcontractors will not be used. ☐ (Stop Here)

Section Two MOB/WOB Subcontractors will be used. ☐ (Complete this page)

I, _____ do certify the supplier has or will enter into a formal agreement with the MOB/WOB enterprise for work listed in this schedule.

Supplier Name	M O B	W O B	Contact Person	Type Supplies to be Provided	Type of Work to be Performed	Dollar Value of Supplies or Service

COMPLETE THE FOLLOWING BOXES IF BOX ABOVE WAS NOT COMPLETED

The following companies were listed on the Good Faith Compliance Affidavit submitted with my bid.

Company Name	Person	Product/Service	MOB	WOB

Explain why each of the above companies could not be used to provide the needed products or services.

Company Name	Reason

Above information submitted by _____

Printed/Typed Name and Title: _____

Appendix A: Insurance Requirements

1. INSURANCE

The Supplier shall maintain, at Supplier's sole expense, on a primary and non-contributory basis, at all times during the life of the contract insurance coverages, limits, and endorsements described herein. All insurance must be underwritten by insurers with an A.M. Best rating of A- : IX or better. Upon award, the Supplier shall provide Certificate(s) of Insurance and amendatory endorsements to KCDC evidencing said insurance coverages. See paragraph "g" for exact naming of certificate holders, additional insureds and mortgage interest.

The Supplier agrees the insurance requirements herein as well as KCDC's review or acknowledgement, is not intended to and shall not in any manner limit or qualify the liabilities and obligations assumed by the Supplier under this contract. KCDC's failure to require a Certificate of Insurance, acceptance of a non-conforming certificate, or allowing the Supplier to commence work shall not operate as a waiver of these minimum insurance requirements or the liabilities and obligations assumed by the Supplier under this contract.

- a. Commercial General Liability Insurance and Umbrella Liability Insurance: occurrence version general liability insurance including contractual liability with minimum limits of \$1,000,000 per occurrence and \$2,000,000 in the aggregate covering the following perils: bodily injury, personal injury, and broad form property damage including products/completed operations for one year after completion of the Project(s). Limits must apply separately to the work/location in this contract.

Umbrella Liability: Umbrella Liability Insurance with a minimum limit of \$5,000,000 per each occurrence and aggregate combined single limit for all liability with a \$10,000 self-insured retention for exposure not covered in underlying primary policies. The policy shall name the Commercial General Liability and Automobile Liability in its underlying schedule.

Such insurance shall contain or be endorsed to contain a provision that includes the Entities listed in paragraph "g" as additional insureds with respect to the Supplier's ongoing and completed operations, providing coverage at least as broad as CG 20 10 07 04 and 20 37 07 04 endorsements. The coverage shall contain no special limitations on the scope of its protection afforded to the listed insureds.

- b. Commercial Automobile Liability Insurance: in an amount not less than \$1,000,000 (combined single limit) for all owned, hired, and non-owned vehicles utilized by Supplier in connection with the Project. Coverage is to include coverage for loading and unloading hazards.

Such insurance shall contain or be endorsed to contain a provision that includes the Entities listed in paragraph "g" as additional insureds.

- c. Workers' Compensation Insurance and Employers' Liability Insurance: Workers' Compensation Insurance with statutory limits as required by the State of Tennessee or other applicable laws. Employers' Liability Insurance with a limit of not less than \$500,000.
- d. Pollution Liability Insurance: coverage, providing defense and indemnity coverage for bodily injury, property damage, and environmental investigation and clean-up costs for pollution conditions

arising from the Contractor's operations. Limit of liability not less than \$1,000,000 each occurrence and \$2,000,000 annual aggregate. The policy shall include a minimum three (3) year Discovery (tail) reporting period, and a Retroactive Date that equals or precedes the effective date of this contract or the performance of work hereunder. Coverage may be provided on a per project basis.

- e. Builder's Risk: coverage shall be written on an All-Risk, Replacement Cost, and Completed Value Form basis in an amount at least equal to one-hundred percent (100%) of the projected completed value of the Work, as well as subsequent modifications of that sum due to Change Order(s). Supplier agrees to be responsible for reporting increases in the projected completed value of the work due to Change Order(s).

Coverage shall insure *without limitation* against the perils of fire and extended coverage and physical loss or damage including, but not limited to, theft, vandalism, malicious mischief, collapse, windstorm, testing and startup, temporary buildings, portions of the work stored off site, all portions of the work in transit, debris removal including demolition occasioned by enforcement of any applicable legal requirements and shall cover reasonable compensation for Architect's and Supplier's services and expenses required as a result of such insured loss. Insurance is to cover all property of Supplier (and its subcontractors), Owner and all certificate holders as their interest may appear. Coverage shall cover the completed value of the construction including without limitation, slab on grade, excavations, foundations, caissons, tenant finish work, and retaining walls around the perimeter of the project. Any exclusion of so-called underground damage to pipes, collapse of structure, or damage resulting from explosion or blasting shall be deleted. Such policy shall provide that any loss thereunder shall be payable to the Supplier, Owner, and others as their interests may appear and shall also have a replacement cost endorsement.

Debris Removal shall be no less than \$250,000 for removal from a casualty loss and no less than \$10,000 for debris removal of pollutants.

Coverage shall include soft costs resulting from damage or destruction to insured property on-site and while in transit including flood, earthquake and earth movement when such perils are required. Such insurance shall cover continuing expenses not directly involved in the direct cost of construction/renovation, including expense incurred upon money borrowed to finance construction or repair, continuing interest on mortgage loans, advertising, promotion, realty taxes and other assessments, the cost to the insured of additional commissions incurred upon re-negotiating leases, loss of earnings and rents and other expenses incurred as a result of property loss or destruction by an insured peril.

f. Other Insurance Requirements:

1. Upon award, Supplier shall furnish KCDC with original Certificate(s) of Insurance and amendatory endorsements effecting coverage required by this section.
2. Provide a waiver of subrogation for each required policy herein. When required by the insurer, or should a policy condition not permit Supplier to enter into a pre-loss agreement to waive subrogation without an endorsement, the policy should be endorsed with a Waiver of Transfer of Rights of Recovery Against Others, or its equivalent.
This waiver of subrogation requirement shall not apply to any policy which includes a condition specifically prohibiting such an endorsement, or voids coverage should supplier enter into such an agreement on a pre-loss basis.

3. Not less than 30-days prior written cancellation notice and no less than 10-days for non-payment of premium for all insurances (by endorsement if necessary) is required.
4. Replace certificates, policies, and endorsements for any such insurance expiring prior to completion of services.
5. Maintain such insurance from the time services commence until services are completed or through such extended discovery/reporting/tail period as required. Failure to maintain or renew coverage or to provide evidence of renewal may be treated by KCDC as a material breach of contract.
6. Any deductibles and/or self-insured retentions greater than \$50,000 must be disclosed to and approved by KCDC prior to the commencement of services. Use of large deductibles and/or self-insured retentions will require proof of financial ability as determined by KCDC.
7. All policies must be written on an occurrence basis with the exception of Errors and Omissions Liability (E & O) / Professional Liability and Pollution Liability which may be claims made coverage.
8. Require all subcontractors to maintain during the term of the resulting contract commercial general liability insurance, automobile liability insurance, and workers' compensation insurance (unless subcontractor's employees are covered by Supplier's insurance) in the same manor and limits as specified for the Supplier.

g. Certificate Holders, Additional Insureds, and Mortgage Interests:

Knoxville's Housing Development Corporation
KCDC, its officials, officers, employees, and volunteers
901 N Broadway
Knoxville, TN 37917

Home Federal Bank of Tennessee
Attn: Jonathan W. Mayfield, Vice President
515 Market Street
Knoxville TN 37902

Any other lender, investor, interest as required.

- h. Right to Revise or Reject: KCDC reserves the right to revise any insurance requirement, including but not limited to, limits, coverages, and endorsements based on changes in scope of work/specifications, insurance market conditions affecting the availability or affordability of coverage.
- i. No Representation of Coverage Adequacy: The coverages, limits or endorsements required herein protect the primary interests of KCDC, and the Supplier agrees in no way should these coverages, limits or endorsements required be relied upon when assessing the extent or determining appropriate types and limits of coverage to protect the Supplier against any loss exposures, whether as a result of the project or otherwise.

All limits indicated are minimums required.

Certificate Holders & Additional Insureds	See paragraph "g" above
Mortgage Interest (see below)	Home Federal Bank of Tennessee
GL – including Contractual Liability (Supplier & Subcontractors)	\$1M / \$2M
Umbrella (Supplier)	\$5M
Auto (Supplier & Subcontractors)	\$1M (owned, hired, & non-owned)
WC (Supplier & Subcontractors)	Statutory limits
Employers' Liability (Supplier & Subcontractors)	\$500,000
Pollution (Supplier)	\$1M / \$2M with 3-year Discovery; with Retro Date at least equal to contract date
Builder's Risk (Supplier)	100% of projected completed value
30-day cancellation (Supplier & Subcontractors)	Required– must indicate on COI
Primary non-contributory (Supplier & Subcontractors)	Required – must indicate on COI
Waiver of Subrogation (Supplier & Subcontractors)	Required for all coverages – must indicate on COI

Solicitation Document F Envelope Coversheet

State Law requires certain State license information on the front of your bid envelope. You are responsible for providing the correct information on the envelope front but KCDC provided this form to guide you. Failure to supply this information may invalidate your bid.

Attach this completed page to the front of your bid envelope

Bid Due Date/Time	07-20-21 at 2:00 p.m..		
State of Tennessee License Holder Name			
State of Tennessee License Number			
Pertinent State of Tennessee License Classification			
State of Tennessee License Expiration Date			
Subcontractors to be used on this project (If subcontract work is not required, write "none required")			
Electrical Subcontractor Name on the State of Tennessee's License		State of Tennessee License Number	
State of Tennessee License Classification(s)		Expiration Date of State License	
HVAC Subcontractor Name on the State of Tennessee's License		State of Tennessee License Number	
State of Tennessee License Classification(s)		Expiration Date of State License	
Masonry Subcontractor Name on the State of Tennessee's License		State of Tennessee License Number	
State of Tennessee License Classification(s)		Expiration Date of State License	
Plumbing Subcontractor Name on the State of Tennessee's License		State of Tennessee License Number	
State of Tennessee License Classification(s)		Expiration Date of State License	

Advisements:

1. KCDC will not consider notes changing the bid written on the bid envelope.
2. For the listed subcontractor types above, you may only list one firm.
3. State requirement information is at <https://www.tn.gov/commerce/regboards/contractors.html>