PROJECT MANUAL
SPECIFICATIONS

OWNER:
MARTIN COUNTY SCHOOL DISTRICT

District Administrative Offices
New Boardroom Tenant Improvement
1939 S.E. Federal Highway, Stuart, Florida 34994

Construction Documents Permit

HJ COMM. NO: 17042.03

DATE OF ISSUE: July 12, 2021

HARVARD JOLLY, INC.
2047 VISTA PARKWAY, SUITE 100
WEST PALM BEACH, FLORIDA 33411
561-478-4457

HARVARD • JOLLY
ARCHITECTURE

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Martin County School District

District Administrative Offices
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ARCHITECT:

HARVARD JOLLY ARCHITECTURE

2047 Vista Parkway, Suite 100
West Palm Beach, Florida 33411
Phone: 561-478-4457

STRUCTURAL ENGINEERS:

MASTER CONSULTING ENGINEERS, INC.

5523 W. Cypress St., Suite 200
Tampa, Florida 33607
Phone: 813-287-3600

MECHANICAL/ELECTRICAL/PLUMBING/FIRE PROTECTION ENGINEERS:

JOHNSON, LEVINSON, RAGAN, DAVILA, INC.

1450 Centrepark Blvd., Suite 350
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Phone: 561-689-2303

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SECTION 01 25 13
PRODUCT SUBSTITUTION PROCEDURES

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Administrative and procedural requirements for consideration of request for substitution during the design and construction phases.
B. Substitution Request Form.

1.2 REFERENCES

A. Section 01 33 00 – Submittal Procedures.
B. Section 01 42 00 – References.
C. Section 01 45 00 – Quality Control.
D. Section 01 78 00 – Closeout Submittals.

1.3 SUBMITTAL PROCEDURES

A. Transmit each substitution request on company letterhead with completed Form 01 25 00 A. Form is as indicated in Para. 3.02.
   1. During bidding phase, substitution requests shall be directed to Project Architect.
   2. During construction phase substitution requests shall be directed to Contractor/CM.
B. Substitution Form shall identify project, Contractor/CM and Architect during bidding phase plus Subcontractor or supplier during construction phase indicating Specification Section and Paragraph number of specified material and pertinent drawing and detail numbers, as appropriate.
C. Include complete information as required in the Substitution Form. Incomplete information will result in automatic rejection of the substitution request.
D. Apply contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information are in accordance with the requirements of the work and contract documents.
E. Schedule submittals to expedite the project and deliver to Architect or Contractor/CM at business address. Coordinate submission of related items.
F. For each submittal for review, allow 15 days excluding delivery time to and from Architect or CM/Contractor.
   1. Identify variations from contract documents and product or system limitations, which may be detrimental to successful performance of the completed work.
   2. Provide space for Contractor/CM and Architect review stamps.
   3. When revised for resubmission, identify all changes made since previous submission.
   4. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
   5. Submittals not requested will not be recognized or processed.

1.4 SUBSTITUTION REQUESTS

A. Requests for substitutions shall be made not later than ten (10) calendar days prior to bid date by prospective bidders, or time set by Owner for receipt of GMP (Guaranteed Maximum Price) from CM. Requests received after the above dates may not be considered.

PART 2 – PRODUCTS

2.1 Not Used.

PART 3 – EXECUTION

3.1 FORM EXECUTION

A. Contractor/CM shall submit Product Substitution Request on Form 01 25 00A on following page with transmittal letter and self-addressed stamped envelope for Architect's use in returning response to substitution request.

3.2 SUBSTITUTION FORM 01 25 13A - PRODUCT SUBSTITUTION REQUEST

A. Specified Product _____

B. Sheet No./Specification Section and Paragraph_____

C. Contractor/CM has reviewed and approved proposed substitution?

Yes_____ No_____

D. Requested Product Substitution: _____
_____

E. Does Product Meet or Exceed Specified Product Requirements? Yes_____No_____
(If answer is no, explain.)_____

F. Does Product Substitution affect dimensions shown on Drawings? Yes_____No_____
(If answer is no, explain.)_____

G. Reason for Requested
Substitution:_____
_____

H. Cost Difference between Product Specified and Product Proposed:
Add $ _____Subtract $_____

I. Electrical Requirements equal to Specified Product: Yes_____ No_____ N/A_____
(If No or N/A,
explain):_____
_____

J. Plumbing Requirements equal to Specified Product: Yes_____ No_____ N/A_____
(If No or N/A,
explain):_____
_____

K. Mechanical Requirements equal to Specified Product: Yes_____ No_____ N/A_____
(If No or N/A,
explain):_____
_____

L. Does the Product Substitution have any effect on other trades? Yes_____ No_____
(If yes, explain):_____
_____

M. Contractor/CM agrees to pay for changes in building design, including engineering and detailing costs, caused by requested product substitution. Yes_____ No_____

N. Signature of Bidder/Contractor/CM shall indicate function, appearance and quality of proposed substitution is equivalent or superior to specified item.

O. Contractor/CM assumes responsibility for delay or claims arising from review and evaluation of requested product substitution.

P. Approval of proposed substitution shall have no effect on coordination and installation of work in accord with contract documents.

Submitted by: For Use by the Architect and Owner:

_____ _____Received Too Late
Contractor/CM

_____ _____ Not Accepted
Firm

_____ Approved As Noted

_____ _____ Approved For Bidding Only,
Final Approval Contingent Upon Address
Submittal of Information in
Accord with this Section

_____ _____
Date Architect Date

_____
Owner Date

END OF SECTION

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Procedures for preparation and submittal of Applications for Payment.
B. Unit pricing shall be in conformance with 2007 Edition of AIA A201 General Conditions of the Contract and as amended by Owner.

1.2 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures.
B. Section 01 78 00 – Closeout Submittals.

1.3 FORMAT

A. Payment format shall in accord with AIA G702 - Application and Certificate for Payment and AIA G703 – Continuation Sheets.
B. Contractor/CM's AIA G702/703 equivalent forms including continuation sheets may be substituted for AIA Payment Forms if preapproved by Owner's Project Manager.

1.4 PREPARATION OF APPLICATIONS

A. Present handwritten pre-application draft payment forms to Owner for review before submitting applications for payment.
B. After revising draft payment forms, prepare and submit six typewritten copies or on electronic media printout Pay Application as preapproved by Owner.
C. Execute certification by signature of authorized officer.
D. Use data from Owner preapproved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
E. List each authorized Change Order as extension on AIA G703 – Continuation Sheet, listing Change Order number. and dollar amount as for original item of Work.
F. Prepare Application for Final Payment as specified in Section 01 78 00 – Closeout Submittals.

1.5 SUBMITTAL PROCEDURES

A. Submit electronic copies of each Application for Payment.
B. Submit an updated construction schedule with each Application for Payment.
C. Payment Period: Submit at monthly intervals not later than the fifteenth of the month unless otherwise stipulated in the Agreement.
D. Submit Release of Liens waivers with each Application for Payment.

1.6 SUBSTANTIATING DATA

A. When Architect or Owner requires substantiating information, submit data justifying dollar amounts.
B. 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.
C. Include following data with application.
    1. Partial release of liens from major subcontractors and vendors.
    2. Affidavits attesting to off-site stored products.
    3. Construction progress schedule, revised and corrected to reflect project status at time of payment application.

1.7 PAYMENTS

A. Payments may be made for materials stored off-site if preapproved by Owner's Project Manager and off-site facility is insured and bonded air conditioned warehouse, and only if project site doesn't allow storage or protection for equipment and supplies.
B. Payments will normally be made to Contractor/CM by 10th of each month, if copies are preapproved by Owner's Project Manager and received by 25th of previous month, unless otherwise stipulated in Agreement.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Project management, coordination of construction activities, interface with Owner's staff for existing facilities and project conditions related to project for new and existing facilities.
B. Meetings for field engineering and project coordination, preconstruction, construction procedures, pay application and progress meetings, pre installation and project closeout meetings.
C. Site mobilization, materials and equipment storage, site cleanup and demobilization.

1.2 RELATED SECTIONS

A. Section 01 25 13 – Product Substitution Procedures.
B. Section 01 29 00 – Payment Procedures.
C. Section 01 33 00 – Submittal Procedures.
D. Section 01 35 53 – Security.
D. Section 01 42 00 – References.
E. Section 01 45 00 – Quality Control.
F. Section 01 66 00 – Project Storage and Handling Requirements.
G. Section 01 78 00 – Closeout Submittals.
H. Section 01 91 00 – Commissioning.

1.3 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating Owner's occupancy of completed portions of project or existing building on site, and items to be furnished or installed by Owner.
B. Verify utility requirements and characteristics of 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.
C. Coordinate space requirements, supports and installation of mechanical and electrical work that is indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
D. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
E. In finished areas with exposed ceilings, piping and conduits shall either concealed or be run at right angles and be attached to underside of floor or deck above. Wiring shall not be exposed. Exposed ductwork shall be painted spiral duct.
E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.
F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accord with Contract Documents, to minimize disruption of Owner's activities.

G. Owner will not consider change orders for extra work required by Contractor due to his inadequate coordination.

1.4 PRECONSTRUCTION MEETING

A. Owner's Project Manager will schedule preconstruction conference after Notice to Proceed.
B. Attendance Required: Owner, Architect, and Contractor/CM.
C. Agenda:
   1. Execution of Owner-Contractor Agreement, if not executed.
   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. Designation of personnel representing the parties in Contract, and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders and Contract closeout procedures.
   7. Scheduling.
   8. Scheduling activities of Geotechnical Engineer.
   9. Issuance of Notice to Proceed.
D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

1.5 SITE MOBILIZATION MEETING

A. Owner will schedule meeting at Project site prior to Contractors start of work.
B. Attendance Required: Owner, Architect, Special Consultants, and Contractor, Contractor's Superintendent, and major Subcontractors.
C. Agenda:
   1. Use of premises by Owner and Contractor.
   2. Owner's requirements and partial occupancy.
   3. Construction facilities and controls provided by Owner.
   4. Temporary utilities provided by Owner.
   5. Survey and building layout.
   6. Security and housekeeping procedures.
   7. Schedules.
   8. Application for payment procedures.
   9. Procedures for testing.
   10. Procedures for maintaining record documents.
   11. Requirements for start-up of equipment.
   12. Inspection and acceptance of equipment put into service during construction period.
D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

1.6 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of work at weekly intervals. Less frequent meetings may be requested for projects or work stages if requested in writing to the Owner's Project Manager.
B. Make arrangements for meetings, prepare agenda with copies for participants, and preside meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner's Project Manager, Architect, as appropriate to agenda topics for each meeting.
D. Agenda:
   1. Review minutes of previous meetings.
   2. Review previous Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress schedule during succeeding work period.
   10. Coordination of projected progress.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Other business relating to work.
E. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

1.7 PREINSTALLATION MEETINGS

A. When required in individual specification section, convene pre-installation meeting at site prior to commencing work of section.
B. Require attendance of parties directly affecting, or affected by, work of specific section.
C. Notify Owner and Architect five working days in advance of meeting date.
D. Prepare agenda and preside at meeting:
   1. Review conditions of installation, preparation, and installation procedures.
   2. Review coordination with related work.
E. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

PART 2 PRODUCTS

2.1 EQUIPMENT ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Motors: Refer to Electrical Sections for specific motor types.
B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
C. Cord and Plug: Provide minimum 6' cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

PART 3 EXECUTION

3.1 EXISTING BUILDING PROJECT PROCEDURES

A. Materials: As specified in Product sections; match existing Products and work for patching and extending work.
B. Employ skilled and experienced installer to perform alteration work.

C. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.
D. Remove, cut, and patch Work in manner to minimize damage and to provide means of restoring Products and finishes to original or specified condition.
E. Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with neat transition to adjacent finishes.
F. Where new Work abuts or aligns with existing, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.
G. When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at natural line of division and submit recommendation to Architect for review.
H. Where change of plane of 1/4" or more occurs, submit recommendation for providing a smooth transition to Architect for review.
I. Patch or replace portions of existing surfaces, which are damaged, lifted, discolored, or showing other imperfections.
J. Work that penetrates fire or smoke rated partitions or floors shall be repaired to provide original fire or smoke rating.
K. Finish surfaces as specified in individual Product Specification Sections.

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROJECT SCHEDULE

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Preparation of preliminary Construction Schedule, Contractor's/CM/GC final master Construction Schedule, hereinafter called the Construction Schedule, Short Interval Schedules (look ahead), and monthly updates.
B. Scope of work and project completion are as indicated. Bidders shall include with their bid, a proposed project schedule indicating each item of work in CSI numbering format showing each work division in CPM (Critical Path Method) work sequencing. Schedule shall base critical path on Owner's providing pre purchase of long lead items, and assuming that those products and services are delivered to the Contractor/CM on time for meeting proposed project schedule.

1.2 SUBMITTALS

A. Submit schedule in accord with Section 01 33 00 – Submittal Procedures.
B. Preliminary Project Schedule:
   1. Purpose of preliminary schedule is to determine Bidder's intent as to how work can be prosecuted to allow project completion in specified time frame.
   2. Bidder's shall comply with "The Use of CPM in Construction – A Manual for General Contractors" published by Associated General Contractors of America, Inc. Schedules shall utilize nationally recognized scheduling format such as Primavera or Microsoft Project. Software version selected shall be compatible with Owner's Microsoft Word or Office software so that schedule can be reviewed and saved in Owner's computer system.
   3. Schedule shall be on 11" x17" paper indicating project activities, duration, start and finish dates of each activity, float or slack time, critical path, and total number of days for project.
   4. Include float or slack time in Schedule. Float is defined as amount of time between earliest start date and latest start date or days between earliest end date and latest end date.
   5. Construction schedule shall begin based on Owner's intent to issue Notice to Proceed Letter to Contractor/CM and be completed within "x" Calendar Days from NTP. Substantial Completion is "date", with "x" calendar days to Final Completion or "date".
   6. Preliminary Project Schedule shall be submitted with Bid Proposal. Failure to do so will be grounds for rejection of the Bid Proposal.

1.3 COORDINATION AND PROJECT CONDITIONS

A. Bidders are responsible for verification of existing conditions to the extent that they are observable and can be inferred by visual inspection.
B. Verify utility requirements and characteristics of 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.

C. Coordinate space requirements, supports and installation of mechanical and electrical work that is indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
D. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
E. In finished areas with exposed ceilings, piping and conduits shall either concealed or painted and be run at right angles, and attached to underside of floor or deck above. Wiring shall not be exposed. Exposed ductwork shall be painted.
F. Coordinate scheduling to allow time for submittals, Owner's approval, Building Dept. review, permitting and inspections to ensure efficient and orderly sequence of installation of interdependent construction elements. Schedule shall provide for accommodating Owner's occupancy of other buildings on site, and items to be furnished or installed by Owner.
G. Owner will not consider change orders for extra work required by Contractor due to his inadequate coordination.

PART 2 NOT USED

PART 3 NOT USED

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Administrative and procedural requirements for processing of submittals during construction process. Submittals may include the following:
   1. Proposed Products Lists.
   2. Proposed Vendor List.
   3. Product Data.
   4. Shop Drawings.
   5. Samples.
   6. Design Data.
   7. Field Test Reporting.
   8. Quality Control Reporting.
   9. Certificates.
   10. Manufacturer's Installation, Handling and Storage Instructions.
   11. Manufacturer's Field Reports.
   12. Erection Drawings.
   13. Closeout Documents
   14. Warranties.
   15. Scheduling of Work.
   16. Construction Progress Schedule.
   17. Submittals Schedule.
   18. Survey and Layout Data.
   19. Construction Progress Reporting.
   20. Periodic Work Observation.
   21. Photographic Documentation.
   22. Purchase Order Tracking.
   23. Operation and Maintenance Documentation.

1.2 RELATED SECTIONS

A. Section 01 29 00 – Payment Procedures.
B. Section 01 31 12 – Project Coordination.
C. Section 01 42 00 – References.
D. Section 01 45 00 – Quality Control.
E. Section 01 66 00 – Product Storage and Handling Requirements.
F. Section 01 78 00 – Closeout Submittals.

1.3 SUBMITTAL PROCEDURES

A. Submittal Procedures shall be in conformance with AIA A201 General Conditions of the Contract and as amended by Owner.
B. Transmit each submittal with AIA Form G810-2001 or Owner’s Standard Transmittal form.
C. Sequentially number each transmittal forms. Revise submittals with original number and a sequential alphabetic suffix.

D. Identify project, Contractor/CM, subcontractor or supplier pertinent drawing and detail number, and specification section number, as appropriate.
E. Apply Contractor/CM's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information are in accord with requirements of the work and contract documents.
F. Schedule submittals to expedite the project and deliver to Engineer and Contractor/CM at business address. Coordinate submission of related items.
G. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor/CM.
H. Identify variations from contract documents and product or system limitations, which may be detrimental to successful performance of the completed work.
I. Provide space for Contractor/CM and Engineer review stamps.
J. When revised for resubmission, identify all changes made since previous submission.
K. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
L. Submittals not requested will not be recognized or processed.

1.4 PROPOSED PRODUCTS LIST

A. Within 15 work days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 PRODUCT DATA

A. Product Data for Review:
   1. Submit to Engineer for review for purpose of checking for conformance with information given and design concept expressed in Contract Documents.
   2. After review, provide copies and distribute per Submittal Procedures article above and for record documents purposes described in Section 01 78 00 – Closeout Submittals.
B. Product Data for Information:
   1. Submittal for Engineer's knowledge as contract administrator or for Owner.
C. Product Data for Project Close-out:
   1. Submit for Owner's benefit during and after project completion.
D. Submit number of copies required by Contractor/CM plus two copies for transmittal to Engineer and two copies for transmittal to Owner's Project Manager.
E. Mark each copy to identify applicable products, models, options, and other data.
G. Supplement manufacturers' standard data to provide information unique to project.
H. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
I. After review, distribute in accord with Submittal Procedures article above and provide copies for record documents described in Section 01 78 00 - Closeout Documents.

1.6 CONSTRUCTION SUBMITTALS

A. Submit one copy of Building Permit, Site Permits, Environmental Permits, or other permits required for construction of work.
B. Submit Payment Applications to Engineer for review for purpose of checking conformance with information given and design concept expressed in Contract Documents.

C. Shop Drawings: Provide following information:
   1. Fabrication and installation Drawings and details.
   2. Template placement diagrams.
   3. Manufacturer's installation instructions.
   4. Product patterns and colors.
   5. Coordination Drawings.
   6. Schedules.
   7. Product mix formulae.
   8. Product design or engineering calculations.
   9. Other information as required by project.
   10. After review, produce copies and distribute per Submittal Procedures article above and for record documents purposes described in Section 01 78 00 – Closeout Submittals.
   11. Submit to Engineer for purpose of checking conformance with information given and design concept and Owner's Project Manager.

D. Project Closeout Documents:
   1. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
   2. Submit number of copies required by Contractor, plus one copy for Engineer, and two copies for Owner.
   3. Submit to Engineer for Owner's benefit during and after project completion.
      a. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
      b. Submit one copy and one reproducible copy required by Contractor/CM, plus one copy for Engineer, and two copies for Owner.

E. Product Samples
   1. Submit to Engineer for purpose of checking conformance with information given and design concept expressed in the documents.
   2. After review, Engineer shall submit color board to Owner's Project Manager per Submittal Procedures.
   3. Sample finishes and colors shall be from full range of manufactures' standard colors, textures, and patterns for Engineer's selection and preparation of color board for Owner's approval.
   4. After review and approval by Owner, provide duplicates and distribute per Submittal Procedures.
   5. Submit samples to illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   6. Include identification on each sample, with full project information.
      a. Submit number of samples specified in specification, one of which Engineer shall retain.
      b. Reviewed samples may be used in work, if indicated.

F. Product Design Data and Test Reports:
   1. Submit to Engineer as contract administrator and for Owner's Project Manager for purpose of checking conformance with information given and completed work on project.

G. Certificates:
   1. When specified, submit certification by manufacturer, installation/application subcontractor, or contractor to Engineer, in quantities specified for Product Data.
   2. Indicate material or Product conforms to or exceeds specified requirements.
   3. Submit supporting reference date, affidavits, and certifications as appropriate.
   4. Certificates may be recent or previous test results on material or Product but must be acceptable to Engineer.

H. Manufacturer's Instructions:
   1. When specified, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Engineer for delivery to Owner in quantities specified for Product Data.
   2. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
   3. Refer to Section 01 45 00 – Quality Control for quality assurance requirements.

J. Manufacturer's Field Reports:
   1. Submit reports to Engineer and Owner's Project Manager.
   2. Submit report within 30 days of observation to Engineer.
   3. Submit for information for purpose of assessing conformance with information given and design concept expressed in Documents.

K. Erection Drawings:
   1. Submit drawings to Engineer and Owner's Project Manager.
   2. Submit for information for purpose of assessing conformance with information given and design concept expressed in Documents.
   3. Data indicating inappropriate or unacceptable work is subject to rejection by Engineer or Owner.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01 35 53
SECURITY PROCEDURES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Development of site security program, project entry control procedures, personnel screening, and identification in compliance with Florida Statute FS1012.465 – Jessica Lunsford Act for vendors and Contractor/CM's.

1.2 RELATED SECTIONS

A. Section 01 31 00 – Project Management and Coordination.
B. Section 01 33 00 – Submittal Procedures.
C. Section 01 56 00 – Temporary Barriers and Enclosures.

1.3 JESSICA LUNSFORD ACT

A. Contractor/CM, his subcontractors, vendors, and suppliers who are to be permitted access to school grounds while students are present or have direct contact with students or have access to or control of school funds shall obtain Level 2 background screening in accord with Florida Statute FS1012.465 – Jessica Lunsford Act.
   1. Level 2 screening excludes personnel working on school district property where students are present who have criminal records that include sexual offender, sexual misconduct with developmentally disabled or mental health patients, terrorism, murder, kidnapping, lewd, lascivious, or indecent acts or exposure, incest, child abuse, or neglect.
   2. Persons screened as noted above with other types of criminal history may be allowed on school grounds provided under following conditions:
      a. Contractor/CM, subcontractors, vendors, and suppliers shall be under continuous direct supervision of school district employee or Level 2 screened and cleared employee as noted above.
      b. Contractor/CM, subcontractors, vendors and suppliers may be allowed on a student occupied site if area of construction is isolated from students by continuous six foot high chain link fence separating work area and school.
      c. Persons with current Level 2 clearance who are subsequently arrested for disqualifying offenses shall be disqualified from access to school sites and shall immediately surrender their Photo ID Badge to their employer who shall be responsible for returning badge to Martin County School District's Department of Human Resources with 48 hours of arrest or notice of arrest or criminal offense.
      d. Persons failing to notify their employer and Martin County School District's Department of Human Resources with 48 hours of arrest will be charged with 3rd degree felony, punishable by up to five years imprisonment and $1,000 fine.
      e. Employers of persons having been arrested for disqualifying offenses who subsequently allows said employee to continue working on school property may also be charged with 3rd degree felony, punishable by up to five years imprisonment and $1,000 fine.
B. Contractor/CM, his subcontractors, vendors, and suppliers working on school board sites shall be fingerprinted and obtain work badges.
   1. Contractor/CM, his subcontractors, vendors, and suppliers have worked and obtained in other school districts must be screened to obtain new badges.

2. Questions regarding fingerprinting or identification badge processing may be directed to District Personnel Department at (772) 219-1200, Ext. 30296.
3. Fingerprinting services are provided by private vendor through Florida Dept. of Education. DOE sponsored website will direct individuals to nearest fingerprinting location.
4. Cost of fingerprinting is (Check with the School District) per person and shall be prepaid either by money order to (Check with the School District) or by credit card payment via Internet. Website is http://www.flprints.com. For information, telephone (877) 357-7456.
5. Money orders shall be made out to 3M Cogent. Money order must be brought to appointment.
6. Individuals shall register online prior to their appointment:
   a. Navigate to https://www.cogentid.com/fl/index_fdoe.htm and select "register online".
   b. For County select Martin County from pull-down box.
   c. For CRI Literal select: FL931392Z Contractors & Vendors.
   d. Fill out remaining information and submit.
   e. Use Internet Explorer.
7. Individuals being fingerprinted shall provide valid, government issued driver's license, identification card or passport.
8. After fingerprinting and criminal background check is complete, individuals shall make appointment for photo ID's by making appointments at Martin County School District Personnel Department located in Building 20 at School District Administration Center, 500 E. Ocean Blvd., Stuart, FL 34994.
9. Appointments for ID photo badges shall be made after completion of fingerprinting with. Martin County School District Personnel Department by phone at (772) 219-1200, Ext. 30296.
10. Photo ID applicants shall have registration confirmation receipt with them when they arrive for appointment.
11. Cost of Photo ID's is (Check with the School District). Payment may be made with company check, money order, or personal check. Checks shall be made payable to Martin County School District.

C. Non-Instructional Contractors with current Martin County School District ID Photo Badges shall update their badges to the State Uniform Badge required by Florida Statute 1012.467, effective July 1, 2014.
1. There is no cost for individuals with current Martin County School District ID Photo Badges to upgrade their badges.
2. Badges from other individual School Districts are no longer accepted on school sites in Florida.
3. New statewide badges are accepted in any School District regardless of where it was issued.
4. Non-Instructional Contractors and their employees working on School sites shall apply for State-Wide Badges as noted above.
5. Non-Instructional Contractors shall submit lists of their badged employees via email to Eileen Loreti at the Martin County School District Personnel Department at loretie@martin.k12.fl.us.

1.4 SECURITY PROGRAM

A. Protect new work, existing facilities, and grounds from damage, theft, vandalism, and unauthorized entry.
B. Initiate security program in coordination with Owner's existing security system at time of project mobilization to ensure safety of students, faculty, and visitors to the unaffected portions of the school facilities.

C. No student contact is permitted between the Contractor's personnel and students. Any breach of this requirement will result in the immediate removal of the personnel from the job site upon direction by the Owner.
D. Smoking is not allowed on School Board property. Any breach of this restriction will result in immediate removal of personnel from the site upon direction by Owner's Project Manager.
E. Maintain security program throughout construction period until Owner's project acceptance.

1.5 ENTRY CONTROL

A. Restrict entrance of persons and vehicles into Project site and existing facilities as indicated by Owner approved security plan.
   1. Allow entrance only to authorized persons with proper identification.
   2. Maintain log of workers and visitors, make available to Owner on request.
   3. Coordinate access of Owner's personnel to site in coordination with Owner's security forces.

1.6 PERSONNEL IDENTIFICATION

A. Contractor/CM on-site staff, subcontractors, and vendors on site shall wear identification badges at all times on site.
B. Identification badges shall be current at time of project and shall be reverified and reissued yearly if project extends past original badge expiration date.

1.7 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Provide list of personnel proposed to be used on project for fingerprinting and background checks (only required for existing school projects).
C. Contractor/CM shall submit initial list of accredited persons and provide monthly updated lists to Owner.
D. Provide security plan to Owner indicating how construction site is to be secured and separated from existing school and its operations including normal and emergency egress and exiting from the operational portion of school and for new additions and existing portion under construction.

PART 2 PRODUCTS

2.1 Not Used.

PART 3 EXECUTION

3.1 Not Used.

END OF SECTION

SECTION 01 42 00
REFERENCE STANDARDS

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. Reference and design standards referenced in Florida Building Code and Florida Fire Prevention Code, 6th Editions are applicable.
B. Documents listed shall be standard references currently in effect at time of project building permitting.
C. American Society of Testing Materials (ASTM):
   1. See individual product specification sections for applicable ASTM standards.
D. American National Standards Institute (ANSI)/Underwriters Laboratories (UL):
   1. See individual product specification sections for applicable ANSI standards.
E. Underwriters Laboratories (UL) – Fire Resistance Directory.
F. Warnock-Hersey – Product Directory.
G. Building Industry Consulting Services International (BICSI):
   1. BICSI-568-2001: Installing Commercial Building Telecommunications Cabling.
   2. BICSI Telecommunications Distribution Methods Manual (TDMM).
   3. BICSI Telecommunications Cabling Installation Manual (TCIM).
   4. BICSI Outside Plant Design Reference Manual, 5th Edition.
H FCC (Federal Communications Commission) Rules.
I. National Electrical Code (NEC):
   1. NFPA 70 National Electrical Code, 2008 Edition.
J. National Fire Protection Association (NFPA):
   1. NFPA 101: Life Safety Code – National Fire Protection Association (NFPA).
   2. NFPA 70: National Electrical Code – National Fire Protection Association (NFPA).
K. Occupational Health and Safety (OSHA): State and Federal Requirements.
L. Telecommunications Industry Association (TIA)/Electronics Industry Association (EIA):
   1. TIA/EIA-568-B.1 and Addenda: Commercial Building. Telecommunications Cabling Standard - Part 1: General Requirements.
   2. TIA/EIA-568-B.2 and Addenda: Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted-Pair.
   3. TIA/EIA-568-B.2-1: Transmission Performance Specifications for 4-Pair 100 Ohm Category 6 Cabling.
   4. TIA/EIA-568-B.3 and addenda: Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling and Components Standard.
   5. TIA/EIA-568-B.3-1: Additional Transmission Performance Specifications for 50/125 ohm Optical Fiber Cables.
   6. TIA/EIA-569-A and Addenda: Commercial Building Standard for Telecommunications Pathways and Spaces, CSA T530.
   7. TIA/EIA-606-A and Addenda: Administration Standard for Telecommunications Infrastructure of Commercial Buildings, CSA T528.
   8. ANSI-J-STD-607-A and Addenda: Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, CSA T530.
   9. TIA/EIA-526-7 and Addenda: Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
   10. TIA/EIA-526-14A and Addenda: Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.

11. TIA/EIA-758: Customer Owned Outside Plant Telecommunications Cabling Standard.

M. International Electrical Code (IEC):
   1. TR3 61000-5-2 - Ed. 1.0 and Amendments: Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines – Section 2: Earthing and Cabling".
   2. ISO/IEC 11801: 2000 Edition, 1.2 and Amendments: Information Technology – Generic cabling for customer premises.

N. International Standards Organization (ISO/IEC): 11801: 2000 Ed. 1.2 and Amendments: Information technology - Generic cabling for customer premises.

O. NACE (National Association of Corrosion Engineers) - Industrial Maintenance Painting.

P. NPCA (National Paint and Coatings Association) - Guide to U.S. Government Paint Specifications.

Q. PDCA (Painting and Decorating Contractors of America) - Painting - Architectural Specifications Manual.

R. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.
   1. SSPC-SP 1 – Solvent Cleaning.
   2. SSPC-SP 2 – Hand Tool Cleaning.
   3. SSPC-SP 3 – Power Tool Cleaning.
   4. SSPC-SP 13 – Nace No 6 Surface Preparation for Concrete.

S. WDMA (Window and Door Manufacturer's Association) I.S. 1-A-2004.

1.2 DEFINITIONS

A. Communication Definitions:
   1. ITS: Information Transport System: Copper cabling or optical fiber for transmission of information on School District property. Transmission includes data, video, voice, fire alarm, security, access control, and other low-voltage networks. Information Transport System is not limited to School District-owned cabling, but includes copper and optical fiber, and equipment owned by outside providers carrying School District's information. Pathways are not limited by School District's ownership but include those owned by third parties. Information Transport System may be referred to as "the network" within project documents.
   2. ICP: Inside Cable Plant: Part of Information Transport System running within buildings. ICP elements include workstation outlet assembly, cabling to the workstation from network rooms, backbone cabling within building, backbone cabling running between physically contiguous buildings, network racks and hardware (routers, switches, hubs, firewalls, etc.), patch panels, punch blocks, fiber distribution panels, patch cords, and cross-connect cables/wires.
   3. OCP: Outside Cable Plant: Part of Information Transport System running between buildings, from building to definable exterior point, between definable exterior points, or from non-School District source to School District building or definable exterior point. OCP includes termination punch blocks, fiber distribution panels, interior splices for outside to inside optical fiber transition, and other initial device into which outside cable attaches. OCP does not include backbone cable running between physically contiguous buildings unless cabling enters OSP pathway element (e.g. OSP conduits, maintenance holes, etc.). OCP includes underground cabling and aerial cabling.
   4. Cable: An assembly of one or more insulated conductors or optical fibers, within an enveloping sheath.
   5. DP: Dead pairs: Unused copper pairs terminating within splice case, but without being splices to outgoing cable.

6. GP: Grounding Electrode: Conductor (rod, pipe or plate or group of conductors) in direct contact with earth for purpose of providing low-impedance connection to earth.
7. GEC: Grounding Electrode Conductor: Conductor used to connect grounding electrode to equipment grounding conductor, or to grounded conductor of circuit at service equipment, or at source of separately derived system.
8. Handbox: Rectangular or square underground pathway element similar to small maintenance hole, which cannot be fully entered, that allows for pulling point or splice point in power, security or communications pathway.
9. Handhole: A round underground pathway element similar to a handbox, which cannot be fully entered, that allows for a pulling point in a pathway.
10. Identifier: An item of information that links a specific element of the Information Transport System infrastructure with its corresponding record.
11. Infrastructure (Information Transport System): A collection of those Information Transport System components, excluding equipment, that together provides the basic support for the distribution of all information within a building or campus.
12. Linkage: A connection between a record and an identifier or between records.
13. Maintenance (man) holes: Underground pathway element large enough for person to fully enter work, used to provide access to underground cable to pull, splice, and maintain.
14. Media (Information Transport System): Wire, cable, or conductors used for Information Transport System.
15. OB: Outlet Box: Metallic or nonmetallic box used to hold Information Transport System outlets/connectors or transition devices.
16. Outlet (Connector) (Information Transport System): Connecting device in work area on which horizontal cable or outlet cable terminates.
17. Pathway: Facility for the placement of Information Transport System cable.
18. Record: Collection of detailed information related to specific element of Information Transport System infrastructure.
19. Report: Presentation of collection of information from various records.
20. Space (Information Transport System): Area used for housing installation and termination of Information Transport System equipment and cable, e.g., equipment rooms, network rooms, work areas, and maintenance holes/handboxes/handholes.
21. Splice: Joining of conductors in splice closure, meant to be permanent.
22. Splice Box: Box, located in pathway run, intended to house cable splice.
23. Splice Closure: Device used to protect splice.
24. Termination Position: Discrete element of termination hardware where information Transport System conductors are terminated.
25. Work Area (work station): Building space where occupants interact with Information Transport System terminal equipment.

B. Painting Definitions:
   1. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products for interpretation of terms used herein.

1.3 ABBREVIATIONS AND ACRONYMS

A. Abbreviations noted in Florida Building Code, Chapter 2 are applicable.
B. General Abbreviations:
   1. AC: Above Counter/Air Conditioning.
   2. ACR: Attenuation-to-Crosstalk Ratio.
   3. ADA: Americans with Disabilities Act.

4. AFF: Above finished floor.
5. AFG: Above finished grade.
6. ANSI: American National Standards Institute.
7. ARCH: Architect or Architectural.
8. ASTM: American Society for Testing and Materials (ASTM International).
9. AWG: American Wire Gauge.
10. BD: Building distributor (replacing main-cross connect and MDF as "building service" room identifiers).
11. BICSI®: Building Industry Consulting Service International, Inc.
12. BTU: British Thermal Unit.
13. CAT6: Category 6 cable.
14. CATV: Community Antenna Television (cable television).
15. CD: Campus distributor (replacing main-cross connect and MDF as "campus-wide service" room identifiers). Also, compact disk for storage of audio or video information.
16. CO: Communications Outlet.
17. COAX: Coaxial Cable.
18. CP: Communications Panel.
19. dB: Decibel.
20. EMS: Energy Management System or Emergency Management System.
21. EMT: Electrical metallic tubing.
22. ENT: Electrical nonmetallic tubing.
23. EDPM: Ethylene-polypropylene-diene membrane.
24. EF: Entrance Facility.
25. EIA: Electronic Industries Alliance.
26. ELFEXT: Equal Level Far-End Crosstalk.
27. EMC: Electromagnetic Compatibility.
28. EMI: Electromagnetic Interference.
29. ER: Equipment Room. Replacing "TR"
30. FMC: Flexible metallic conduit.
31. FCC: Federal Communications Commission.
32. FD: Floor distributor (replacing network room, intermediate and horizontal cross-connect, and telecommunications as "building service" room identifiers). Also, Floor Drain as part of building plumbing system.
33. FDDI: Fiber Distribution Data Interface.
34. FEXT: Far-End Crosstalk.
35. FO: Fiber Optic.
36. Freq: Frequency.
37. GE: Grounding equalizer (replacing TBBIBC).
38. Gnd: Ground.
39. HB: Handbox. Also, hose bibb for water supply part of plumbing system.
40. HC: Horizontal Cross-Connect (replaced by floor distributor "FD").
41. HH: Handhole.
42. HVAC: Heating, Ventilation, and Air Conditioning.
43. Hz: Hertz.
44. IC: Intermediate Cross-Connect (replaced by building distributor "BD").
45. IDC: Insulation Displacement Connectors.
46. IDF: Intermediate Distribution Frame (replaced by "BD" or "FD").
47. IEEE: Institute of Electrical and Electronics Engineers.
48. IMC: Intermediate metal conduit.
49. IN: Inches.

50. ISO: International Organization for Standardization.
51. ISP: Inside Cable Plant.
52. JB: Junction Box.
53. LBS: Pounds.
54. LED: Light Emitting Diode.
55. LFMC: Liquidtight flexible metal conduit.
56. LFNC: Liquidtight flexible nonmetallic conduit.
57. Mbps: Megabits per second.
58. MC: Main Cross-Connect (replaced by campus distributor "CD").
59. MDF: Main Distribution Frame (replaced by "CD" or "BD").
60. MER: Main Equipment Room.
61. MH: Maintenance Hole.
62. MHz: Megahertz.
63. NBR: Acrylonitrile-butadiene rubber.
64. NEC: National Electrical Code, NFPA 70.
65. NEMA: National Electrical Manufacturers Association.
66. NESC: National Electric Safety Code, C2-1997.
67. NFPA: National Fire Protection Association.
68. NIC: Not in Contract.
69. NR: Network Room.
70. #: Number.
71. OFCI: Owner Furnished Contractor Installed.
72. OFOI: Owner Furnished Owner Installed.
73. OSHA: Occupational Safety and Health Administration.
74. OCP: Outside Cable Plant.
75. OTDR: Optical Time Domain Reflectometer.
76. PR: Pair.
77. PVC: Polyvinyl Cloride.
78. RCDD®: Registered Communications Distribution Designer.
79. RFI: Radio Frequency Interference.
80. RGC or GRC: Rigid Galvanized Conduit.
81. RH: Relative Humidity.
82. RNC: Rigid nonmetallic conduit.
83. SCS: Structured Cabling System.
84. SS: Stainless Steel.
85. SM: Single Mode.
86. TIA/EIA: Telecommunications Industry Association/Electronic Industry Association.
87. TBB: Telecommunication Bonding Backbone.
88. TBBIBC: Telecommunication Bonding Backbone Interconnecting Bonding Conductor (replaced by grounding equalizer "GE").
89. TE: Telephone Equipment (Wall Mounted Equipment Rack).
90. TEL: Telephone.
91. TGB: Telecommunications Grounding Buss bar.
92. TMGB: Telecommunications Main Grounding Buss bar.
93. TR: Telecommunications Room. (Replaced with Main-MDF or Intermediate-IDF Distribution Frame Locations).
94. TYP: Typical.
95. UL: Underwriters Laboratory.
96. UPS: Uninterruptible Power Supply.
97. UTP: Unshielded Twisted Pair.

98. V: Volt.
99. WAO: Work Area Outlet.

1.4 UNITS OF MEASURE

A. Weights and Measures shall be as identified by Weights and Measures Division, NIST, U. S. Department of Commerce, 100 Bureau Dr., Stop 2600, Gaithersburg, MD 20899-2600.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 45 00
QUALITY CONTROL

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Quality assurance procedures to control labor and product installation including tolerances, adherence to references, and standards.
B. Construction of mockups and field samples to set standard of quality for product installation.
C. Independent inspecting and testing laboratory services for quality control and adherence to contract documents.
D. Manufacturers' field services for quality control and adherence to contract documents.
E. Work shall be in conformance with 2007 Edition of AIA A201 General Conditions of the Contract and as amended by Owner on July 13, 2009. Copy is included in Division 1, Section 00 72 00 – General Conditions.

1.2 RELATED SECTIONS

A. Section 01 29 00 – Payment Procedures.
B. Section 01 31 00 – Project Management and Coordination.
C. Section 01 33 00 – Submittal Procedures.
D. Section 01 42 00 – References.
E. Section 01 66 00 – Product Storage and Handling Requirements.
F. Section 01 78 00 – Closeout Submittals.
G. Section 01 91 00 – Commissioning.
H. Section 23 05 93 – Testing, Adjusting and Balancing of HVAC.

1.3 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and work to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
B. Verify utility requirements and characteristics of 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.
C. Coordinate space requirements, supports and installation of mechanical and electrical work that is indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel or perpendicular with line of building. Conduits and piping shall be spaced neatly, consistently, and uniformly when in groupings. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
D. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.
F. 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.

G. Owner will not consider change orders for extra work required by Contractor/CM due to improper or untimely coordination.

1.4 QUALITY ASSURANCE

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
B. Comply fully with manufacturers' instructions, including each step in sequence.
C. Should manufacturers' instructions conflict with contract documents, request clarification from Architect before proceeding, and document any instructions or directions that may invalidate warranty.
D. Comply with specified standards as a minimum quality for work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Perform work by persons qualified to produce workmanship of specified quality.
F. Verify that field measurements are as indicated on shop drawings or as instructed by manufacturer.
G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
H. Schedule work so no absorbent materials are installed and no concealed areas are closed up until building is dried-in and permanent doors and windows are installed to prevent development of mold or entrapment of mold or moisture inside concealed spaces or moisture absorption into interior materials.

1.5 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, most stringent tolerance shall prevail.
C. Adjust products to appropriate dimensions; position before securing products in place.

1.6 REFERENCES AND STANDARDS:

A. Comply with Section 01 42 00 – References for reference standards, definitions, abbreviations, and acronyms applicable to project.
B. Workmanship shall comply with requirements of standards specified by product or trade association, or other consensus standards of specified products, except when applicable code requirements are more stringent.
C. Use current reference standard(s) in effect at time of contract execution.
D. Obtain copies of standards where required by product specification sections.
E. Contractual relationships, duties, nor responsibilities of parties in Contract nor those of Architect shall be altered from contract documents by mention or inference otherwise in reference documents.

1.7 TESTING SERVICES:

A. Owner will appoint and pay for services specified for independent firm to perform testing.
B. Independent firm will perform tests and other specified services as outlined in individual specification sections and as required by Owner.

C. Testing and quality control may occur on or off project site.
D. Independent firm shall submit reports to Owner and Architect and Contractor/CM, indicating observations and results of tests and compliance or non-compliance with contract documents.
E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
    a. Notify Owner, Architect, and independent firm 24 hours prior to expected time for operations requiring services.
    b. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
    c. Testing does not relieve Contractor to perform work per contract requirements.
    d. As directed by Architect, independent testing firm shall re-test as result of non-conformance with requirements. Contractor shall pay for re-testing cost by deducting testing charges from the Contract Sum/Price.

1.8 BUILDING INSPECTION SERVICES:

A. Owner will employ in-house Building Official, or hire independent Building Official, and Construction Inspectors as required to perform Document review and approval, and on-site building inspections in accord with Florida Building Code, Section 453 State Requirements for Educational Facilities and other applicable codes.
B. Building Official and Inspectors will perform code interpretation, document review, project inspections, and other services specified and required in individual specification sections and shall be paid by Owner.
C. Inspections firm will conduct inspections and observations of work, indicate compliance or non-compliance with applicable codes and contract documents, and will submit reports to Architect, Contractor/CM and Owner.
D. Cooperate with inspection firm; provide safe access and assistance by incidental labor as requested.
E. Notify Owner and Architect and inspection firm 24 hours prior to expected time for operations requiring services.
F. Inspection of work does not relieve Contractor of performing work in accord with contract requirements.

1.11 MANUFACTURERS' FIELD SERVICES:

A. Where specified, 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 of equipment and as applicable, and to initiate instructions when necessary.
B. Submit qualifications of observer to the Architect 30 days in advance of required observations, the observer is subject to Owner's approval.
C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
D. Comply with Section 01 33 00 – Submittal Procedures.

1.12 COMMISSIONING

A. Comply with Section 01 91 00 – Commissioning for training of Owner’s personnel in operation and maintenance of equipment identified in this Section.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 EXAMINATION:

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work, beginning new work means acceptance of existing conditions.
B. Verify that existing substrate is capable of structural support or attachment of new work.
C. Examine and verify specific conditions described in individual specification sections. Immediately notify AE or Owner's Project Manager of conditions that would prevent meeting contractual requirements.
D. Verify that utility services are available, of correct characteristics, and in correct locations.

3.2 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 in manner approved by product manufacturer.
C. Apply manufacturers required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 CLEANING AND WASTE MANAGEMENT

A. Comply with Section 01 74 00 – Cleaning and Waste Management.

END OF SECTION

SECTION 01 66 00
PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Packaging and transportation, delivery and receiving, product handling, storage, conditions and location, maintenance, protection, repair, and replacement of products damaged while handling or in storage.

1.2 RELATED DOCUMENTS

A Section 01 31 00 – Project Management and Coordination.
B. Section 01 33 00 – Submittal Procedures.
C. Section 01 35 53 – Security Procedures.
D. Section 01 45 00 – Quality Control.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 TRANSPORTATION AND HANDLING

A. Packaging and Transportation:
   1. Supplier shall package finished products in boxes or crates to provide protection during shipment, handling, and storage at site.
   2. Products shall be protected against exposure to outside storage against damage due to weather conditions.
   3. Protect products sensitive to damage against impact, abrasion, puncture, and other damage during handling and transport to project.

3.2 DELIVERY AND RECEIVING

A. Arrange deliveries of products in accord with project schedule to allow installation and project completion per approved project schedule.
B. Prior to project commencement, Contractor's personnel shall meet with Owner's Project Manager and School staff for renovation and new construction to delineate areas for materials storage lay-down areas.
C. Restrict access of persons to storage areas in accord with Section 01 35 33 – Security Procedures.
D. Material deliveries to Owner occupied sites shall be coordinated with Owner's Project Manager to ensure availability of personnel and handling equipment for safe and secure unloading and storage of equipment.
E. Deliver products in undamaged, dry condition, in original unopened containers or packaging with identifying labels intact and legible.
F. Clearly mark partial deliveries of component parts of equipment to identify equipment and contents, to permit easy accumulation of parts, and to facilitate assembly.
G. Upon delivery, Contractor/CM shall inspect shipments for following items:
   1. Products received match reviewed submittals and Contract Documents.

2. Correct quantities.
3. Accessories and installation hardware are included.
4. Containers and packages are intact and labels are legible.
5. Products are adequately protected for conditions and are undamaged.

H. Product Handling:
1. Provide equipment and personnel to handle products to prevent product damage.
2. Handle products to avoid bending, flexing, or overstressing.
3. Lift large or heavy components by using designated lifting points in accord with manufacturers written directions.

3.3 STORAGE AND PROTECTION

A. General Requirements:
1. Store products immediately upon delivery in accord with manufacturers written directions.
2. Arrange for storage location to allow access, maintenance, and inspection of products.
3. Stored products shall not conflict with work conditions. construction is contiguous to or within existing school, Provide demising walls to physically separate new or renovation work from existing on-going school operations.

B. Enclosed Storage:
1. Store products subject to damage by weather in weathertight enclosure.
2. Maintain temperature and humidity within ranges stated in manufacturer's instructions.
4. Provide temperature and humidity control within ranges stated in manufacturer's instructions.
5. Store unpacked or loose products on shelves, in bins, or in neat groups of like items.

C. Exterior Storage:
1. Provide platforms, blocking, or skids to support fabricated products above ground, and sloped to allow drainage.
2. Protect products to avoid soiling or staining.
3. Provide product cover to prevent water or condensation on product while allowing ventilation.
4. Store loose granular materials on clean, solid surfaces such as pavement or on rigid sheet materials to prevent mixing with foreign matter.
5. Provide for surface drainage to prevent humidity, mold, or algae growth.

D. Maintenance of Storage:
1. Periodically inspect stored products on scheduled basis.
2. Verify storage facilities and environmental conditions are in compliance with manufacturer's written requirements.
3. Verify that product surfaces exposed to weather are undamaged, stolen, or have otherwise been adversely affected.

E. Maintenance of Equipment Storage:
1. Stored mechanical and electrical equipment shall comply with manufacturer's written service instructions for each item, with notice of instructions attached to each item of equipment.
2. Stored equipment shall be serviced on regular basis, maintaining log of services, and submitted to Architect in accord with Section 01 78 00 – Submittal Procedures as part of Project Record Documents.

F. Storage of Owner's Salvaged Furnishings and Equipment:
1. Contractor/CM shall provide temporary storage facilities for items to be salvaged and reinstalled.

3.4 PROTECTION OF FINISHED WORK

A. Protect finished surfaces, including doors, door jambs, soffits of openings used as passageways, through which equipment and materials are handled.
B. Protect finished floor surfaces in traffic areas prior to allowing equipment or materials to be moved.
C. Keep finished surfaces clean, unmarked, and suitably protected until Owner's project acceptance.

3.5 REPAIRS AND REPLACEMENTS

A. Promptly replace or repair damaged equipment or building surfaces caused by moving equipment at no additional cost to Owner.

B. Additional time required to repair or replace damaged equipment or building surfaces shall not be grounds for Contract time extension or Contractor's additional expense unless Owner specifically authorizes time extension or additional costs.

END OF SECTION

SECTION 01 74 00
CLEANING AND WASTE MANAGEMENT

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Administrative and procedural requirements for waste management and cleaning during construction and final cleaning at Substantial Completion.
B. Development and implementation of Waste Management Plan to indicate following procedures:
   1. Limiting amount of project waste through planning, scheduling, and project management.
   2. Recycling demolished structures and construction and waste materials, and reuse of recycled or salvaged materials whenever possible.
   3. Procedures to reduce construction noise, fumes, vibration, dust or other airborne contaminates.
   4. Adherence to Federal, State, and local environmental and anti-pollution regulations and ordinances.
   5. Waste materials shall be suitably disposed off site in approved landfill sites.
   6. Development of contamination containment plan to include procedures for addressing volatile and hazardous materials or their waste products, cleaning materials and residue.
C. Cleaning and Protection:
   1. Development of daily and periodic construction cleaning and protection of products stored on site or erected in project and shall include sequence and frequency policy and schedule for project duration.
   2. Development of evacuation, fire and life safety plan, staff training procedures in handling and disposal of materials deleterious to human contact or exposure.
   3. Final cleaning leaving project ready for Owner's acceptance.

1.2 RELATED SECTIONS

A. Section 01 31 00 – Project Management and Coordination.
B. Section 01 33 00 – Submittal Procedures.
C. Section 01 42 00 – References.
D. Section 01 66 00 – Product Storage and Handling Requirements.
E. Section 01 78 00 – Closeout Submittals.

1.3 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Submit MSDS sheets for products requiring special care or handling in storage, application, or cleanup.
C. Submit Waste Management and Cleaning Plans identifying and providing operational procedures for each item noted in Scope of Work.

1.4 COORDINATION

A. Coordinate scheduling and implementation of Waste Management and Cleaning Plans with each trade on site.

B. Ensure enforcement to promote efficient and orderly sequence of installation of interdependent construction elements, with intent to reduce waste maximize efficient and safe work environment.
C. Coordinate periodic and final clean-up of Work of each trade in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.

1.5 QUALITY ASSURANCE

A. Monitor each trade, product suppliers, product deliveries, waste generation, site conditions, and workmanship, to minimize waste and maximize recycled materials and reuse of retained materials.

PART 2 PRODUCTS

NOT USED (See individual product specifications for cleaning products recommended by manufacture.)

PART 3 EXECUTION

NOT USED (See individual product specifications for written cleaning procedures and instructions recommended by manufacture.)

END OF SECTION

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Closeout procedures.
B. Final cleaning.
C. Adjusting.
D. Project record documents.
E. Operation and maintenance data.
F. Spare parts and maintenance Products.
G. Warranties and bonds.
H. Maintenance service.
I. Training.

1.2 RELATED SECTIONS

A. Section 01 29 00 – Payment Procedures.
B. Section 01 33 00 – Submittal Procedures.
C. Section 01 91 00 – Commissioning.
D. Section 27 60 00 – Integrated Audio System.

1.3 CLOSEOUT PROCEDURES

A. Submit written certification that contract documents were reviewed, work inspected, and that work is complete in accord with contract documents and ready for Owner's Project Manager and AE's review.
B. Provide submittals to AE and Owner's Project Manager that are required by building and fire authorities.
    1. Submit final application for payment identifying total adjusted contract sum, previous payments, and sum remaining due.
    2. Owner may opt to occupy all or portions of completed facilities upon substantial completion of those portions of work.
    3. Contractor/CM shall provide punch list to AE identifying items remaining to be completed.
    4. AE shall inspect project to determine completion of punch list and project compliance with Contract Documents.

1.4 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains, and foreign substances.
C. Clean equipment and fixtures to sanitary condition with cleaning materials per manufacturer's written recommendations.
D. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.5 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of record documents, recording accurate field revisions to contract documents to include:
   1. Drawings/specifications and addenda.
   2. Change orders and other modifications to work.
   3. Reviewed shop drawings, product data, and samples.
   4. Manufacturer's instruction for assembly, installation, and adjusting.
B. Ensure entries are complete and accurate, enabling ready access and reference by Owner's Project Manager.
C. Store record documents separate from documents used for construction.
D. Record information concurrent with construction progress.
E. Specifications shall be legibly marked and recorded for each product used indicating the following:
   1. Manufacturer's name, product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by addenda and modifications.
F. Record drawings and shop drawings shall be legibly marked with each item recorded to indicate actual construction as follows"
   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 details.
   5. Details not on original contract drawings.
H. Upon project completion, transfer project record drawing information to Autocad (2010 or later format) files and provide four copies of CD's to Architect for review and transmitted to Owner, prior to claim for final Application for Payment.
   1. Contractor/CM shall also submit two hard copies of record drawings and project manual maintained during project to Owner's Project Manager.
   2. Owner will be responsible for making prints from CD's and for their distribution to Owner's user groups.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit documentation as noted in individual product specifications and as noted herein.

1.8 SPARE PARTS AND MAINTENANCE PRODUCTS

1. Provide spare parts, maintenance, and extra products in quantities specified in specification.
2. Deliver to Owner; obtain receipt prior to final payment.

1.9 WARRANTIES

A. Submit documentation as noted in individual product specifications and as noted herein.
B. Provide duplicate notarized copies.
C. Execute and assemble transferable warranty documents from subcontractors, suppliers, and manufacturers.
D. Provide Table of Contents and assemble in D-side 3-ring white binders with typed title sheet of contents inside durable plastic front cover.
E. Submit prior to final application for payment.
F. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in specification sections for one-year from date of project substantial completion.
B. Examine, clean, adjust, and lubricate system components as required for reliable operation.
C. Include systematic examination, adjustment, and lubrication of components repairing or replacing parts as required with parts produced by the manufacturer of the original component.
D. Owner shall approve in writing of transfers or reassignments of maintenance service tasks.

1.11 ASBESTOS CERTIFICATION

A. Provide notarized letter from Contractor/CM certifying that “to the best of his/her knowledge no asbestos containing building materials were used as a building material in the project”, per FS 255.40.

1.12 PROJECT CLOSE-OUT PROCEDURES

A. Items are to be submitted to the School District’s Construction Manager’s Office once the request for final payment has been submitted.

1. ____ 4 Copies: AIA Application For Payment, Signed and Sealed, Noted as Final Payment.

2. ____ Consent of Surety to make final payment.

3. ____ Release of Lien from all Sub-Contractors or Laborers who have filled an Intent to Lien.

4. ____ Warranty/Guarantee from Construction Manager for one-year from the date of Substantial Completion.

5. ____ Warranty/Guarantee from each Sub-Contractor for one-year from the date of Substantial Completion.

6. ____ Copy of the approval by the Architect-Engineer and the transmittal to the end user of manuals, shop drawings, as-builds, brochures, warranties, list of sub-contractors with phone numbers, addresses and contact persons.

7. ____ Verification that all applicable district personnel have been trained in the operation of their new equipment (per system: HVAC, controls, etc.)

8. ____ Executed Roof Warranty in the name of the Martin County School District.

9. ____ 4 Copies: OEF Form 209, Certificate of Final Inspection.

10. ____ 4 Copies: Completed Punch-list.

11. ____ SREF 4.2(3)(e) Architect's Certificate of Specification of Asbestos Containing Materials.

12. ____ SREF 4.2(3)(e) Contract's Certificate of Asbestos Use.

13. ____ SREF 4.2(3)(d) Threshold inspector's statement that building complies with Threshold Plan.

14. ____ 4 Copies: OEF Form 110B, Certificate of Occupancy.

15. ____ OEF Form 564 for new construction or additions to existing schools only. (Return to Director's Secretary)

16. ____ Inspection Log Book

PART 2 PRODUCTS

2.1 APPROVED PRODUCTS

A. Use only cleaning and maintenance products approved for use in Florida Educational Facilities.

PART 3 EXECUTION

3.1 Not used.

END OF SECTION

SECTION 01 91 00
COMMISSIONING

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Administrative and procedural requirements for commissioning facilities and facility systems.
B. Demonstration and training.
C. Starting systems.
D. Demonstration and instructions.

1.2 RELATED SECTIONS

A. Section 01 31 00 – Project Coordination.
B. Section 01 78 00 – Closeout Documents.
C. Section 23 05 93 – Testing, Adjusting, and Balancing HVAC.

1.3 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.
B. Notify Architect and Owner seven days prior to startup of each item.
C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.
D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
E. Verify wiring and support components for equipment are complete and tested. Execute startup under supervision of responsible Contractors' personnel 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 startup, and to supervise placing equipment or system in operation.
G. Submit written reports per section 01 78 00 – Execution and Closeout Documents that equipment or system is installed and functioning correctly.

1.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
B. Demonstration of equipment shall be performed by qualified manufacturers' representative who is knowledgeable about the Project and equipment.
C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.
F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. Amount of time required for instruction in each piece of equipment and system is indicated in individual equipment and system specification sections.

1.5 TESTING, ADJUSTING, AND BALANCING

A. Contractor/CM shall employ and pay for commissioning services other than TAB firm to perform testing, adjusting, and balancing of other systems as indicated or require for fully functional systems.
B. Independent TAB firm shall perform services specified in Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC system(s).
C. The Contractor/CM shall submit reports to Architect indicating observations, results of tests, and compliance or non-compliance with specified requirements and with requirements of contract documents.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 LIST OF EQUIPMENT TO BE COMMISSIONED:

A. Communications System
B. Fire Alarm System
C. Intercom System
D. Kitchen Equipment
E. HVAC Equipment.
F. Lighting Systems
G. Fire Protection System
H. Movable Interior Partitions

3.2 EQUIPMENT COMMISSIONING REQUIREMENTS

A. Comply with individual specification sections for equipment start-up, operation, and training.

END OF SECTION

SECTION 02 41 13
SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Required demolition of designated existing elements
   2. Salvage of designated items

1.3 REFERENCES

A. Comply with NFPA 1 – Chapter 29 and NFPA 241 Standard for Safeguarding Construction Alteration and Demolition Operation 2000 Edition
B. Florida Building Code – FBC

1.4 NOTIFICATION OF OWNERS OF UTILITY LINES AND EQUIPMENT

A. Notify the Owner or local authority owning any conduits, wires, pipes, or equipment affected by demolition work.
B. Arrange for removal or relocation of affected items and pay fees or costs in conjunction with removal or relocation, except as otherwise noted.

1.5 PROTECTION

A. Prior to starting any work on site, provide a safety plan as outlined in Section 453 FBC to the Building Department for approval.
B. Coordinate the implementation of the safety plan with the Building Department, Campus Police, School Representative, and Program Management.
C. Prior to starting demolition operations, provide necessary protection of existing spaces and items to remain.
D. Owner may be continuously occupying areas of the building immediately adjacent to areas of selective demolition. If Owner continues to occupy the facility comply with the following:
   1. Conduct demolition work in a manner that will minimize need for disruption of the Owners normal operations.
   2. Provide protective measures as required to provide free and safe passage of Owner's personnel and public to and from occupied portions of the facilities.
   3. Provide minimum of 72 hours advance notice to Owner of demolition activities that will impact Owners normal operations.
      a. Obtain specific approval from Owner for impact.
E. Owner assumes no responsibility for actual condition of items to be demolished.
   1. Owner will maintain conditions at time of commencement of contract insofar as practical.

F. Protect any exposed existing finish work that is to remain during demolition operations.
G. Erect and maintain dust proof partitions, closures, and ventilator system as required preventing the spread of dust or fumes to occupied portions of the building.
    1. Take whatever precautions necessary to minimize impact on occupied areas.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable codes for demolition of structures, safety of adjacent structures, dust control, runoff, and erosion control, and disposal of demolished materials.
B. Obtain required permits from authorities having jurisdiction.
C. Notify affected utility companies before starting work and comply with their requirements.
D. Do not close or obstruct roadways, sidewalks, and hydrants, without permits.
E. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.
    1. Contact the Architect and Owner immediately.
F. Test soils around buried tanks for contamination.
G. No demolition will occur during school hours without the written permission of the Owner.

1.7 EXPLOSIVES

A. The use of explosives is strictly prohibited.

PART 2 PRODUCTS - (Not applicable)

PART 3 EXECUTION

3.1 PREPARATION

A. Verify the proper disconnection and capping of all abandoned utilities.
B. Verify that required barricades and other protective measures are in place.
C. Provide necessary shoring, bracing, and other precautions required for proper support of existing structure during cutting and demolition operations.
D. Photograph existing conditions of structure, surfaces, equipment and surrounding spaces that could be misconstrued as damage resulting from selective demolition work; submit photographs and written report of existing damage to Architect prior to starting work.
    1. Contractor shall repair damage caused to existing facilities at no cost to Owner unless they can provide documentation is indicating pre-existing damage.

3.2 DEMOLITION OPERATIONS

A. Cut and remove elements and equipment as designated on Drawings.
    1. Remove elements in their entirety unless otherwise indicated.
B. Execute demolition in a careful and orderly manner with least possible disturbance or damage to adjoining surfaces and structure.
C. Exercise extreme caution in cutting and demolition of portions of existing structure.
    1. Obtain approval of Architect prior to cutting or removing structural members for any reason.
D. Avoid excessive vibrations in demolition procedures that may transmit through existing structure and finish materials.

E. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning assessment, removal, handling, and protection against exposure or environmental pollution and immediately contact the District's ECO.

3.3 DISPOSAL

A. Materials, equipment, and debris resulting from demolition operations shall become property of Contractor.
   1. Remove demolition debris at least once each day in accordance with applicable City, State, and Federal Laws.
B. Cover debris in trucks with approved netting to prevent spillage during transportation.
C. Do not store except in approved containers or burn materials on site.
   1. Remove combustible waste materials in a manner approved by local Fire Department.
   2. Remove, handle, and dispose of any hazardous waste and debris in accordance with applicable City, State, and Federal Laws.
D. Transport demolition debris to off-site disposal area and legally dispose of debris.
E. Use street routes specifically designated by City for hauling debris.
F. When possible dispose of material to recycling centers.

3.4 CLEANING AND REPAIR

A. Leave building broom clean and free of debris, ready to receive new work.
B. Repair demolition performed in excess of that required.
   1. Return structures and surfaces to remain to condition existing prior to commencement of selective demolition.

END OF SECTION

SECTION 03 10 00 – CONCRETE FLOOR REMOVAL AND REPLACEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Concrete removal and replacement.
   b. Reinforcement.
   c. Accessories.

1.3 REFERENCES

A. ACI 117 – Standard Tolerances for Concrete Construction and Materials
B. ACI 301 – Specifications for Structural Concrete for Buildings
C. ACI 302.1R – Guide for Concrete Floor and Slab Construction
D. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
E. ASTM A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
F. ASTM C33 – Standard Specification for Concrete Aggregates
G. ASTM C150 – Standard Specification for Portland Cement

1.4 ACTION SUBMITTALS

A. Product Data: Material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For concrete specialist.

B. Material Certificates: For each type of portland cement and aggregate supplied for mixing or adding to products at Project site.

1.6 QUALITY ASSURANCE

A. Concrete-Maintenance Specialist Qualifications: Engage an experienced concrete firm that employs installers and supervisors who are trained to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing or patching new concrete is insufficient experience for concrete-maintenance work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

B. Store cementitious materials off the ground, under cover, and in a dry location.

C. Store aggregates covered and in a dry location; maintain grading and other required characteristics and prevent contamination.

1.8 FIELD CONDITIONS

A. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.

B. Hot-Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of 90 deg F (32 deg C) and above.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. Comply with ACI 301, ACI 302, and ACI 117 (ACI 117M).

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615, Grade 60.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, or Type III.

B. Normal-Weight Aggregate: ASTM C 33/C 33M, 1/2-inch nominal maximum aggregate size.

C. Air-Entraining Admixture: ASTM C 260/C 260M.

D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

E. Water: ASTM C 94/C 94M.

2.4 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: Monofilament or fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

2.5 CURING MATERIALS

A. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.6 BONDING AGENTS

A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Manufactured product that consists of water-insensitive epoxy adhesive, portland cement, and water-based solution of corrosion-inhibiting chemicals that forms a protective film on steel reinforcement.

2.7 SHEET MATERIALS

A. Below Grade Sheet Retarder shall have the following properties:

1. Basis of Design: “Stego Vapor Barrier” as manufactured by Stego Co.

2. Permeance Rating: Per ASTM E96 or ASTM F1249. Material shall meet permeance requirement for both new material and after ASTM E1745 mandatory condition test sections 8, 11, 12, and 13.
3. Water Vapor Retarder: Meet or exceed Class A per ASTM E1795
4. Polyethylene film, 15-mil thick, and perm rating of .01 perms (gr/ft2/hr/in-HG)

B. Polyurethane Sealant: ASTM C920, single component, chemical curing, non-sagging, and black color

1. Elongation Capability: 25%
2. Shore A Hardness Range: 20 to 35

C. Tape shall be as required by the manufacturer of the vapor retarder with a maximum water vapor transmission rate of .03 perms (ASTM E 96).

2.8 CONCRETE MIXTURES

A. Comply with ACI 301 (ACI 301M).

B. Normal-Weight Concrete:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
3. Slump: 4 inches to 5 inches with verified slump of 2 to 4 inches before adding high.
4. Air Content: Maintain within range permitted by ACI 301 (ACI 301M). Do not allow air content of trowel-finished floor slabs to exceed 3 percent.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116 and furnish batch ticket information.

1. When air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL

A. Have concrete-maintenance work performed only by qualified concrete-maintenance specialist.

B. Comply with manufacturers' written instructions for surface preparation and product application.

3.2 PREPARATION

A. Ensure that supervisory personnel are on-site and on duty when work begins and during its progress.

B. Protect surrounding surfaces of building from harm resulting from work.

1. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.
2. Use only proven protection methods appropriate to each area and surface being protected.
3. Provide temporary barricades, barriers, and directional signage to exclude public from areas where concrete maintenance work is being performed.
4. Contain dust and debris generated by concrete maintenance work and prevent it from reaching the public or adjacent surfaces.
5. Protect adjacent surfaces and equipment by covering them with heavy polyethylene film and waterproof masking tape or a liquid strippable masking agent. If practical, remove items, store, and reinstall after potentially damaging operations are complete.
6. Dispose of debris and runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

C. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is in working order.

1. Prevent solids such as aggregate or mortar residue from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from concrete maintenance work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

D. Preparation for Concrete Removal: Examine construction to be repaired to determine best methods to safely and effectively perform concrete maintenance work. Examine adjacent work to determine what protective measures will be necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed in the course of repair.

1. Verify that affected utilities have been disconnected and capped.

3.3 CONCRETE REMOVAL

A. Saw-cut perimeter of areas indicated for removal to a depth of at least 1/2 inch. Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcement.

B. Thoroughly clean removal areas of loose concrete, dust, and debris.

3.4 BONDING AGENT APPLICATION

A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Apply to concrete by stiff brush or hopper spray according to manufacturer's written instructions. Apply to reinforcing bars in two coats, allowing first coat to dry two to three hours before applying second coat. Allow to dry before placing patching mortar or concrete.

3.5 SOIL TREATMENT

A. Soil Treatment: Treat soil per Specification Section “Soil Treatment”.

3.6 VAPOR BARRIER INSTALLATION

A. Install, protect, and repair vapor retarders according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.

B. Remove loose or foreign matter that might impair adhesion.

C. Clean and prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.

D. Vapor barrier shall be installed in accordance with manufacturer's specifications, free of air pockets and wrinkles.

E. All laps shall be continuously sealed with adhesive according to manufacturer's recommendations.

F. Lap all joints a minimum of 6” and tape joints.

G. Seal all penetrations (including pipes) per manufacturer’s requirements with tape to restore barrier integrity.

H. Secure to existing vapor barrier at least 6” where possible. If not possible provide 2” tape lap under existing vapor barrier and tie in new vapor barrier and provide additional tape to provide a tight seal.

3.7 REINFORCEMENT INSTALLATION

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Install #5 rebar dowels 12" long at 24" o.c. around perimeter of opening. Drill 6” deep hole in existing concrete and secure with non-shrink grout.

C. Install welded wire fabric and lap adjoining pieces at least one full mesh and lace splices with 16 gauge wire.

3.8 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

C. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.

3.9 CONCRETE PLACEMENT

A. Comply with ACI 301 for placing concrete.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

C. Do not add water to concrete during delivery, at Project site, or during placement.

D. Consolidate concrete with mechanical vibrating equipment according to ACI 301.

3.10 FINISHING UNFORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.

1. Do not further disturb surfaces before starting finishing operations.

C. Finish: Match adjacent existing floor finishes unless otherwise indicated.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 (ACI 301M) for hot-weather protection during curing.

B. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

C. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests: Perform according to ACI 301 (ACI 301M).

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

END OF SECTION 03 10 00

SECTION 03 10 10 – CAST-IN-PLACE CONCRETE PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
    a. Concrete patching.
    b. Reinforcement.
    c. Accessories.

1.3 REFERENCES

A. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
B. ASTM A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
C. ASTM C33 – Standard Specification for Concrete Aggregates.
D. ASTM C150 – Standard Specification for Portland Cement.

1.4 ACTION SUBMITTALS

A. Product Data: Material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For concrete specialist.

B. Material Certificates: For each type of portland cement and aggregate supplied for mixing or adding to products at Project site.

1.6 QUALITY ASSURANCE

A. Concrete-Maintenance Specialist Qualifications: Engage an experienced concrete firm that employs installers and supervisors who are trained to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing or patching new concrete is insufficient experience for concrete-maintenance work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

B. Store cementitious materials off the ground, under cover, and in a dry location.

C. Store aggregates covered and in a dry location; maintain grading and other required characteristics and prevent contamination.

1.8 FIELD CONDITIONS

A. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.

B. Hot-Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of 90 deg F (32 deg C) and above.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: For repair products, obtain each color, grade, finish, type, and variety of product from single source and from single manufacturer with resources to provide products of consistent quality in appearance and physical properties.

2.2 BONDING AGENTS

A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Manufactured product that consists of water-insensitive epoxy adhesive, portland cement, and water-based solution of corrosion-inhibiting chemicals that forms a protective film on steel reinforcement.

2.3 PATCHING MORTAR

A. Patching Mortar Requirements:

1. Only use patching mortars that are recommended by manufacturer for each applicable horizontal, vertical, or overhead use orientation.
2. Color and Aggregate Texture: Provide patching mortar and aggregates of sizes necessary to produce patching mortar that matches existing, adjacent, exposed concrete. Blend several aggregates if necessary to achieve suitable matches.

B. Polymer-Modified, Cementitious Patching Mortar: Packaged, dry mix for repair of concrete and that contains a latex additive as either a dry powder or a separate liquid that is added during mixing.

2.4 AGGREGATE

A. Aggregate: Washed aggregate, ASTM C 33/C 33M.

2.5 REINFORCEMENT

A. Reinforcing Bars (ReBar): ASTM A615, Grade 60 for bars No. 5.

B. Welded Wire Fabric (WWF): ASTM A1064.

2.6 SHEET MATERIALS

A. Below Grade Sheet Retarder (Building slabs on grade) shall have the following properties

1. Basis of Design: “Stego Vapor Barrier” as manufactured by Stego Co.
2. Permeance Rating: Per ASTM E96 or ASTM F1249. Material shall meet permeance requirement for both new material and after ASTM E1745 mandatory condition test sections 8, 11, 12, and 13.
3. Water Vapor Retarder: Meet or exceed Class A per ASTM E1795
4. Polyethylene film, 15-mil thick, and perm rating of .01 perms (gr/ft2/hr/in-HG)

B. Polyurethane Sealant: ASTM C920, single component, chemical curing, non-sagging, and black color

1. Elongation Capability: 25%
2. Shore A Hardness Range: 20 to 35

C. Tape shall be as required by the manufacturer of the vapor retarder with a maximum water vapor transmission rate of .03 perms (ASTM E 96).

2.7 MISCELLANEOUS MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I, II, or III unless otherwise indicated.

B. Water: Potable.

2.8 MIXES

A. General: Mix products, in clean containers, according to manufacturer's written instructions.

1. Do not add water, thinners, or additives unless recommended by manufacturer.
2. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit of measure.
3. Do not mix more materials than can be used within time limits recommended by manufacturer. Discard materials that have begun to set.

PART 3 - EXECUTION

3.1 CONCRETE REPLACEMENT

A. Have concrete-maintenance work performed only by qualified concrete-maintenance specialist.

B. Comply with manufacturers' written instructions for surface preparation and product application.

3.2 EXAMINATION

A. Notify Architect seven days in advance of dates when areas of deteriorated or delaminated concrete and deteriorated reinforcing bars will be located.

B. Locate areas of deteriorated or delaminated concrete using hammer or chain-drag sounding and mark boundaries. Mark areas for removal by simplifying and squaring off boundaries. At columns and walls make boundaries level and plumb unless otherwise indicated.

C. Perform surveys as the Work progresses to detect hazards resulting from concrete-maintenance work.

3.3 PREPARATION

A. Ensure that supervisory personnel are on-site and on duty when concrete maintenance work begins and during its progress.

B. Protect persons, motor vehicles, surrounding surfaces of building being repaired, building site, plants, and surrounding buildings from harm resulting from concrete maintenance work.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Use only proven protection methods appropriate to each area and surface being protected.

E. Provide temporary barricades, barriers, and directional signage to exclude public from areas where concrete maintenance work is being performed.

F. Contain dust and debris generated by concrete maintenance work and prevent it from reaching the public or adjacent surfaces.

G. Protect adjacent surfaces and equipment by covering them with heavy polyethylene film and waterproof masking tape or a liquid strippable masking agent. If practical, remove items, store, and reinstall after potentially damaging operations are complete.

H. Dispose of debris and runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

I. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is in working order.

1. Prevent solids such as aggregate or mortar residue from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from concrete maintenance work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

J. Preparation for Concrete Removal: Examine construction to be repaired to determine best methods to safely and effectively perform concrete maintenance work. Examine adjacent work to determine what protective measures will be necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed in the course of repair.

1. Verify that affected utilities have been disconnected and capped.

3.4 CONCRETE REMOVAL

A. Saw-cut perimeter of areas indicated for removal to a depth of at least 1/2 inch. Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcement.

B. Thoroughly clean removal areas of loose concrete, dust, and debris.

3.5 BONDING AGENT APPLICATION

A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Apply to concrete by stiff brush or hopper spray according to manufacturer's written instructions. Apply to reinforcing bars in two coats, allowing first coat to dry two to three hours before applying second coat. Allow to dry before placing patching mortar or concrete.

3.6 PATCHING MORTAR APPLICATION

A. Place patching mortar as specified in this article unless otherwise recommended in writing by manufacturer.

B. Pretreatment: Apply specified bonding agent.

C. General Placement: Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.

D. Finishing: Allow surfaces of lifts that are to remain exposed to become firm and then finish to a smooth surface with a wood or sponge float.

E. Curing: Wet-cure cementitious patching materials, including polymer-modified cementitious patching materials, for not less than seven days by water-fog spray or water-saturated absorptive cover.

3.7 SOIL TREATMENT

A. Soil Treatment: Treat soil per Specification Section “Soil Treatment”

3.8 VAPOR BARRIER INSTALLATION

A. Remove loose or foreign matter that might impair adhesion.

B. Clean and prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.

C. Vapor barrier shall be installed in accordance with manufacturer's specifications, free of air pockets and wrinkles.

D. All laps shall be continuously sealed with adhesive according to manufacturer's recommendations.

E. Lap all joints a minimum of 6” and tape joints.

F. Seal all penetrations (including pipes) per manufacturer’s requirements with tape to restore barrier integrity.

G. Secure to existing vapor barrier at least 6” where possible. If not possible provide 2” tape lap under existing vapor barrier and tie in new vapor barrier and provide additional tape to provide a tight seal.

3.9 REINFORCEMENT INSTALLATION

A. Install #5 rebar dowels 18” long at 24” o.c. around perimeter of opening. Drill 6” deep hole in existing concrete and secure with non-shrink grout.

B. Install welded wire fabric and lap adjoining pieces at least one full mesh and lace splices with 16 gauge wire.

3.10 CONCRETE PLACEMENT

A. Place concrete as specified in this article.

B. Pretreatment: Apply epoxy-modified, cementitious bonding and concrete substrate.

C. Standard Placement:

1. Use vibrators to consolidate concrete as it is placed.
2. At unformed surfaces, screed concrete to produce a surface that when finished with patching mortar will match required profile and surrounding concrete.
3. introduced. When formed space is full, close air vents and pressurize to 14 psi (96 kPa).

D. Wet-cure concrete for not less than seven days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.

END OF SECTION 03 10 10

SECTION 03 29 00
UNDER-SLAB VAPOR BARRIER/RETARDER

PART 1 GENERAL

1.1 SUMMARY

A. Products Supplied Under This Section
   1. Vapor Barrier, seam tape, pipe boots, and detail strip for installation under concrete slabs.
B. Related Documents
   1. Specification 033000 Cast-in-Place Concrete

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM E 1745-97 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil Or Granular Fill Under Concrete Slabs.
   2. ASTM E 154-88 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.
   3. ASTM E 96-95 Standard Test Methods for Water Vapor Transmission of Materials.
   4. ASTM E 1643-98 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
B. American Concrete Institute (ACI)
   1. ACI 302.1R-96 Vapor Barrier Component.

1.3 SUBMITTALS

A. Quality Control / Assurance
   1. Independent laboratory test results showing compliance with ASTM & ACI Standards.
   2. Manufacturer's samples, literature.
   3. Manufacturer's installation instructions for placement, seaming and pipe boot installation.

PART 2 PRODUCTS

2.1 MATERIALS

A. Vapor Barrier (Performance based specification)
   1. Vapor Barrier membrane must have the following properties.

a.	Minimum WVTR as tested by	ASTM E96	of 0.008
b.	Water Vapor Barrier	ASTM E-1745	Meets or exceeds Class B
c.	Water Vapor Transmission Rate	ASTM E-96	0.006 gr./ft^2/hr. or lower
d.	Permeance Rating	ASTM E-96	0.01 gr./ft^2/hr. or lower
e.	Puncture Resistance	ASTM E-1745	minimum 1970 grams
f.	Tensile Strength	ASTM E-1745	minimum 45.0 lbf/in

   2. Vapor Barriers
      a. Stego (15mil) Vapor Barrier by STEGO INDUSTRIES LLC.
      b. W.R. Meadows Premoulded Membrane with Plasmatic Core
      c. Vaporguard by Reef industries

2.2 ACCESSORIES

A. Seam Tape
   1. High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4".
B. Pipe Boots
   1. Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.

PART 3 EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by architect
   1. Level and tamp or roll aggregate, sand or tamped earth base.

3.2 INSTALLATION

A. Install Vapor Barrier:
   1. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643–98.
      a. Unroll Vapor Barrier with the longest dimension parallel with the direction of the pour.
      b. Lap Vapor Barrier over footings and seal to foundation walls.
      c. Overlap joints 6 inches and seal with manufacturer's tape.
      d. Seal all penetrations (including pipes) with manufacturer's pipe boot.
      e. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
      f. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all four sides with tape.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to work of this Section.
B. Specification 032900 – Under Slab Vapor Barrier / Retarder.

1.2 DESCRIPTION OF WORK

A. Provide cast-in-place concrete work as shown on the drawings and specified herein.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified;
   1. ACI 301 "Specifications for Structural Concrete for Buildings."
   2. ACI 304 "Recommend Practice for Measuring, Mixing, Transporting, and Placing Concrete."
   3. ACI 311 "Recommend Practice for Concrete Inspection."
   4. ACI 315 "Manual of Standard Practice for Detailing Concrete Structures."
   5. ACI 318 "Building Code Requirements for Reinforced Concrete."
   6. ACI 347 "Recommend Practice for Concrete Formwork."
   7. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."
B. Full Cooperation shall be given to mechanical, electrical, and plumbing installers to allow them time to coordinate and install all items of their work which are to be encased or built into concrete. Contractor to assure that other work such as sleeves, electrical conduits, pipes, anchors, etc., are properly placed and secured in position before concrete is placed. Items that require inspection shall have been inspected and tested for both material and mechanical operation and shall have been completed before concrete is placed.

1.4 SUBMITTAL

A. Shop Drawings: Submit for review shop drawings for all concrete work showing reinforcement, bending details, bar schedules, stirrup spacing, and placing details for all reinforcement.
B. Shop drawings shall bear the initials of both the detailer and checker to indicate that said shop drawings have been checked by the shop prior to submission.
C. Any error, including omissions, coordination, and errors in dimensions shown on shop drawings shall be the responsibility of the Contractor. Prepare shop drawings in sufficient time to allow the Architect 14 calendar days from his receipt of the full set in which to review and check same.
D. Shop drawings for formwork indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually. Formwork shop drawings must be signed and sealed by a professional engineer in the state of Florida.

E. Mix Designs: Submit for review lab test reports for concrete materials and mix designs as specified. Provide test data sample with standard deviation calculations for each mix submitted.
F. Mill Reports: Submit for information purposes only mill reports covering the chemical and physical properties of reinforcing as specified.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
B. Store materials to permit easy access for inspection and identification. Keep reinforcing steel under cover and off the ground using supports. Protect reinforcing steel from rusting, oil, grease, or distortion.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Unless otherwise shown or specified, construct all formwork for exposed concrete surfaces with a rigid non-absorptive material to offer optimum appearance and leave a smooth, stain-free surface. Furnish in largest practicable sizes to minimize number of joints. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without objectionable bow or deflection.
B. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I.
C. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
D. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
E. Form Ties: Provide factory-fabricated, adjustable-length, removable metal form ties with cones on each side, designed to prevent deflection, and to prevent spalling concrete surfaces upon removal.
F. Unless otherwise indicated, provide form ties which will leave a hole not larger than 1" diameter in the concrete surface.
G. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 mg/l volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 CONCRETE MATERIALS

A. Portland Cement: Portland Cement shall conform to ASTM C150, Type 1.
B. All cement shall be from the same mill and manufacturer to insure cement of uniform color and shade for all exposed concrete.
C. High early strength Portland cement or other special cement shall be used only when authorized by the Architect.
D. Fly Ash: ASTM C618, Type F., 20% max.
E. Fine Aggregate: Fine aggregate shall be clean, natural siliceous sand consisting of hard, strong, durable, uncoated particles, and shall conform to the requirements of ASTM C33.

F. Coarse Aggregate for Stone Concrete: Coarse aggregate for stone concrete shall consist of clean, hard, uncoated, strong, durable gravel or crushed stone and shall conform to the requirements of ASTM C33.
G. Color and source of aggregates shall be approved by the Architect after review of mock-up samples. All aggregates for each class of concrete used shall be from the same source to insure that concrete is of uniform color and shade.
H. Water: Water for mixing and curing concrete shall be potable and shall not contain amounts of impurities injurious to the concrete. Drinkable.

2.3 REINFORCING MATERIALS

A. Reinforcing Steel: Reinforcing steel must be correctly rolled to section and free from all surface defects and shall be in accordance with ASTM A615 Grade 60 as evidenced by manufacturer's certificates. The grade of steel shall be intermediate, new billet stock. All bars shall be deformed and rolled with raised symbols to identify the manufacturer and the size of the bar.
B. Welded Wire Mesh shall conform to ASTM A185 and ASTM A82 (FY = 65 ksi). Flat sheets only.
C. Steel Wire: The Wire shall be No. 18 U.S. Steel wire gauge black annealed wire.
D. Supports for Reinforcement: Spacer bars, slab bolsters, chairs, wiring, nails, and other accessories shall be standard commercial metal supports, and plastic or stainless steel where exposed to weather, or where rust could impair architectural finishes. Use chairs with plastic tips on all framed slabs.

2.4 ADMIXTURES

A. General: No admixtures other than those listed below shall be used in concrete mixes after design mix approval. Admixtures shall contain no more chloride ions than are present in municipal drinking water. Certification of conformance to requirements and the chloride ion content will be required from the admixture manufacturer prior to mix design review to the Architect. Upon request only, provide a qualified, full-time representative to assure proper use of admixtures.
B. Water Reducing Admixture: The water-reducing admixture "Eucon WR-75" manufactured by the Euclid Chemical Company, "Plastocrete 161" manufactured by the Sika Chemical Corporation, or "Pozzolith 322N" manufactured by Master Builders Company or equal shall be used in all concrete. The admixture shall conform to ASTM C494, Type A, and shall not contain more chloride ions than are present in municipal drinking water.
C. High Range Water Reducing Admixture (Superplasticizer): "Eucon 37" by The Euclid Chemical Company or "Sikament" by Sika Chemical Corporation, may be used in all pumped concrete and concrete with a water-cement ratio below 0.50. The admixture shall conform to ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
D. Non-Corrosive, Non-Chloride Accelerator: "Accelguard 80" by the Euclid Chemical Company or "Pozzolith LL880" by Master Builders. The admixture shall conform to ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. It shall be used in all concrete placed at temperatures below 50 degrees F.
E. The admixture manufacturer must have long-term, non-corrosive test data from an independent testing laboratory (of a least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.

F. Water Reducing Retarder Admixture: The water reducing retarder admixture "Eucon Retarder-75" manufactured by the Euclid Chemical Company, "Plastocrete 161R" manufactured by Sika Chemical Corporation or "Pozzolith 100-XR" manufactured by Master Builders or approved equal, shall not contain more chloride ions than are present in municipal drinking water.
G. Air Entraining Admixture: The air-entraining admixture shall conform to ASTM C260 and shall be used where necessary to achieve the specified air content.
H. Calcium Chloride: Calcium chloride, thiocyanate, or admixture containing more than 0.05% chloride ions are not permitted.
I. Air Content: Air content of concrete shall be as follows:
J. For concrete exposed to soil and/or weather, 5%+ 1.5%.
K. 3% for all other concrete.

2.5 RELATED MATERIALS

A. Joint Filler: Expansion joint fillers shall be asphalt impregnated fiber board conforming to ASTM D-1751. Joint fillers shall extend full depth of slab or joint and be thickness and lengths indicated on drawings.
B. Anchor Slots: Hot-Dipped galvanized, #22 ga. metal, felt filled, equal to No. 305 made by Hohman & Bernard or approved equal.
C. Inserts: Inserts shall be either adjustable, threaded or wedge types depending on use as manufactured by Hohman & Bernard or approved equal.
D. Non-Shrink Grout: Pre-mixed non-shrink grout as called for on drawings shall be manufactured by:
    1. The Euclid Chemical Company -"Euco N-S Group" (All exposed grout).
    2. The Euclid Chemical Company - "Firmix".
    3. Master Builders - "Embeco 885".
    4. Anto-Hydro Company - "Axpandcrete Metallics."
    5. Sonneborn - "Ferrolith G".
    6. Lambert Corporation - "Vibropruf #11".
E. Vapor Barrier: Provide under slab vapor barrier / retarder as per specification section 072600
F. Curing Compounds:
    1. Manufacturer: Subject to compliance with requirements, products incorporated in the work shall be one of the following:
        a. "Clear Bond"; Guardian Chemical.
        b. "Master Seal"; Master Builders.
        c. "Abco Cure N Seal 830"; Nox-Crete.
        d. "Crystal Gard - 0800"; Lambert Corporation.
G. Absorptive Cover: Burlap cloth made from Jute or Kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
H. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C171.
    1. Waterproof paper.
    2. Polyethylene film.
    3. Polyethylene coated burlap.
I. Chemical Hardener: Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 lbs. of fluosilicate per gal.
J. Plastic Reglets: Provide "Type A" prefilled P.V.C. reglets where indicated, made by the Superior Concrete Accessories, Inc. Install in strict accordance with manufacturers details and directions.

K. Bonding Compound: The Compound shall be a two (2) component, 100% solids, 100% reactive compound suitable for use on dry or damp surfaces, "Euco Epoxy #463 or #615" by the Euclid Chemical Company or "Sikadur Hi-Mod" by Sika Chemical Corporation.

PART 3 EXECUTION

3.1 FORMS

A. Forms shall be so constructed that the finished concrete will conform to the shapes, lines, and dimensions shown on the Contract drawings. They shall be substantially built and sufficiently tight to prevent leakage of water or paste and securely braced in order to maintain their true position and shape. If any form loses its proper shape or position, it shall immediately be repaired to the satisfaction of the Architect or removed and replaced with a new form.
B. The design and engineering of the formwork, as well as its construction, shall be the responsibility of the Contractor.
C. Wetting and Oiling Forms: The inside surface of woodboard forms shall be soaked with clean water prior to placing concrete. Unfinished plywood or presswood forms (except as otherwise specified herein) shall be treated with an approved form oil or lacquer. If oil is used, all excess oil shall be wiped off with rags to leave the surface of the forms just oily to the touch. Oil is not to be applied after reinforcing is in place.

3.2 VAPOR RETARDER/BARRIER INSTALLATION

A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour. Follow Specification section 03290.
B. Lap joints 6 inches and seal as per manufacturer's recommendations. See specification section 032900.

3.3 CONCRETE PROPORTIONS

A. All mix designs shall be proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318-05 and as noted below. Preparation of mix designs are the responsibility of the Contractor. If trial batches are selected as the method of proportioning, the mix design shall be proportioned to achieve an average 28-day compressive strength of 1200 psi in excess of the design strength indicated on the Contract drawings. All proposed mixes shall be submitted with complete standard deviation analysis or trial batch data for the Architect's review a minimum of 14 days prior to the use of the mix.
B. Limit use of fly ash to not exceed 20 percent of cement content by weight.
C. Water-Cement Ratio: Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:
    1. 5000-psi, 28-day compressive strength; W/C ratio, 0.42 maximum (non-air-entrained), 0.32 maximum (air-entrained).
    2. 4000-psi, 28-day compressive strength; W/C ratio, 0.45 maximum (non-air-entrained), 0.35 maximum (air-entrained).
    3. 3500-psi, 28-day compressive strength; W/C ratio, 0.48 maximum (non-air-entrained), 0.40 maximum (air-entrained).
    4. 3000-psi, 28-day compressive strength; W/C ratio, 0.52 maximum (non-air-entrained), 0.46 maximum (air-entrained).

D. All concrete required to be watertight shall have a maximum water-cement ratio of 0.40. All reinforced concrete subjected to brackish water, salt spray or de-icers shall have a maximum water-cement ratio of 0.40. All concrete subjected to freezing and thawing shall have a maximum water-cement ratio of 0.45.

E. Lightweight Concrete - Design mix to produce strength and modulus of elasticity as noted on drawings, with a splitting tensile strength factor (Fct) of not less than 5.5 for 3000-psi concrete and a dry weight of not less than 95 lbs. or more than 110 lbs. after 28 days. Limit shrinkage to 0.03 percent at 28 days.

F. Use water-reducing admixture or high-range water-reducing admixture (Superplasticizer) in concrete as required for placement and workability.

G. Use high-range water-reducing admixture (HRWR) in pumped concrete, concrete for industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water/cement ratios below 0.50.

H. Use admixtures for water reduction and set control in strict compliance with manufacturer's directions.

I. Slump Limits - Proportion and design mixes to result in concrete slump at point of placement as follows:
   1. Ramps slabs, and sloping surfaces - Not more than 3 inches.
   2. Reinforced foundation systems - Not less than 1 inch and not more than 4 inches.
   3. Concrete containing HRWR admixture (Superplasticizer) - Not more than 8 inches after addition of HRWR to site-verified 2-inch to 3-inch slump concrete.
   4. Other concrete - Not more than 4 inches.

J. Cement, aggregate, cylinder molds, and other materials required for design or verification mixes by the laboratory shall be supplied by the Contractor. The test lab cost shall be at the expenses of the Contractor.

K. Measurements of fine and coarse aggregate shall be made separately by weight. The proportioning of aggregate for fractional sacks of cement will not be permitted unless the cement is weighed for each batch. Weighing equipment shall be arranged to permit making compensation for changes in the weight of moisture contained in the aggregate.

L. Lightweight Concrete - Proportion mix as specified. Design mix to produce strength and modulus of elasticity as noted on drawings, with a splitting tensile strength factor (Fct) of not less than 5.5 for 3000-psi concrete and a dry weight of not less than 95 lbs. or more than 110 lbs. after 28 days. Limit shrinkage to 0.03 percent at 28 days.

3.4 MIXING

A. General: The mixing shall be done by the use of modern, efficient, mechanical equipment and devices satisfactory to the Architect for accurately controlling and easily checking the weight of each of the ingredients. The Architect shall have free access to the plant at all time for sampling the materials, or inspection of the work.

B. Concrete mixers shall be of the revolving drum type. Each batch shall be mixed for not less than 2 minutes after the water has been added at the rate of rotation specified by the manufacturer. The concrete shall be discharged completely before the mixer is recharged.

C. Ready-mixed concrete, shall be mixed and delivered as specified for central-mixed or truck-mixed concrete in ASTM C94. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

3.5 PLACING REINFORCEMENT

A. Fabrication: Reinforcement fabricated to the shapes and dimensions shown or required shall be in place where indicated on the drawings, or as required to comply with the Contract Documents.
B. Tags: Reinforcing bars shall be furnished with identification tags.
C. Cleaning: Before any reinforcement is placed, any loose rust or mill scale, or coatings, including ice or oil, which would reduce or destroy the bond shall be removed. Reinforcement material reduced in section shall not be used.
D. Concrete cover over steel reinforcement shall not be less than that permitted by "Building Code Requirements for Reinforced Concrete, ACI 318" or as shown on the drawings.
E. Positioning: Bar reinforcement shall be carefully formed to the shapes shown and required to resist most effectively the stresses involved. Bars with kinks or bends not required shall not be used. The reinforcement shall not be bent or straightened in a manner that would injure the material. The heating of reinforcement for bending or straightening will not be permitted.
F. Bends or hooks, unless otherwise shown or required, shall be cold formed around pins. Hooks shall be ACI Standard.
G. Securing Reinforcement: Reinforcement shall be wired securely at intersections and shall be held in place with approved bars, spacers, chairs, high chairs, bolsters, or other supports so that it will not be dislocated or otherwise disturbed during the depositing of concrete.
H. Splices: Steel reinforcement shall not be spliced at points of maximum stress. Laps shall be tied and seized tight at both ends. See drawings for lap lengths and details.
I. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.6 CONVEYING AND PLACING

A. General: Concrete shall be conveyed from the mixer to the forms as quickly as possible by method which will prevent segregation and loss of materials. Concrete shall be deposited in the forms as nearly as practicable in its final position to avoid rehandling. Special care shall be exercised to prevent splashing of forms or reinforcement with concrete in advance of pouring. Concrete shall be deposited in a continuous manner until a given unit of construction, as approved by the Architect, has been completed.
B. Temporary Runways: Delivery carts and/or buggies where used shall be kept on temporary runways built over the construction, and runway supports shall not bear upon reinforcing steel or fresh concrete.
C. Maximum Time: Concrete shall not be incorporated in the work after it has attained its initial set nor in any event more than 1-1/2 hours after water has been added to the dry materials, or more than 1-1/2 hours after cement has been added to aggregate. This period may be reduced at the option of the Architect if it develops that presetting is taking place, particularly in hot weather.
D. Redosage with the specified high range water-reducing admixture (superplasticizer) may be permitted with the approval of the Architect as to methods and procedure.
E. Vertical Drop: Concrete containing the specified high range water-reducing admixture (superplasticizer) shall not be allowed to drop freely more than 10 feet. Maximum drop for other concrete shall be 6 feet. Provide placement holes in formwork, chutes, or elephant trunks for placement of concrete where the drop exceeds these limits.
F. Patching: After form approval, repairable defective areas shall be immediately patched.

G. Repair of Defective Areas: With prior approval of the Architect, as to method and procedure, all repairs of defective areas shall conform to ACI 301, Chapter 9, except that the specified bonding compound must be used.

H. All structural repairs shall be made with prior approval of the Architect as to method and procedure, using the specified epoxy adhesive and/or epoxy mortar. Where epoxy injection procedures must be used, an approved low viscosity epoxy made by the manufacturers previously specified shall be used.

3.7 COMPACTION AND VIBRATION

A. General: Concrete shall be consolidated with the aid of mechanical internal vibrating equipment supplemented by hand spading, rodding, and tamping to force out air pockets, to work the materials into corners and around reinforcement and embedded items, and to eliminate honeycomb. Concrete shall not be moved horizontally over long distances with the use of mechanical vibrator. Use and type of vibrators shall be in strict conformance with ACI 309, "Recommended Practice for Consolidation of Concrete".

3.8 COLD WEATHER PLACEMENT

A. In temperatures of 40 deg. F and above, when it is not anticipated that temperatures will drop below 40 deg. F., no special protection is required for placing concrete other than providing heated concrete and the means of maintaining concrete temperatures of at least 50 deg. F. for a period of seven (7) days after placing. If high early strength concrete is used, this time period may be reduced to three (3) days.

B. For temperatures below 40 deg. F., concrete must be delivered to the project site at between 55 deg. F. and 70 deg. F. Water shall not be heated over 180 deg. F. Concrete work shall be protected by wind breaks, curing compounds, and blanket covers if necessary in order to maintain the concrete in-place temperatures of at least 50 deg. F. for five (5) days.

C. Non-Corrosive, Non-Chloride Accelerating Admixture shall be used as previously specified. In no case shall calcium chloride, thiocyanate, or admixtures containing more than 0.05% chloride ions be used.

D. Heating Methods: All methods proposed for heating materials, and protecting the concrete shall be subject to approval by the Architect. Concrete shall never be heated over 90 deg. F. nor will any other overheating which would produce a flash set be permitted.

3.9 WARM AND INCLEMENT WEATHER PLACEMENT

A. During very warm weather, the concrete shall be delivered to the forms at the coolest practicable temperature. In no case shall concrete above 90 deg. F. be placed. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.

B. When high temperatures and/or placing conditions dictate, the Contractor shall use the water-reducing, retarding formulation (Type D) in lieu of the specified water-reducing admixture (Type A) as specified. Concrete shall not be placed when the sun, heat, wind, rain, sleet, or humidity would prevent proper placement.

3.10 CONSTRUCTION JOINTS

A. Where indicated, construction joints shall be of the types and at the locations specified on the drawings or as requested by the Architect on the shop drawings. All other construction joints shall be resubmitted for the Architect's approval.
B. Shear Keys: Construction joints shall be provided with adequate shear keys for succeeding placements and reinforcement shall be continuous through such joints, unless otherwise noted on the drawings.
C. Joint Spacing: Unless otherwise noted, the maximum spacing of construction joints shall be as follows:
   1. Foundation walls: forty-five (45) feet.
   2. Slabs: Fifteen (15) feet.

3.11 BONDING

A. General: Before any new concrete is deposited on or against concrete that has hardened, the form shall be retightened, the surfaces of the hardened concrete shall be roughened as required, thoroughly cleansed of foreign matter, dampened and the specified bonding compound applied. The forms shall then be retightened. New concrete shall be placed after the bonding compound has dried.

3.12 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 3 days.
C. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
D. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified.
E. Provide moisture curing by following methods:
   1. Keep concrete surface continuously wet by covering with water.
   2. Continuous water-fog spray.
   3. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
F. Provide moisture-cover curing as follows:
   1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with side and ends lapped at least 3" and sealed by waterproof tape or adhesive.
   2. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
G. Provide curing compound to slabs as follows:
   1. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Maintain continuity of coating and repair damage during curing period.

2. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

H. Chemical Hardener Finish: Apply chemical-hardener finish to interior concrete floors where indicated. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Dilute liquid hardener with water, and apply in 3 coats; first coat, 1/3 strength, second coat, 1/2 strength; third coat, 2/3 strength. Evenly apply each coat, and allow 24 hours for drying between coats.

3.13 CONCRETE FINISHES

A. Troweled Finish: All concrete slabs, except as noted below but including those that shall receive resilient flooring, tile with a thin set application, or carpet shall be screeded level to the established elevations, thoroughly consolidated and bullfloated. When slabs have set sufficiently, machine float and then trowel with a steel trowel.

B. Concrete shall be in condition acceptable to trades that will furnish and install the finish materials.

C. During the floating and troweling operations, care shall be taken that no holes or depressions are left from the removal of coarse aggregate and that no excess moisture or bleed water is present on the surface. The trowel finished surface shall be level so that the surface conforms to an F25 number as measured by the "Dipstick" or an optical device approved by the Architect.

D. Exposed surfaces: Provide smooth rubbed finish to exposed surfaces (except floor slabs), which have received smooth form finish treatment, not later than one day after form removal. Moisten concrete surfaces, and rub with abrasive until a uniform texture is produced. Do not apply cement grout other than that created by rubbing. Immediately repair deflective surfaces and remove excess paste from adjacent surfaces.

E. Scratched Finish: For slab surfaces intended to receive bonded applied "mud set" cementitious applications, ceramic tile or quarry tile, etc., after the concrete has been placed, struck-off consolidated and leveled, the surface shall be roughened with stiff brushes or rakes before final set.

F. Rough Finish: Rough concrete finish shall be used for all other concrete for which no other finish is indicated or specified. Obtain by using clean, straight lumber, plywood, or metal forms. Concrete having a rough finish shall have honeycombing and minor defects patched.

G. Sidewalk Finishes: Unless noted otherwise, sidewalk shall have broom finish.

H. Rock salt finish - Where noted on Architectural Plans, sidewalks shall receive rock salt treatment by hand sprinkling onto wet concrete surface and tamping. Provide a 4 sf sample for Architect approval.

3.14 BUILT IN ITEMS

A. Mechanical, Electrical and Plumbing installers shall be given time to coordinate and install all items of their work which are to be encased in concrete.

3.15 TESTING AND INSPECTION

A. General: The Owner shall pay for the services of a test laboratory for concrete inspection. Retesting of any material that fails to meet the specified standards and testing of any material that has replaced rejected material shall be paid by the Contractor. Contractor shall coordinate his work with testing laboratory and shall cooperate in the testing procedure.

B. Certified copies of mill reports covering the chemical and physical properties of the steel used in the work shall be furnished at the Contractor's expense.

C. Codes: The Testing Laboratory will test the concrete for compliance with contract documents and all applicable ACI and ASTM codes and standards.

D. Understrength Concrete: If, in the opinion of the Contractor, test cylinders that fail to meet the strength requirements are not truly representative, he may have the right to cut cores from the work affected.

E. Such core shall be not less than 3 in number and shall comply as to size and shape and shall be secured and tested in conformance with the requirements of ASTM C42. The cores shall be taken at points mutually agreeable to the Contractor and the Architect, and shall be tested at points mutually agreeable to the Contractor and the Architect, and shall be tested in the presence of the Architect by a laboratory approved by the Architect. All costs incurred shall be borne by the Contractor. If test results are not satisfactory to the Architect, the Contractor shall remove from the work all affected concrete and replace such defective work in a satisfactory manner, all without further compensation.

F. Contractors' Responsibility: The sole responsibility for producing concrete in the field having the strength required without causing excessive shrinkage cracks shall rest on the Contractor, regardless of the laboratory determination. If, in his opinion, the field conditions are such that a lower water-cement ratio is necessary to produce the required strength, he shall submit the mix he proposes to use to the Architect in writing. In no case will the Contractor be permitted to use a higher water-cement or lower cement factor than those used in the approved mix.

3.16 TESTING DURING PROGRESS OF WORK

A. Batch Plant Inspection by the Testing Laboratory, if authorized, will include:
   1. Attendance at the batching plant during all batching.
   2. Determination that all weighing and measuring equipment is in proper working order and that calibration certificates of scales are current.
   3. Determination that the truck mixers are regularly cleaned and maintained and that the drums revolve at the proper speeds.
   4. Ascertain that only correct weights of cement and aggregate are used.
   5. Ascertain that only those admixtures as specified and in proper qualities are used in mix.
   6. Ensure that only the correct amount of mixing water is loaded into the tank of the truck.
   7. Ensure that only approved materials are used.
   8. Ascertain that aggregated and water are of the proper temperature.
   9. Make necessary tests of the aggregates to determine the moisture content so that the total water in the batch may be properly adjusted.
   10. Test of aggregates received at the batching plant for gradation and cleanliness.
   11. Check and sign delivery tickets issued by supplier that will identify each load of concrete dispatched to the project as having been inspected when directed by the Architect.

B. Field Inspection by the Testing Laboratory, if authorized, will include:
   1. Attendance at the project site during all concrete placing operations.

2. Ascertain that concrete delivered to the site has been inspected by the batch plant inspector, if so directed by Architect.
3. Control the addition of mixing water in order to maintain the required water/cement ratio.
4. Ascertain that the concrete is conveyed from the mixer to the point of pour in accordance with specifications and good practice.
5. Ascertain that the concrete is of the proper temperature when placed.

C. Air Contents Tests: At least two tests shall be made for each day's placing or from each batch of concrete from which cylinders are cast. Tests shall be representative of each type of concrete.

D. Slump Tests: At frequent intervals to properly control the consistency and at least one at time of casting each group of cylinders and at least one test for every 25 cubic yards. Test should be done at point of discharge.

E. Concrete Compression Cylinders: Unless otherwise specified, there shall be taken from the concrete of each strength placed on any one day at least one set of five representative 6"x12" test cylinders. For large placements on any one day there shall be taken not less than one set of five representative type cylinders for each 50 cubic yard more than the first 25 cubic yards of each type of concrete placed in any one day. Two cylinders to be tested at 7 days, two at the age of 28 days, and the fifth cylinder in reserve for further testing. Ascertain that the test specimens are properly protected until shipped to the testing laboratory. Record and identify each cylinder with the location of the concrete from which the specimen was taken. Keep marking in sequence. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test (same day, same placement) results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

F. Additional Test Lab Responsibilities: Report any material or work performed that fails to meet the job specifications immediately with the Contractor, and then to the Architect. Work will be checked as it progresses. Failure to detect any defective work or materials shall not in any way prevent later rejections or obligate the Architect for final acceptance.

G. Reports on Inspection: Submit reports on testing and inspection. Reports shall include detailed data with respect to all requirements of the specifications referenced. Materials or workmanship not meeting the requirements of the Contract Documents, either at the plant or project site, will be rejected by the Testing Laboratory and Immediately reported to the Contractor and then to the Architect. In no case shall the laboratory recommend any method of adjustment or correction without obtaining prior approval of the Architect. Include in all reports and project title and number, location, contractor's name, and date work was performed.

H. Report Copies and Timing: Immediately after tests or inspections have been made and in no case late than seven (7) days after tests of inspection have been made, the laboratory shall furnish copies of all test and inspection reports.

I. Batch Plant Inspection Daily Report: The batch plant inspectors shall submit a daily report that shall contain the following data:
    1. Concrete supplier.
    2. Weather conditions and air temperature (ranges).
    3. Type of concrete.
    4. Required strength of concrete.
    5. Total number of batches, batch weight, and identifying number of each batch and truck load.

6. Basic control data concrete mix, indicating mix number source, and type of cement, source of aggregates, type of admixtures, basic quantities of cement, aggregates (dry), water and admixtures of concrete per cubic year, required slump, required air entrainment and water/cement ratio.
7. Actual data and quantities of concrete batch, indicating time of batching, actual quantities of cement, aggregates (moist) and admixtures, gallons of water added to plant; percent of total moisture in aggregates; temperature of aggregates and water, gallons of water to be added in transit or at site; time truck dispatched from plant.
8. Name of inspector, with time of arrival and departure from batch plant and total hours for day.

J. Site Inspection Daily Report: The site inspectors shall submit a daily report which shall contain the following data:
1. Concrete supplier.
2. Weather conditions and air temperature (ranges).
3. Type of concrete placed.
4. Location of placed concrete and time of starting and stopping of placement.
5. Identification of truck loads.
6. Amount of water added in transit or at site.
7. Time of discharging concrete from truck.
8. Temperature of concrete during discharging from truck and during placing.
9. Slump test results, identifying truck load and cylinders made.
10. Air entrainment test results, identifying truck load.
11. Test cylinders cast, identifying cylinder number, design strength, time taken, slump, truck numbers from which taken and location of pours with yardage of concrete placed at each location.
12. Name of inspector, with time of arrival and departure from site and total hours for day.
13. Cylinder Test Reports: Reports on test cylinders for 7 and 28 day tests (also show 7-day data on 28 day report).
14. Location of pour and specific location represented by cylinders.
15. Date cast.
16. Date tested.
17. Age of test.
18. Number of days cured in laboratory.
19. Required strength.
20. Actual strength.
21. Type of fracture.
22. Consistency as measured by slump.
23. Air content (if air entrained concrete).
24. Weight of cylinders as received.
25. Temperature of concrete when placed.

END OF SECTION

SECTION 03 35 19 – SPECIAL CONCRETE FINISHES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Rock salt finishing applied to exterior concrete pavements.

1.3 REFERENCES

A. American Concrete Institute (ACI):

1.	ACI 301	Specification for Structural Concrete for Buildings.
2.	ACI 302.1R	Recommended Practice for Concrete Floor and Slab Construction.
3.	ACI 303.1	Standard Specification for Cast-In-Place Architectural Concrete.
4.	ACI 304	Recommended Practice for Measuring, Mixing, Transporting and Placing of Concrete.
5.	ACI 305R	Recommended Practice for Hot Weather Concreting.
6.	ACI 306R	Recommended Practice for Cold Weather Concreting.
7.	ACI 316	Recommendations for Construction of Concrete Pavements and Bases.

B. American Society for Testing and Materials (ASTM):

1.	ASTM C494	Standard Specification for Chemical Admixtures for Concrete.

C. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: Provide manufacturer’s complete technical data sheets on all proprietary materials.

B. Design Mixes: For each type of concrete.

1.5 INFORMATION SUBMITTALS

A. Maintenance Data: Provide data on maintenance renewal of applied coatings.

1.6 QUALITY ASSURANCE

A. Concrete Installer Qualifications: Concrete work shall be performed by a firm with three years' experience and shall have successfully completed not less than 5 projects of similar scope and quality comparable in scale and complexity.

1. Statement of Installer's Qualifications: Submit list of at least 5 completed projects including project name, project address and owner contact information.

B. Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.

C. Textured Concrete Mockup:

1. Construct mockup using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, and expansion joints in sample panels.
2. Obtain Architect's approval of mockup prior to proceeding with topping installation.
3. Accepted mockup shall provide a visual standard for work of this Section.
4. Mockup shall remain through completion of the Work for use a quality standard for finished work.
5. Remove mockup when directed.

1.7 DELIVERY, STORAGE AND HANDLING

A. Products shall be delivered in original factory packaging, unopened and undamaged. Packaging shall bear identification of product, manufacturer's identification and batch numbers. A technical information sheet and MSDS shall be available for each product throughout the Project.

B. Store products in strict accordance with the manufacturer's recommendations in a location protected from damage, construction activity, and weather conditions.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Temporary Lighting: Provide minimum 200 W light source, 8' above the floor surface, for each 425 sq. ft. of floor being finished.

B. Temporary Heat: Ambient temperature of 50° F (10° C) minimum

C. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

1.9 FIELD CONDITIONS

A. Protection: Precautions shall be taken to protect surrounding areas and landscaping.

B. Schedule placement to minimize exposure to wind and hot sun.

C. Avoid placement if rain is forecast within a 24-hour period. Protect fresh concrete from moisture.

D. Comply with professional practices described in ACI 305R and ACI 306R.

1.10 PRE-JOB CONFERENCE

A. One week prior to placement of concrete, a meeting shall be held to discuss the Project and application methods. The Owner, Architect, Contractor, Concrete Installer, and propriety product manufacturer(s) are encouraged to attend.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Rock Salt: Sifted to remove all materials smaller than 1/8".

B. Evaporation Retarder (if required): BRICKFORM® Evaporation Retarder™, Division of Solomon Colors factory concentrated surface retarder, or approved equal.

2.2 CONCRETE MIX DESIGN

A. Concrete including slump shall be as specified in "Cast-In-Place Concrete" specification section.

B. DO NOT add calcium chloride to mix as it causes mottling and surface discoloration.

C. Supplemental admixtures shall not be used unless approved by manufacturer.

D. DO NOT add water to the mix in the field.

PART 3 – EXECUTION

3.1 CONCRETE PLACEMENT

A. Move concrete into place with square-tipped shovels or concrete rakes.

B. Vibrators, when used, shall be inserted, and withdrawn vertically.

C. Concrete shall be struck to specified level with wood or magnesium straight edge or mechanical screed.

D. The concrete surface shall be further leveled and consolidated with highway magnesium straight edge and/or magnesium bull float.

E. Mechanically float concrete surfaces as soon as concrete surface has taken it's initial set and will support weight of a power float machine equipped with float shoes or combination blades and operator.

3.2 ROCK SALT APPLICATION

A. Screed, tamp, and float concrete.

B. While concrete is still in a plastic stage, evenly dispense rock salt over the surface at the rate of ten pounds per 150 square feet.

C. Carefully float the rock salt to depress it into concrete. Avoid covering rock salt.

D. Allow concrete to cure and set thoroughly under normal procedures.

E. After seven to ten days, thoroughly wash all remaining salt from the area. Do not contaminate any adjacent planting areas with salt.

3.3 PROTECTION OF FINISHED WORK

A. Provide final protection and maintain conditions in a manner acceptable to installer that ensure topping is without damage or deterioration at the time of Substantial Completion.

B. Protect other work from staining or damage due to cleaning operations.

C. Prohibit foot or vehicular traffic on floor surface.

D. Barricade area to protect installation.

END OF SECTION 03 35 19

SECTION 03 45 00
PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:
   1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
      a. Architectural precast concrete bollard.
      b. Architectural precast concrete bench.

1.3 REFERENCES

A. ACI 117 – Standard Tolerances for Concrete Construction and Materials.
B. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
C. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete.
D. Concrete Reinforcing Steel Institute, "Manual of Standard Practice.
E. ACI 308 – Standard Practice for Curing Concrete.
F. ACI 315 – Details and Detailing of Concrete Reinforcement.
G. ACI347R – Guide to Formwork for Concrete.
H. ASTM A185 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
I. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
J. ASTM A780/A780M – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
K. ASTM C33/C33M – Standard Specification for Concrete Aggregates.
L. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar.
M. ASTM C150/C150M – Standard Specification for Portland Cement.
N. ASTM C260 – Specification for Air-Entraining Admixtures for Concrete.
O. ASTM C404 – Standard Specification for Aggregates for Masonry Grout.
P. ASTM C494 – Specification for Chemical Admixtures for Concrete.
Q. ASTM C642 – Standard Test Method for Density, Absorption, and Voids in Hardened Concrete.
R. ASTM C1218/C1218M – Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
S. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
T. ASTM F594 – Standard Specification for Stainless Steel Nuts.
U. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.
C. Shop Drawings:
   1. Detail fabrication and installation of architectural precast concrete units.
   2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
   3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish and details at building corners.
   4. Indicate type, size, and length of welded connections by AWS standard symbols. Detail loose and cast-in hardware, connections, and anchorage.
   5. Indicate relationship of architectural precast concrete units to adjacent materials.
D. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.
   1. When other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.
   2. Grout Samples: Color charts consisting of actual sections of grout showing manufacturer's full range of colors.
E. Delegated-Design Submittal: Submit design calculations, analysis data and shop drawings indicating compliance with dedicated design requirements signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project name, addresses, names of architects and owners, and other information specified.
B. Material Certificates: Cementitious materials.
C. Material Test Reports: For aggregates.

1.6 PRODUCT SAMPLES

A. Before casting architectural concrete, provide physical samples to verify selections made under sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
B. In presence of Architect, damage part of the exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of tie holes and surface blemishes to match adjacent undamaged surfaces.
C. Obtain Architect's approval of sample before casting architectural concrete.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance to erect Category A (Architectural Systems) for non-load bearing members.

B. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other rehandling.
B. Support units during shipment on nonstaining shock-absorbing material.
C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
D. Place stored units so identification marks are clearly visible, and units can be inspected.
E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
F. Lift and support units only at designated points indicated on Shop Drawings.

1.9 FIELD CONDITIONS

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.10 PERFORMANCE REQUIREMENTS

A. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
B. Delegated-Design: Provide design services, calculations and shop drawings for delegated design requirements complying with code requirements, performance requirements and design criteria signed and sealed by an engineer registered in the State of Florida.

PART 2 - PRODUCTS

2.1 PRECAST ELEMENT – BOLLARD

A. Basis of Design: Peterson Manufacturing Co., Inc., Model: B7
   1. 24”x24”, anchor option: Type B protruding galvanized steel pipe.

2.2 PRECAST ELEMENT – BENCH

A. Basis of Design: Belson Outdoors, LLC, Model TF5116 Custom; 74”x18”x16”H, 6-foot radius.

2.3 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

B. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

2.4 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
B. Plain-Steel Welded Wire Reinforcement: ASTM A185/A185M, fabricated from galvanized-steel wire into flat sheets.

2.5 CONCRETE MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type III, unless otherwise indicated.
   1. For surfaces exposed to view in finished structure, use Lehigh Type 1 cement.
B. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33/C33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
   1. Face-Mixture-Fine Aggregates: Selected, natural, or manufactured sand compatible with coarse aggregate; to match approved finish sample.
C. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
D. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
E. Coloring Admixture: ASTM C 979/C 979M, colored water-reducing admixtures, temperature stable, and nonfading.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.
   1. Use a single design mixture for units with more than one major face or edge exposed.
B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
C. Normal-Weight Concrete Mixtures: Proportion by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 Days): 5000 psi minimum.
   2. Maximum Water-Cementitious Materials Ratio: 0.45.
D. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.

2.7 CONCRETE ADMIXTURES

A. Content of admixtures will be required from the admixture manufacturer prior to mix design review by the Architect.
B. Prohibited Admixtures: Calcium chloride or admixtures containing more than 0.05 percent chloride ions are not permitted.

2.8 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

2.9 ACCESSORIES

A. Masonry and concrete penetrating water repellents:
   1. Silane, Penetrating Water Repellent: Clear, containing 20 percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, or other proprietary solvent carrier; and with 600 g/L or less of VOCs as manufactured by Prosoco.

2.10 FABRICATION

A. Fabricate precast elements to shapes, configurations and sizes as indicated on drawings
B. Cast-in Anchors, Inserts, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
C. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
D. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
E. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
F. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
G. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
   1. Place backup concrete mixture to ensure bond with face-mixture concrete.
H. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.
I. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
J. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.
K. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
L. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.11 FABRICATION TOLERANCES

A. Erect precast units level, plumb, square and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.
B. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with the following product tolerances:
   1. Overall Length and Width Tolerance of Units: Measured at 10 feet or under, plus or minus 1/8 inch.

2.12 FINISHES

A. Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units as selected by the Architect.
B. Architect shall select finish and color from manufacturers standard offerings of acid wash, weatherstone, and weatherstone glass options.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
D. Water Repellant: Apply water repellant as per manufacturer’s recommendations.

3.3 ERECTION TOLERANCES

A. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.
B. Erect architectural precast concrete units level, plumb, square, and in alignment, without exceeding a tolerance 1/4" in 10’-0”.

3.4 REPAIRS

A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.
C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.
D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.5 CLEANING

A. Clean surfaces of precast concrete units exposed to view.
B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
    1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
    2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

SECTION 04 22 00 – CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
    a. Concrete masonry units.
    b. Mortar and grout.
    c. Steel reinforcing bars.
    d. Masonry-joint reinforcement.
    e. Miscellaneous masonry accessories.
    f. Masonry-cell fill.

1.3 REFERENCES

A. ASTM A82 – Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
B. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
C. ASTM A167 – Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
D. ASTM A366 – Standard Specification for Commercial Steel (CS) Sheet, Carbon (0.15 Maximum Percent) Cold Rolled.
E. ASTM A510 – Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
F. ASTM A641/A641M – Standard Specification for Zinc–Coated (Galvanized) Carbon Steel Wire.
G. ASTM A951/A951M – Standard Specification for Steel Wire for Masonry Joint Reinforcement.
H. ASTM A580 – Standard Specification for Stainless Steel Wire.
I. ASTM C67 – Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
J. ASTM C90 – Standard Specification for Loadbearing Concrete Masonry Units.
K. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar.
L. ASTM C150 – Standard Specification for Portland Cement.
M. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes.
N. ASTM C270 – Standard Specification for Mortar for Unit Masonry.
O. ASTM C 920 – Standard Specification for Elastomeric Joint Sealants.
P. ASTM D412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers–Tension.

Q. ASTM D638 – Standard Test Method for Tensile Properties of Plastics.
R. ASTM A1064/A1064M – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
S. ASTM D1056 – Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
T. ASTM E2178 – Standard Test Method for Air Permeance of Building Materials.
U. ACI 530/ASCE 5/TMS 402 – Building Code Requirements for Masonry Structures.
V. ACI 530.1 /ASCE 6/TMS 602 – Specifications for Masonry Structures.
W. National Concrete Masonry Association (NCMA), including "TEK Bulletins."
X. Portland Cement Association (PCA), "Concrete Masonry Handbook."

1.4 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification: For each type and color of the following:

1. CMUs.

D. Local/Regional Materials: Submit manufacturer's documentation substantiating the following requirements for materials extracted/harvested and manufactured within a 500 mile radius from the project site. Not less than 20 percent of building materials (by cost) shall be regional materials. Unless otherwise indicated, submit the following for each type of product provided under work of this section for locations:

1. Sourcing Location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
2. Manufacturing Location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
4. Product Component(s): Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: Include material test reports substantiating compliance with requirements. For masonry units, include data and calculations establishing average net-area compressive strength of units.

1. Integral water repellant used in CMUs.
2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.
7. Joint reinforcement.
8. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

C. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

E. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

F. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.

G. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

H. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

1.8 PREINSTALLATION MEETINGS

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.9 PRECONSTRUCTION TESTING SERVICE

A. A qualified independent testing agency shall perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Testing Prior to Construction: One set of tests.

C. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

D. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

E. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.11 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills exposed to the exterior with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1.12 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

B. Standards: Comply with the most recent edition of the following:

1. National Concrete Masonry Association (NCMA), including “TEK Bulletins”.
2. American Concrete Institute (ACI), ACI 530/ASCE 5/TMS; and ACI 530.1/ASCE 6.
3. Portland Cement Association (PCA), “Concrete Masonry Handbook”.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

2.3 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for units exposed to the exterior.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514/E 514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

C. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi.
2. Density Classification: Normal weight.
3. Size 8 x 8 x 16 Nominal: Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample, match existing.

2.4 CONCRETE LINTELS

A. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 033000 "Cast-in-Place Concrete," and with reinforcing bars indicated.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or II.

B. Hydrated Lime: ASTM C 207, Type S.

C. Masonry Cement: ASTM C 91/C 91M.

D. Mortar Cement: ASTM C 1329/C 1329M.

E. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C 404.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

I. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch interior 0.187-inch exterior diameter.
4. Wire Size for Cross Rods: 0.148-inch interior 0.187-inch exterior diameter.
5. Spacing of Cross Rods: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.7 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.
3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.105-inch thick steel sheet, galvanized after fabrication.
   a. 0.064-inch thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
3. Corrugated-Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wave length of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.075-inch thick steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete.
   a. 0.064-inch thick, galvanized sheet may be used at interior walls unless otherwise indicated.

E. Partition Top Anchors: 0.105-inch thick metal plate with a 3/8-inch diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.8 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
   a. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inch thick coating of adhesive.
   b. Self-Adhesive Sheet with Drip Edge: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inchthick coating of rubberized-asphalt adhesive. Where flashing extends to face of masonry, rubberized-asphalt coating is held back approximately 1-1/2 inches from edge.
      1) Color: Gray.
   c. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
2. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637/D 4637M, 0.040 inch thick.

B. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing [with a drip edge or flexible flashing with a metal drip edge] [or elastomeric thermoplastic flashing with a drip edge.

C. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use masonry cement mortar unless otherwise indicated.
3. For exterior masonry, use masonry cement mortar.
4. For reinforced masonry, use masonry cement mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry Type M or Type S.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that reinforcing dowels are properly placed.
3. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.

2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet maximum.
4. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet maximum.
5. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet maximum.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond or bond to match existing; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

C. Tool exposed joints to match existing or slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

E. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.

4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

A. Provide concrete lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING

A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer].
2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
3. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.11 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.12 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 22 00

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections apply to work on this Section.

1.2 DESCRIPTION OF WORK

A. Provide structural steel work as shown on drawings and specified herein. Hoisting of the metal deck shall be the responsibility of Contractor. Structural steel is that work defined in AISC "Code of Standard Practice" and as otherwise shown on drawings.

B. Related Work Specified Elsewhere
   1. Steel Joist Framing: Section 05 21 00.
   2. Metal Decking: Section 05 30 00.

1.3 QUALITY ASSURANCE

A. Codes and Standards
   1. Contractor shall conform to the provisions of the following, except where more stringent requirements are shown or specified:
      a. AISC "Code of Standard Practice for Steel Buildings and Bridges."
      b. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," including the "Commentary" and Supplements thereto as issued.
      c. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
      d. AWS D1.1 "Structural Welding Code," latest editions.
      e. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use.

B. Qualifications for Welding Work
   1. Qualify welding processes and welding operators in accordance with the AWS "Standard Qualification Procedure."
   2. Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous 12 months.
   3. If recertification of welders is required, retesting will be the Contractor's responsibility and at his expense.

1.4 COORDINATION

A. Contractor shall fully coordinate the structural steel work. Coordinate with Metal Deck Installer for hoisting of the metal deck.

B. Contractor shall fully verify all dimensions and details. Any discrepancies shall be immediately reported to the Architect.

C. Contractor shall locate dimensionally on setting plans all anchor bolts, inserts, base plates, etc. and shall prepare and deliver all required templates and fully dimensioned setting plans, all in time for the proper execution of the work.
D. Contractor shall set the anchor bolts and inserts. Contractor shall field survey all such settings for correctness after they have been cast in place, and before proceeding with steel erection. Checking shall be performed within ten days of notification by concrete installer that his work is complete.
E. Contractor shall within 10 days report to the Architect and certify that he has complied with the above checking requirements and shall indicate any inaccuracies found and corrections which must be made. Any inaccuracies not included in this report and found during or after steel erection shall be the responsibility of the Contractor, and the cost of corrective measures shall be borne by him.
F. Use base lines, bench marks, or other standards for survey work. If permanent building bench marks have been established, they will be used for the aforementioned field checking.
G. Contractor shall coordinate erection areas and sequence and temporary bracing locations.

1.5 SUBMITTALS

A. Product Data
    1. Submit 4 copies of producer's or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
        a. Structural Steel (each type), including certified copies of mill reports covering the chemical and physical properties.
        b. High strength bolts.
        c. Structural steel primer paint.
B. Shop Drawings
    1. Shop drawings shall give all necessary information for the fabrication and erection of the structure and shall be based on AISC Specifications. Minimum connections used shall be as indicated on the drawings and shall support the total uniform load capacity of members. Provisions for the connection of other work required shall be indicated and provided by Steel Installer. Index sheets shall be furnished with all beam and column details at the same time the details are submitted for the review of the Architect. Standard connection details conforming to those shown on the drawings shall be submitted with first erection plan. All details shown are typical; similar details apply to similar conditions, unless otherwise indicated.
    2. The review of shop drawings shall be for size and arrangement of principal members and strength of connections only.
    3. Provide anchor bolt and setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.
    4. Promptly notify the Architect whenever design of members and connections for any portion of the structure are not clearly indicated.
    5. Shop drawings shall bear the initials of the detailer's checker prior to submission.
    6. Shop drawings shall indicate the sequence and extent of areas to be erected by using division or derrick numbers.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time so as not to delay that work.
C. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. The Contractor shall be responsible for any demurrage charges due to failure to unload or store materials properly. Structural steel shall be kept properly drained. Do not store materials on the structure in a manner that might cause distortion or damage to the members of the supporting structures.
D. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the installed work and materials of all other trades.
E. Replacement: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.
F. Shop Fabrication and Assembly
    1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on approved shop drawings. Provide camber in structural members where indicated.
    2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
G. Connections
    1. Shop connections shall be welded or high strength bolted. Field Connections shall be bolted with high strength bolts in friction-type connections conforming to ASTM Designation A325, except where welded connections or other connections are indicated.
    2. Combinations of bolts and welds in the same connections are not permitted, unless otherwise shown on the drawings.
    3. Where structural joints are made using high strength bolts, hardened washers and nuts tightened to a high tension; the materials, methods of installation and tension control, type of wrenches to be used, and inspection methods shall conform to ASTM Designation A325 as approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation. Each bolt shall have a hardened washer under the nut.
    4. The high strength bolts used shall have a suitable identifying mark placed on top of the head before leaving the factory.
    5. Tightening of nuts shall be done with properly calibrated pneumatic wrenches. The minimum bolt tension for the size of the bolt used shall be in accordance with tables listed in the above referenced Standards. Each wrench shall be checked for accuracy at least once daily for actual conditions of application.
    6. Bolts that have been completely tightened shall be marked with identifying symbols.
    7. The Contractor shall have a properly calibrated torque gauge on hand, and when requested by the Architect, shall provide a check on any bolt at any time until final acceptance of the work by the Owner

PART 2 PRODUCTS

2.1 MATERIALS

A. Metal Surfaces – General
    1. For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes, including pitting, seam markers, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding or by welding and grinding prior to cleaning, treating, and application of surface finishes.

B. Structural Steel Shapes, Plates, and Bars: ASTM A36
C. Steel Pipe: ASTM A53, Types E or S, Grade B.
D. Anchor bolts shall conform to ASTM A307 with size and shape as indicated on the drawings.
E. Column Base Plates: ASTM A36
F. Arc Welding Electrodes shall conform to the AWS Code as Revised. All electric current require shall be furnished by Contractor.
G. Paint for Shop Painting Structural Steel and Field Touch-up shall be manufacturer's standard primer.
H. All items exposed to weather, such as shelf angles and items as noted on the drawings, shall be zinc coated in accordance with the provisions of ASTM Designation A123 as revised to date.

2.2 FABRICATION

A. General: Fabricate items of structural steel in accordance with AISC Specifications and as indicated on the approved shop drawings.
B. Bearing surfaces shall be planed to true beds, and abutting surfaces shall be closely fitted. All columns and bearing stiffeners shall be milled to give full bearings.
C. Bolt holes shall be drilled or punched in accordance with AISC Specifications, subject to the provisions specified herein. Holes shall be accurately centered and shall register true upon erection. Poor matching of holes shall be cause for a rejection. Small errors may be repaired by drilling or reaming.
D. Contact surfaces shall be thoroughly cleaned before assembly. Assembled parts shall be brought into close contact. Drift pins shall be used only for aligning members and shall not be used in a manner which will damage metal or enlarge or distort holes. Members requiring accurate alignment shall be provided with slotted holes and/or washers for truing up the steel as required. All finished members shall be true to line and free from twists, bends, and open joints.
E. Welding shall be performed by operators qualified in accordance with the American Welding Society "Standard Qualification Procedure" to perform the type of work required. Such qualification test shall have been passed within the preceding 12-month period. Shop drawings shall indicate the size, length, spacing, and type of all welds. Comply with AWS Code for procedures, appearance, and quality of welds, and for methods used in correcting welding work.
F. Holes for Other Work
    1. Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on approved shop drawings.
    2. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.
    3. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.3 SHOP PAINTING

A. Provide one shop coat of paint as specified under Article "Materials" to all steel except for members receiving galvanizing or as specified hereafter.
B. Paint shall be delivered to the shop in original sealed containers which shall be clearly marked with the manufacturer's name and the identifying brand number or name. The paint shall be used as prepared by the manufacturer without thinning or other admixtures.
C. Surface Preparation: After inspection and before shipping, clean steelwork to be painted complying with Steel Structures Painting Council (SSPC) SP-2 "Hand Tool Cleaning," or SSPC SP-3 "Power Tool Cleaning."

D. Do not paint contact surfaces which are to be welded or high-strength bolted. No paint shall be applied within 3" of any high strength bolt holes.
E. Do not paint any zinc-coated items.
F. Paint shall be applied under dry and dust-free conditions and unless otherwise allowed by the Architect, shall not be applied when the temperature is below 45 deg.
G. Painting shall be done in workmanlike manner so as to produce an even dry film of uniform thickness of 2 mil. Edges, corners, crevices, and joints shall receive special attention so that they are thoroughly cleaned and they receive an adequate thickness of paint.

PART 3 EXECUTION

3.1 ERECTION

A. General: Installer must examine the areas and conditions under which structural steel work is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
B. Codes: Comply with the AISC Specifications and Code of Standard Practice, and as herein specified. Maintain work in a safe and stable condition during erection.
C. Anchor Bolts: Steel installer shall furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Steel installer shall furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations. Contractor shall set anchor bolts and other insert anchors required.
D. Field Assembly: Set structural members to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
E. Temporary Shoring and Bracing: Provide as required, with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy line to achieve proper alignment of the structures as erection proceeds. Coordinate locations of temporary bracing with the Contractor.
F. Splice members only where indicated.
G. Do not enlarge unfair holes in members by burning or by the use of drift pins. Ream or drill holes that must be enlarged to admit bolts.
H. Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing.
I. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraided areas of the shop paint, and paint all exposed areas with the same materials as used for shop painting. Apply by brush or spray to provide a minimum dry file thickness of 2.0 mils.

3.2 TESTING AND INSPECTION

A. The Contractor shall notify the Architect in writing five days in advance of the starting of fabrication and of erection of the structural steel.

B. The Owner and his agents shall have free access and the Contractor shall provide same, to all points where materials for this project are being fabricated and/or erected, and all materials, equipment and workmanship shall be subject to inspection, tests and approval by the Owner's agents or laboratories. They shall have full authority to reject all material and work that fails to conform in every respect to these specifications.
C. Owner will engage in independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.
D. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements and specifically state any deviations therefrom.
E. Testing agency may inspect structural steel at plant before shipment; however, Architect reserves right, at any time before final acceptance, to reject material not complying with specific requirement.
F. Shop inspection will include periodic inspection at the place of fabrication and identification of tested material, checking of fabrication for compliance with approved shop drawing and these Specifications, and inspection of shop painting, as well as the following:
    1. Examination of all steel for straightness and alignment.
    2. Examination of all fabricated pieces and checking of same with erection plans and detail drawings.
    3. Shop-Bolted Connections: Inspect in accordance with AISC Specifications. See paragraph entitled "High Strength Bolt Inspection" below.
    4. Shop Welding: Inspect and test during fabrication of structural steel assemblies as follows:
        a. Check that welders are certified. Record type and locations of defects found in work. Record work required and performed to correct deficiencies or defects found.
        b. Perform periodic visual inspections of random welds.
        c. Perform the following:
            1) Ultrasonic Inspections: ASTM E164. 100% of first 400 butt welds or more until rejection rate is less than 5% and then 25% as long as rejection rate remains below 5%.
            2) Magnetic Particle Testing: ASTM E109. 25% of fillet welds with size larger than 3/8".
    5. Examination of surface preparation, painting/priming and galvanizing.
G. Field inspection will include periodic inspection after delivery at site of material, fabrication, and shop painting, and work connected with erection and field painting of steel structure, as well as the following:
    1. Proper erection of all pieces.
    2. Proper installation of bolts.
    3. Plumbness of structure.
    4. Condition of shop painting after erection and field touch-up painting.
    5. Field-Bolted Connections: Inspect in accordance with AISC specifications. See paragraph below titled "High-Strength Bolt Inspection."
    6. Field Welding: Inspect and test during erection of structural steel as follows:
        a. Check that welders are certified. Record types and locations of defects found in work. Record work required and performed to correct deficiencies or defects found.
        b. Perform periodic visual inspections of random welds.
        c. Perform the following:
            1) Ultrasonic Inspection: All penetrating welds performed in the field shall be tested by ultrasonic testing.
            2) Magnetic Particle Testing: Perform as described above.

3) High Strength Bolt Inspection: Perform inspection of installation of high-strength bolts to determine that selected installation procedures as prescribed in the Specification for structural joints using ASTM A325 or A490 bolts are properly used and that bolts are properly tightened and as follows:
   a) All bolted connections shall be visually inspected.
   b) At least two bolts of every connection between girders and columns and trusses and columns shall be checked.
   c) All bolted connections that fail shall be corrected and all bolts in that connection shall be retested.

H. Contractor shall correct deficiencies in structural steel work, which inspections and laboratory test reports have indicated to be not in compliance with requirements, perform additional tests, at Contractor's expense, as may be necessary to re-confirm any non-compliance of the original work, and as may be necessary to show compliance of corrected work.

I. When required by Architect or Contractor's engaged Inspection Organization, Contractor shall make available to Inspector a calibrated torque wrench and calibrating device, as well as the manpower required to operate same, for the purpose of checking high-strength bolts. Adequate platforms and scaffolding shall be provided to ensure safe performance of this operation.

J. Report Copies and Timing: Immediately after tests or inspection have been made, and in no case later than seven (7) days after tests of inspection have been made, the laboratory shall furnish copies of all test and inspection reports as follows:
   1. One (1) copy to Contractor.
   2. One (1) copy to Master Consulting Engineers, Inc.
   3. One (1) copy to Owner.

END OF SECTION

SECTION 05 21 00
STEEL JOIST FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Section, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Provide steel joists work as shown on the drawings and specified herein.
B. Related Work Specified Elsewhere
   1. Structural Steel: Section 05 12 00.
   2. Metal Decking: Section 05 30 00.

1.3 REFERENCES (All latest editions)

A. ASTM A 307: Carbon Steel Threaded Standard Fasteners.
B. ASTM A 325: High Strength Bolts for Structural Steel Joints.
C. AWD D1.1: Structural Welding Code.
D. SSPC: Steel Structures Painting Council.
E. Steel Joist Institute (SJI): Standard Specification for Open Web Steel Joists, K-Series, Standard Specifications for Long Span Steel Joists, LH Series and Deep Long Span Steel Joists, DLH Series, and Standard Specification for Joist Girders.

1.4 QUALITY ASSURANCE

A. Conform to SJI Standard Specifications, Load Tables, and Weight Tables.

1.5 SHOP DRAWINGS

A. Indicate profiles, sizes, spacing, and locations of structural members, connections, attachments, fasteners, cambers, and loads.
B. Indicate specified procedures concerning erection and fastening of steel joists.

PART 2 PRODUCTS

2.1 PRODUCTS

A. Open Web Steel Joist Members: SJI Type K Open Web and Type LH longspan.
B. Primer Manufacturer's standard primer.

2.2 FABRICATION

A. Fabricate steel joists in accordance with SJI Standard Specifications, including headers, supplementary framing, and cambers.
B. Provide bottom and top joist chord extensions when indicated.

C. Clean steel work to be painted complying with Steel Structures Painting Council, SSPC SP-3, "Power Tool Cleaning".
D. Shop prime structural steel members. Do not prime surfaces to be field welded or high strength bolted.
E. Joist shall be inspected by the manufacturer before shipment to verify compliance with these specifications.
F. Any repairs necessary to the joist shall be made prior to shipment.

PART 3 EXECUTION

3.1 ERECTION

A. Erect steel joists in accordance with SJI Standard Specifications.
B. Bear joists on supports in accordance with SJI Standard Specifications and the drawings.
C. During erection, provide temporary bracing for induced loads and stresses.
D. Field weld joist seat to bearing surface after aligning and positioning joists and after installation of bridging. Deep long span joists and joist girders shall be high strength bolted.
E. Do not field cut or alter joists without approval of the Architect.
F. After erection, prime welds, abrasions, and surfaces not primed. Use the same primer as the specified shop coat.

END OF SECTION

SECTION 05 30 00
METAL DECKING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Section, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Provide metal decking as shown on the drawings, including basic layout and type of deck units required, and specified herein.
B. Related Work Described Elsewhere
   1. Structural Steel - Section 05 1200.
   2. Steel Joists - Section 05 2100.

1.3 QUALITY ASSURANCE

A. Codes and Standards:
   1. Comply with provisions of the following codes and standards, except as otherwise shown or specified.
   2. AISI "Specifications for the Design of Cold-Formed Steel Structural Members."
   3. AWS "Structural Welding Code."
   4. SDI "Design Manual for Floor Decks and Roof Decks."
   5. MRDTI "Specifications for Steel Roof Deck Construction" as adopted by the Metal Roof Deck Technical Institute.

1.4 QUALIFICATIONS OF FIELD WELDING

A. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure." Welding decking in place is subject to inspection and testing by a Testing Laboratory engaged by the Owner.
   1. Remove and replace work found to be defective and not complying with requirements.

1.5 PERFORMANCE REQUIREMENTS

A. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading as shown on the contract documents design wind pressure tables based on tributary area.
B. Underwriter's Label: Provide metal deck units manufactured by a firm listed in the Underwriter's laboratories "Fire Resistance Director - Index of Manufacturers." Each required type deck unit shall bear the UL label and marking.

1.6 SUBMITTALS

A. Product Data: Submit four copies of manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.

B. Shop Drawings: Submit detailed drawings showing size and location of floor and roof framing supports, layout and types of deck panels, deck finish and method, lengths and piece marks of deck units, fastening and anchorage details, and any openings to be cut in field. Deck units shall be marked to show sequence or erection. Detailed drawings shall also indicate closure pieces, fittings, sump pans, any special jointing, and other accessories necessary to provide a complete decking installation. Indicate welds by standard welding symbols adopted by The American Welding Society. Weld washers shall be used for all roof deck.

1.7 COORDINATION

A. Contractor shall coordinate loading of deck units on the steel frame and erection sequence with Structural Steel Installer. Contractor shall coordinate the actual size and depth of sump pans.

PART 2 PRODUCTS

2.1 MATERIALS

A. Metal Deck
   1. Roof Deck Units: Roof deck shall be as indicated in the “Roof Framing Notes” in the roof plan.
   2. Floor Deck Units: Floor deck shall be as indicated in the “Floor Framing Notes” in the floor plan. See drawings for specific location of application.
   3. Metal Cover Plates: Fabricate metal cover plates for end-abutting deck units of not less than 18 gage sheet steel. Form to match contour of deck units and approximately 6 inches wide.
   4. Metal Closure Strips: Fabricate metal closure strips, for openings between decking and other construction, of not less than 18-gage sheet steel. Form to provide tight-fitting closure at open ends of cells or flutes and sides of decking.

PART 3 EXECUTION

3.1 INSPECTION

A. Installer must examine areas and conditions under which metal decking is to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until satisfactory conditions have been corrected in a manner acceptable to installer.

3.2 INSTALLATION

A. General: Install deck units and accessories in accordance with manufacturer's recommendations and approved shop drawings, and as specified herein.
B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.
C. Place deck units in straight alignment for entire length of run.
D. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
E. Coordinate and cooperate with structural steel installer in loading decking bundles to prevent overloading of structural members.

F. Do not use floor deck units for storage or working platforms until permanently secured.
G. End Closures: Tack weld or use machine screws at 1'-0" O/C for fastening end closures.
H. Comply with AWS requirements and procedures for manual shielded metal arc welding, the appearance and quality of welds, and the methods used in correcting welding work.
I. Side Laps: Steel roof deck and floor deck shall have nesting side laps of adjacent units attached by 3/4-inch diameter #12 screws or button punching at the center of each span or 6 inches O/C, whichever is a least dimension, unless noted otherwise on plans.
J. Cutting and Fitting: Saw cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking as shown on the drawings.
K. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units.
L. Closure Strips: Provide metal closure strips at all open perimeter ends, interior openings, uncovered ends and edges of roof and floor decking, and in the voids between decking and other construction. Weld into position to provide a complete decking installation.
M. Touch-Up Painting: After decking installation, wire brush, clean and paint scarred areas, welds, and rust spots on the top surface of roof deck units.
N. Touch-up painted surfaces with the above specified paint applied in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 05 52 13 – PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Aluminum pipe tube railings and accessories

1.3 REFERENCES

A. ASTM B210 – Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
B. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
C. ASTM B241/A241M – Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
D. ASTM B483 – Standard Specification for Aluminum and Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications
E. ASTM E935 – Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings
F. ASTM E985 – Standard Specification for Permanent Metal Railing Systems and Rails for Buildings
G. AAMA 606.1 – Voluntary Guide Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum
H. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum
I. AWS – Structural Welding Code
J. ACSE 7 – Wind Loads
K. FBC – Florida Building Code

1.4 ACTION SUBMITTALS

A. Product Data: For the railings, brackets and items indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.

1. Fittings and brackets.
2. Assembled sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
3. Show method of connecting members at intersections.

E. Assembled sample of railing system, made from full-size components, including handrail. Sample need not be full height.

1. Show method of connecting members at intersections.

F. Delegated-Design Submittal: Submit design calculations, analysis data and shop drawings indicating compliance with dedicated design and performance requirements signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

G. Recycle: Submit manufacturer's documentation substantiating the following requirements for materials for each type provided under work of this section for recycled content:

1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

H. Local/Regional Materials: Submit manufacturer's documentation substantiating the following requirements for materials extracted/harvested and manufactured within a 500 mile radius from the project site. Not less than 20 percent of building materials (by cost) shall be regional materials. Unless otherwise indicated, submit the following for each type of product provided under work of this section for locations:

1. Sourcing Location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
2. Manufacturing Location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
3. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
4. Product Component(s): Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

1.5 INFORMATION SUBMITTALS

A. Welder current certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

B. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project name, addresses, names of architects and owners, and other information specified.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.

B. Welding Standards: Comply with applicable provisions of AWS - "Structural Welding Code".

C. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

B. Coordination installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.8 PERFORMANCE REQUIREMENTS

A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on performance requirements.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

C. Temperature Change: 120 deg. F, ambient; 180 deg. F, material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

E. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity, horizontal, uniform and concentrated loads, and stresses within limits and under conditions indicated as indicated by applicable codes.

F. Delegated-Design: Provide delegated design services including calculations and shop drawings for railings and load bearing items to comply with performance requirements, applicable code requirements and design criteria signed and sealed by an engineer registered in the State of Florida.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer shall be one of the following in each category however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Aluminum Pipe and Tube Railings:
   a. Superior Aluminum Products, Inc.
   b. Tubular Specialties Manufacturing, Inc.
   c. Wagner, R & B, Inc.; a division of the Wagner Companies

2.2 ALUMINUM RAILING

A. Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand design loads.

1. Handrails, Rails, and Posts: 1-1/2-inch outside diameter, schedule 40 minimum.
2. Picket Infill: 1-inch square, 0.065” thick minimum pickets spaced 4 inches o.c.
3. Lower Rails: 1-1/2-inch outside diameter, schedule 40 minimum.

B. Railing Welded Connections: Fabricate railings with welded connections.

C. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. For railings, provide cast aluminum fittings, T-brackets, escutcheons, wall brackets, fasteners, and sleeves.
2. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.
3. Fasteners for Interconnecting Railing Components: Provide concealed spigots and fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

2.3 FASTENERS

A. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

1. Frame construction: Prepare backing plate for mounting in wall.
2. Exposed Fasteners: Flush countersunk screws or bolts consistent with design of railing.

B. Bolts, Nuts, and Washers: Type 304 stainless steel.

C. Toggle Bolts: Type 304 stainless steel.

D. Anchor Bolts: Type 304 stainless steel.

E. Post-Installed Chemical Anchors: Epoxy chemical set hot-dipped alloy steel B7 conforming to ASTM A193 of dimensions required to comply with delegated design and flat washers. Chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

F. Post-Installed Torque-controlled Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Interior: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5, unless otherwise indicated.
2. Exterior: Alloy stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

G. Provide adjustable brackets and flanges, with aluminum inserts for casting in concrete where indicated.

2.4 MATERIALS

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Extruded Bars Tubing: ASTM B 221, Alloy 6063-T5/T52.

C. Extruded Structural Pipe Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe minimum, unless otherwise indicated.

D. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.

E. Plate and Sheet: ASTM B 209, Alloy 6061-T6.

F. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.

G. Brackets, Flanges and Anchors: Cast or formed metal of same type of material and finish as supported rails unless indicated otherwise.

H. Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

2.5 MISCELLANEOUS MATERIALS

A. Welding Materials: AWS type required for welded materials, provide metal type as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M, formulated for 30-mil thickness per coat.

D. Aluminum to Steel Isolation Gaskets: Provide #15 asphalt impregnated felt gaskets between aluminum to steel bolted connections. Trim gasket tight to mounting base plate.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads. Railings shall be fabricated by one manufacture.

B. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for re-assembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

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 flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
5. Form changes in directions by bending or utilizing prefabricated elbow fittings
   a. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
6. Connect members where required with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints

F. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

G. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

H. Close exposed ends of railing members with prefabricated end fittings.

I. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

K. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

L. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

N. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

O. Fillers: Provide fillers made from plate material, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

P. Fabricate system to accommodate railing anchor plates.

2.7 FINISH

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

B. Aluminum Surfaces: Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

E. Clear Anodic Finish: Mechanical Finish, nonspecular as fabricated Chemical Finish, etched Anodic Coating, clear coating 0.7mils or thicker complying with AAMA 612. Complying with manufacturer's written instructions for cleaning, preparing, pretreating and apply coating to exposed metal surfaces.

2.8 ENVIRONMENTAL

A. Recycled Content: Provide products with an average recycled content of metal products so 100% of postconsumer recycled content plus 50% of preconsumer recycled content is not less than 20 percent.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

1. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

2. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Corrosion Protection: Coat concealed surfaces that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and ¾ inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed with anchoring material flush with adjacent surface.

C. Use cast pipe sleeves preset and anchored into concrete for installing exterior railing.

3.4 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

3.5 ADJUSTING AND CLEANING

A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 05 52 13

SECTION 06 10 00 – ROUGH CARPENTRY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. This Section includes the following:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
    a. Miscellaneous blocking, grounds, and nailers.

1.3 REFERENCES

A. ALSC (American Lumber Standards Committee) – Softwood Lumber Standards
B. EWA (The Engineered Wood Association)
C. APA (American Plywood Association)
D. AWPA U1 – Use Category System - User Specification for Treated Wood
E. AWPA P5 – Standard for Waterborne Preservatives
F. AFPA (American Forest and Paper Association)
G. ANSI/APA (American National Standards Institute/American Plywood Association)
H. ASTM C645 – Standard Specification for Nonstructural Steel Framing Members
I. ASTM C653/C653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
J. ASTM D226 – Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
K. MFMA (Metal Framing Manufacturer's Association) – Guidelines for the Use of Metal Framing
L. HPVA HP-1 – Hardwood Plywood and Veneer Association
M. Voluntary Product Standards PS-20 and PS-1
N. Grading rules of Southern Pine
O. FBC – Florida Building Code

1.4 DEFINITIONS

A. Rough carpentry includes carpentry work not specified as part of other Sections and generally not exposed, unless otherwise specified.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.6 INFORMATION SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.8 FIELD CONDITIONS

A. Examine substrates and supporting structure and the conditions under which work is to be installed. Do not proceed with the installation until unsatisfactory conditions have been corrected.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.
2. Keep treated wood waste separated from other wood to be recycled or reused as mulch. Discard in a legal manor.

PART 2 – PRODUCTS

2.1 LUMBER, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

B. Lumber Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

C. Inspection Agencies: SPIB – Southern Pine Inspection Bureau.

D. Grade Stamps: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

E. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.

1. Provide dressed lumber, S4S, unless otherwise indicated.
2. Provide seasoned lumber with 15 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness and 19 percent maximum for size 2” or more nominal thickness, unless otherwise indicated.

2.2 WOOD GROUNDS, NAILERS AND BLOCKING

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including blocking, nailers, and similar items.

B. Lumber for blocking may be any grade and classified standard and better for western species or classified No. 2 for Southern Pine. Plywood shall not be used for blocking materials.

C. Provide lumber for support or attachment of other construction including rooftop equipment curbs and support bases, grounds, and similar members.

D. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. Wood grounds, nailers, and sleepers shall be pressure treated as specified herein. The manufacturer and applicator of pressure treatment shall mark all wood.

2.3 EQUIPMENT PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood construction panels and, for products not manufactured under PS 1 provisions, with APA PRP-108. Furnish construction panels that are each factory-marked with APA trademark.

1. Panels: Exterior, AC, fire-retardant treated 3/4” thick.

2.4 FASTENERS

A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

B. Nails, Wire, Brads, and Staples: FS FF-N-105, or ASTM F1667.

C. Power Driven Fasteners: National Evaluation Report NER-272.

D. Wood Screws: ASME B18.6.1.

E. Treated Wood: Provide stainless steel fasteners of a type and size required for attachment.

F. Screws for Fastening to Metal Framing: ASTM C 954, except with wafer heads and reamer wins, length as recommended by screw manufacturer for material being fastened.

G. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

H. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.5 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

A. Where lumber or plywood is indicated as preservative-treated wood or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood). Mark each treated item with the AWPB or SPIB Quality Mark Requirements.

B. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

C. Pressure-treat above-ground items with water-borne preservatives to a minimum retention of 0.25 pcf. For interior uses, after treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Treat indicated items and the following:

1. Wood nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches above grade.
4. Wood floor plates installed over concrete slabs directly in contact with earth.

D. Pressure-treat wood members in contact with the ground or fresh water with water-borne preservatives to a minimum retention of 0.40 pcf.

E. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.6 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all rough carpentry unless otherwise indicated.

2.7 MISCELLANEOUS MATERIASL

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm):

PART 3 – EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

E. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.

2. Use copper naphthenate for items not continuously protected from liquid water.

G. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

SECTION 06 20 00 – FINISH CARPENTRY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Miscellaneous interior woodwork.
   b. Miscellaneous plastic laminate.
   c. Miscellaneous clad items.
   d. Shelving

1.3 REFERENCES

A. ALSC (American Lumber Standards Committee) – Softwood Lumber Standards.
B. EWA (The Engineered Wood Association).
C. APA (American Plywood Association).
D. AWPA U1 – Use Category System- User Specification for Treated Wood.
E. AWPA P5 – Standard for Waterborne Preservatives.
F. AFPA (American Forest and Paper Association).
G. ANSI/APA (American National Standards Institute/American Plywood Association).
H. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
I. AWI – Quality Standards.
J. NEMA (National Electric Manufacturer's Association) LD3 – High Pressure Decorative Laminates.
K. Voluntary Product Standards PS-20 and PS-1.
L. HPVA HP-1 – Hardwood Plywood and Veneer Association.
M. Grading rules of Southern Pine.
N. FSC – Forestry Stewardship Council.
O. SFI – Sustainable Forestry Initiative.
P. AMTF – American Tree Farm System.
Q. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Provide manufacturer's product data for each type of product and process specified in this section and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

B. Submit complete shop drawings and submit coordination drawings where other trades are involved with finished work by an approved fabricator for proposed items requiring shop fabrication processes.

C. Samples of:

1. Proposed solid woods for transparent finish (three 3/4 inch by 3 inch by 8 inch pieces of each species and cut).
2. Proposed veneered woods for transparent finish (three 3/4 inch by 8 inch by 8 inch pieces of each species and cut).
3. Available color and pattern choices for plastic laminate surfacing (one complete chain).

D. Product certificates signed by woodwork manufacturer certifying that products comply with specified requirements.

E. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

F. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664 and AWPA C27B.

G. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 QUALITY ASSURANCE

A. Quality Standards: Except as otherwise shown or specified, comply with specified provisions of the Architectural Woodwork Institute (AWI) "Quality Standards."

B. Optimum Moisture Content: Kiln-dry woodwork to an average moisture content within the following ranges or as otherwise recommended by applicable Quality Standards for the regional climatic conditions involved.

1. Interior woodwork - 5 to 10 percent.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soiling, and deterioration.

B. Do not deliver woodwork until painting, wet work, grinding, and similar operations which could damage, soil, or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in areas which meet the requirements specified for installation areas.

1.7 PROJECT CONDITIONS

A. Examination of Substrate and Conditions: The Installer must examine the substrate and the conditions under which the Work under this Section is to be performed and notify the Contractor in writing of any unsatisfactory conditions. Do not proceed with Work under this Section until unsatisfactory conditions have been corrected.

B. Do not install woodwork until the required temperature and relative humidity have been stabilized in installation areas.

C. Maintain temperature and relative humidity as required for a tolerance of plus or minus one percent of the specified optimum moisture content until woodwork receives specified finishes. Maintain temperature and humidity conditions until acceptance of the Work by the Owner.

D. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of work.

E. Protect installed woodwork from damage by other trades until Owner's acceptance of the Work. Advise Contractor of required protection procedures.

1.8 PERFORMANCE

A. All interior woodwork shall comply with Architectural Woodwork Standards (AWS).

PART 2 – PRODUCTS

2.1 INTERIOR MATERIALS

A. General: Provide materials that comply with requirements of the AWI Woodworking Standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:

1. Softwood Plywood: PS 1.
2. Hardwood Plywood and Face Veneers: HPVA HP-1.
3. Lumber: PS 20.
4. Trim:
    a. Softwood Species: Fir, select
    b. Hardwood Species: White Oak

c. Finish: Paint
d. Finger Joining: Not allowed
e. Face Surface: Smooth

5. High Pressure Laminate: NEMA LD3.
6. Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:
   a. Hardwood Plywood: HPMA FE

2.2 MISCELLANEOUS LAMINATE CLAD ITEMS

A. Laminate clad casework shall comply with custom grade quality standards as set forth in AWI, Section 400, Division 400B, "Laminate Clad Cabinets."

B. High Pressure Plastic Laminate (for miscellaneous millwork and paneling items).

1. Plastic laminate except backing or balancing sheets shall be high pressure laminate conforming to NEMA LD-1985. Color shall be selected by the Architect from the full line of standard colors.
2. Exposed Horizontal Surfaces: Shall be nominal .048 inch thick minimum with textured finish and conforming to NEMA standards for HGS horizontal grade.
3. Exposed and Semi-Exposed, Interior and Exterior Vertical Surfaces: Shall be .028 inch thick minimum with low lustre textured finish and conforming to NEMA standards for VGS vertical grade.
4. Backing Sheet for Concealed Surfaces: Shall be .028 or .020 inches thick, conforming to NEMA standards for VGS vertical grade or CL20 cabinet liner.
5. Backing Sheet for Semi-Exposed Surfaces: Shall be .028 inches thick, conforming to NEMA standards for VGS vertical grade. Use to balance face laminate.
6. Paneling (Plastic Laminate on Plywood): Shall be .048 conforming to HGS for face and all exposed edges.

C. Plastic laminate color shall be as selected by the Architect.

D. Manufacturer is as indicated however equal or better performing products of other manufacturers will be considered for acceptance by the Architect.

1. Formica Corporation
2. Laminart
3. Nevamar Corp.
4. Pioneer Plastics Corp.
5. Arborite, Forbo

2.3 SHELVING

A. Closet Shelving: Made from the following material, 3/4 inchthick.

1. Shelf: MDF with solid-wood front edge.
2. Shelf Cleats: 3/4-by-3-1/2-inchboards.

3. Brackets: Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.

2.4 FIRE-RETARDENT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
3. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841. [For enclosed framing and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings, and the following:

1. Plywood backing panels where indicated on drawings.

2.5 FASTENERS AND ANCHORS

A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

1. For metal framing supports, provide screws as recommended by metal framing manufacturer.

B. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

1. Low-Emitting Materials: Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 FINISH

A. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.

B. For painted finishes, refer to the Painting Specifications for final finishing of installed architectural woodwork and for material and application requirements of prime coats and final finish for woodwork.

2.7 ENVIRONMENTAL

A. Manufacturers: Submit manufacturer's documentation substantiating the requirements for each type of materials as indicated:

1. Provide Letter of Certification(s) for Sustainable Forestry from one of the following:
   a. Forestry Stewardship Council – (FSC)
   b. Sustainable Forestry Initiative – (SFI)
   c. American Tree Farm System – (AMTF)
2. Provide letter of certification signed by lumber supplier, indicating compliance with sustainable organization requirements and identify certifying organization.
3. Submit organization certification numbers; identify each certified product on a line-item basis.
4. Submit copies of invoices bearing the sustainable organization certification numbers.

B. Ureaformaldehyde: No ureaformaldehyde products shall be added or allowed in any products.

C. Adhesives: For adhesives, including printed statement of VOC content.

D. Composite Wood: For composite-wood products, documentation indicating that product contains no urea formaldehyde.

E. Recycled Content: Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with an average recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 20 percent.

F. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

1. Use adhesive that has a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Contact Adhesive: 250 g/L.

H. Adhesives: Adhesives for or site installation or factory fabrication: Submit manufacturer's documentation substantiating the following requirements for each type of materials provided per this specification:

1. Data: Product data for adhesives as indicated.
2. Submit manufacturer’s certification that products comply with VOC limits when calculated according to 40CFR 59, Subpart D (EPA Method 24).
3. Submit manufacturer's product data for adhesives. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.
4. Submit Green Seal Certification to GS-36 and description of the basis of certification.
5. Submit manufacturer's certification that products comply with SCAQMD #1168. Submit manufacturer's certification that products comply with SCAQMD Rule 1168 in areas where exposure to freeze/thaw conditions and direct exposure to moisture will not occur. In areas where freeze/thaw conditions do exist or direct exposure to moisture can occur, submit manufacturer's certification that products comply with Bay Area AQMD Reg. 8, Rule 51 for containers larger than 16 oz with California Air Resources Board (CARB) for containers 16 oz or less.

PART 3 – EXECUTION

3.1 PREPARATION

A. Condition finish carpentry to average prevailing humidity conditions in installation areas prior to installing.

B. Before installing finished carpentry, examine shop fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 FINISH CARPENTRY INSTALLATION

A. Quality Standard: Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.

B. Install, plumb, level, true, and straight with no distortions. Shim as required using concealed shims.

C. Cut to fit unless specified to be shop fabricated or shop cut to exact size. Where woodwork abuts other finished work, scribe and cut for accurate fit. Before making cutouts, drill pilot holes at corners.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use screws or fine finishing nails for exposed fasteners, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

E. Distribute defects allowed in the quality grade specified to the best overall advantage when installing job assembled woodwork items.

END OF SECTION 06 20 00

SECTION 06 41 16 – PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Plastic-laminate-faced architectural cabinets.

1.3 REFERENCES

A. Plywood Product Standards: Comply with PS 1 (ANSI A199.1) or, for products not manufactured under PS 1 provisions, with applicable APA Performance Standard PRP-108 for type of panel indicated.
B. ANSI/APA (American National Standards Institute/American Plywood Association).
C. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
D. AWI – Quality Standards.
E. BHMA A156.9 – Cabinet Hardware.
F. FED MMM-A-130 – Adhesive, Contact.
G. NEMA (National Electric Manufacturer's Association) LD3 – High Pressure Decorative Laminates.
H. PS 1 – Construction and Industrial Hardwood.
I. PS 20 – American Softwood Lumber Standard.
J. Voluntary Product Standards PS 20-70.
K. Grading rules of Southern Pine.
L. FSC – Forestry Stewardship Council.
M. SFI – Sustainable Forestry Initiative.
N. AMTF – American Tree Farm System.
O. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated including cabinet hardware and accessories and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Indicate quality grade, materials, species, construction, sizes, shapes, quantities, locations, and conditions of adjoining work.
2. Indicate items in related or dimensional position with sections or details shown either full size or 3" = 1'-0" scale.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
5. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Samples for Initial Selection:

1. Plastic laminates and materials
2. Accessories
3. Sheet wall protection

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of product, signed by product manufacturer.

C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturers with at least five (5) years experience making the specified materials as a current catalog and regular production item. Manufacturer shall employ skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance and is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Employ only experienced Installers skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five (5) years and are certified participant in AWI's Quality Certification Program.

C. Source Limitations: Provide products of the same manufacturer for all cabinets.

D. Fire Hazard Classification: Comply with required NFPA, ANSI, and UL surface burning characteristics for plastic laminates, lumber, and plywood.

E. All cabinets shall comply with AWI’s Woodwork Quality Standards for grades of interior architectural woodwork, construction, finishes and other requirements.

1. Provide AWS Certificate with shop drawings indicating that the woodwork complies with the requirements of the grades specified.

1.7 DEFINITIONS

A. Exposed Portions of Casework: Bottoms of casework more than two feet above floor shall be considered as exposed. Visible members in open cases also shall be considered as exposed portions.

B. Semi-Exposed Portions of Casework: Includes those members such as divisions, interior faces of ends, case back, backs and bottoms.

C. Concealed Portions of Casework: Include panels and other surfaces not usually visible after installation.

1.8 MOCK-UP

A. Submit a sample of the cabinet, if the sample deviates from the specification and Design Criteria in any way, the Contractor must submit a substitution request. If the product is comparable to the specification, the Contractor must submit a comparable product request.

B. Sample does not have to be full scale but large enough to display all the materials listed in this standard to include: fronts, tops, backs, sides laminate, shelf, pulls, slides, backing, rails, hinges, base, doors and drawers.

C. The sample may be an on-site mockup and may be used as part of work upon Architect approval.

1.9 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. All cabinets shall be manufactured in a climate-controlled environment, stored after fabrication in a climate controlled (temperature and humidity) storage area and shipped to the jobsite in an enclosed container (semi-tractor trailer).

C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Coordinate work with plumbing, mechanical, electrical, and other trades for rough-in work and installation of adjacent and associated components.

E. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed and indicate measurements on Shop Drawings.

F. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

G. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

1.12 WARRANTY

A. Cabinet Manufacturer shall warrant all casework products against manufacturing defects in materials and workmanship for a period of five (5) years.

B. Manufacturer shall warrant against structural failure of the cabinet body for a period of ten (10) years.

C. Installers Warranty: The installer shall warrant the entire installation against defects in material and workmanship for a period of one (1) years.

D. Duration of all warranties shall begin on the date of Substantial Completion.

E. Products will be repaired or replaced by Manufacturer, without cost to the Owner.

1.13 PERFORMANCE

A. Manufacturers shall have independently tested their products and be able to submit documentation of results indicating compliance with AWI Performance Duty Level 3 as a minimum for structural performance.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Fabricators: Fabricators shall provide products subject to compliance with requirements and criteria as indicated.

2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Custom Premium

C. Type of Construction: Frameless. Face frame

D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay. Reveal overlay Full overlay

E. Reveal Dimension: 1/2"

F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.

1. Laminate Cladding for Exposed Surfaces:
   a. Horizontal Surfaces: Grade HGS (.048) - Horizontal Grade, High Pressure Decorative Laminate.
   b. Post-Formed Surfaces: Grade HGP (.042) - Post Forming.
   c. Vertical Surfaces: Grade VGS (.028) - Vertical Grade, High Pressure Decorative Laminate.
   d. Concealed Backing: Grade BKH (.028) - High Pressure Backer. Thermoset decorative panels.
   e. Cabinet Liner: Grade CLS (.020) - High Pressure Cabinet Liner. Thermoset decorative panels.
2. Materials for Semi-Exposed Surfaces:
   a. Surfaces not specifically indicated: High-pressure decorative laminate, NEMA LD 3, Grade CLS.
   b. Concealed Backing: Grade BKH (.028) - High Pressure Backer. Thermoset decorative panels.
   c. Cabinet Liner: Grade CLS (.020) - High Pressure Cabinet Liner. Thermoset decorative panels.

d. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade CLS.

3. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops
4. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
5. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces as selected by Architect from laminate manufacturer's full range in the following categories.
   a. Solid colors.
   b. Wood grains.
   c. Patterns.
   d. Finish Types
6. Manufacturer is as indicated however equal or better performing products of other manufacturers will be considered for acceptance by the Architect.
   a. Wilsonart International
   b. Nevamar
   c. Formica Corporation
7. Edges: PVC edge binding, 12” thick matching laminate in color or as selected by the Architect. Match laminate in color, pattern, and finish.

G. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

H. Core Material:

1. Provide millwork or casework plywood cores of hardwood plywood “Veneer Core” Grade AA, with no-added-Urea Formaldehyde adhesives.
   a. Use 3/4" thick, closed-grain hardwood plywood typical unless noted otherwise.
   b. Use 1/4" thick hardwood plywood at indicated locations.
2. Particleboard: 3/4" or as noted and complying with ANSI A208.1, Grade M-2 - Exterior Glue.
3. Medium Density Fiberboard (MDF): 3/4” or as noted and comply with ANSI A208.2, Grade 155. made with binder containing no urea formaldehyde.
4. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
5. Marine Grade Plywood: 3/4" specially designed panel made entirely of Douglas-fir or Western Larch. The grade of all plies of veneer is B or better. Exposure rating is Exterior and the glue used is a fully waterproof structural adhesive. Marine grade plywood shall be used for sink cabinets bases. Marine grade plywood shall be used at countertops and backsplashes within 3’-0” of sink areas.
6. Softwood Plywood: 3/4" and as indicated, AC pressure DOC PS 1.
7. Hardwood plywood, 1/4', 1/2" thick or as indicated, Grade AA, HPVA HP-1 formaldehyde free, water resistant exterior glue.
8. Hardboard: 1/4” tempered smooth both sides conforming to ANSI A135.4.
9. Lumber: Solid wood hardwood, 1/2”, 3/4" or as indicated kiln-dried, select Poplar, Fir or Grade III mill option.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
4. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of architectural cabinets.

C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

1. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi (550 kPa); and screw-holding capacity on face and edge, 250 and 225 lbf, respectively.
2. For panels 13/16 to 1-1/4 inches thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, 1300 psi; modulus of elasticity, 250,000 psi; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf, respectively.

D. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

2.4 MISCELLANEOUS MATERIALS

A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

B. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, fire-retardant-treated softwood lumber kiln dried to less than 15 percent moisture content.

C. Adhesives: Do not use adhesives that contain urea formaldehyde. Water based low Volatile Organic Compound (VOC) Non-toxic, PVA adhesive.

D. Glazing: Provide clear, tempered glass for glazed doors and openings in cabinetwork, 1/4" thick unless otherwise indicated, or approved.

2.5 HARDWARE

A. Hinges: Steel Institutional 2-3/4-inch, five-knuckle with interlaying leaves, 0.095-inch-thick metal with 170 degree opening.

B. Door Catches: Provide heavy duty, spring loaded, large 11/16" diameter roller mounted catch at bottom edge of door. All doors over 48" in height shall have top and bottom catches. At double doors provide cast aluminum “Ives #2 Elbow Catch” at inactive leaf. Pull chains not permitted. At wardrobe cabinets provide fixed shelf at center of unit for catch mounting.

C. Pulls: Solid 5" stainless-steel wire pulls 2-1/2" deep and 5/16” in diameter, fastened from back with two screws. Provide two pulls for drawers more than 24 inches wide. Pull design shall comply with Americans with Disability Act (ADA).

D. Chain Stops: Provide at doors that open towards other finished materials, equipment or building components such as existing and future appliances, walls, and other cabinets. Provide 12” long chain with 1-1/2" x 1" attachment plates at either end. Install near top of cabinet door so the door will not open beyond 90 degrees and less if required so the door handle will not hit adjacent surfaces.

E. Adjustable Shelf Supports: Recessed shelf standards with adjustable metal clips, K&V 255 standards and 256 supports or approved equal.

F. Shelf Supports: Two-pin-locking plastic shelf rests complying with BHMA A156.9, Type B04013.

1. Pins: Polycarbonate double pin #55036 clear as manufactured by AllenField Innovative Design & manufacturing.

G. Shelf Supports: L-shaped 0.25” metal pin shelf rests complying with BHMA A156.9, Type B04013.

H. Adjustable Shelf Supports: Injection molded polycarbonate (clear color), friction fit into cabinet and panels and vertical dividers, adjustable on 1-1/4" centers. Each shelf support with two (2) integral supports pins, 5 mm diameter, to interface pre-drilled holes and prevent accidental rotation of support. Supports automatically adaptable to 3/4" or 1" thick shelving and provide non-tip feature for shelving. Supports are designed to readily permit field fixing of shelf if desired. In lieu of above, provide 1/4" diameter holes at 1-1/4" o.c. vertically to receive Hafele Type “H” nickel-plated shelf clamp supports (four per shelf). Shelving 3-feet wide or wider shall be 1-inch thick.

I. Drawer Slides: Standard clear zinc finish, ball bearing rollers, and 100 pounds dynamic load, Model #8400 by K&V or approved equal and for file drawers 150 pounds dynamic load, Model #8600 by K&V or approved equal. Drawer Slides: Accuride standard clear zinc finish, ball bearing rollers and 100 pounds dynamic load, Model #3301 or approved equal.

J. Drawer Slides: BHMA A156.9.

1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; full-extension type; zinc-plated steel with polymer rollers.
2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
3. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.
4. For drawers more than 3 inches (75 mm) high but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.
5. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-200.
6. For computer keyboard shelves, provide Grade 1HD-100.
7. For trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide Grade 1HD-100.

K. Locks: Cylinder type with 5-disc tumbler mechanism and each area or room shall be keyed alike and keyed to the room entry door. Locks shall be provided where shown on the drawings. Provide on all doors and drawers, on pair of doors the left leaf shall be provided with a concealed spring-loaded manual latch and the lock shall be located on the right door.

L. Door and Drawer Silencers: Clear soft-stem bumpers #32479 as manufactured by Rockler Woodworking & Hardware or approved equal. Provide at all doors and drawers.

M. Finish: Satin chrome US 26D

N. Finish: Satin stainless steel US 32D

2.6 FABRICATION

A. General:

1. All exposed cabinet edges shall be beveled or rounded to prevent sharp edges or corners.

B. Fabrication Workmanship:

1. Construct millwork items in accordance with specified quality grade of reference standards, except as otherwise specified or detailed.
2. Construct millwork items using materials specified for plastic laminate finish.

C. Milling:

1. Fabricate and assemble work at mill as complete as practicable.
2. Deliver ready to assemble and set in place.
3. Machine sand all work at mill and deliver free of machine or tool marks or defects that will show through finish.

D. Provide plastic laminate finish on all exposed surfaces of doors, drawers, countertops, splashes, etc. of cabinets unless noted otherwise.

E. Countertops and Backsplashes:

1. See drawings and specifications for additional types of countertops.
2. Countertops: 3/4" plywood 1-1/2" thick edge and with high pressure plastic laminate.
3. Backsplashes: 3/4" plywood with high pressure plastic laminate.
4. Provide 3/4" thick marine grade plywood in within 3’-0” of sinks.
5. Provide 1" radius at exposed corners.

F. Base: 4- inch high, 3/4" pressure treated plywood or lumber.

G. Body: 3/4" plywood.

1. Tops, bottoms, and sides to be glued and paneled.
2. High Pressure Plastic Laminate.
3. Provide 3/4" thick marine grade plywood for body where sinks are located.

H. Cabinet Backs: Cabinet back shall be 1/2" plywood and shall be fully bound (dadoed) into sides, top and bottom, recessed 7/8" from the cabinet rear. Rear, unexposed side of back shall be toe-nailed to cabinet body with mechanical fasteners and solidified with a continuous bead of industrial grade hot melt adhesive to withstand a bond test as described in ANSI/WDMA I.W.1A. All cabinet backs shall have a minimum of two plywood laminate clad flush mounting blocks (hang rails).

I. Hang rails shall be 3/4" x 4” high plywood and located at rear of cabinet back and on the inside and fastened to cabinet sides. Provide 2 hang rails at wall cabinet, 1 hang rail at base cabinet and three hang rails at tall cabinets.

J. Doors: 3/4" plywood up to 36” wide and/or high and 1” thick over 36” wide and/or 36” high.

1. Front and Back: High Pressure Laminate.

K. Shelving: 3/4" plywood, maximum 36" unsupported width, 1” for shelves over 36’ wide up to 48” wide.

1. Top and Bottom: High pressure laminate.
2. Provide 1" radius at exposed corners in open shelving.
3. Shelves shall be full depth.

L. Drawer:

1. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
2. Join sub-fronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.
3. Front: 3/4" plywood with high pressure laminate face with cabinet liner on the back.
4. Bottom: 1/4", plywood, thermoset decorative panels fully bound (dadoed) into front, sides and back laminated with cabinet liner.
5. Sides and back: 1/2" thick hardwood plywood, medium density fiberboard thermoset decorative panels with cabinet liner.

M. Body, Door, Drawer, and Shelves Edges

1. Edges: PVC edge band.
2. Edges: High Pressure Laminate.

N. Dust Panels: 1/4-inch plywood above compartments and drawers unless located directly under tops.

O. Construction Tolerances

1. Gap between doors, drawers, panels and frames shall be 1/8".

P. Fabricate cabinets to dimensions, profiles, and details indicated.

Q. Plastic laminate shall be applied to the top of all tall cabinets and scribed to wall.

R. Finish Hardware: Fit drawer guides and cabinet-mounted shelf standards at mill.

1. Ship other finish hardware items loose for installation at job site.

S. Glazing: Install glazing at mill to the greatest extent practical.

1. Field glazing shall be with dry type glazing gaskets sized to eliminate gaps and prevent loose glazing installations.

T. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

U. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 – EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

C. Examine surfaces for conditions that would prevent quality installation of millwork.

D. Verify that grounds and blocking are in place to support millwork.

E. Do not install on defective conditions, doing so shall indicate acceptance of site conditions and require you to correct any defects.

3.2 INSTALLATION

A. Do not start installation until the building is enclosed and the HVAC system controls the temperature and humidity (75 degrees, 55 RH) in the room space.

B. Erect the cabinets plumb, level, true and straight with no distortions. Countertops shall be installed to with-in 1/8-inch of level in a 10-foot length.

C. All cabinet faces shall be plumb and true from door face to door face. There shall be no side hanging or non-plumb doors. Seams shall be flush.

D. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk, and filled flush with woodwork.

1. Use filler matching finish of items being installed.

F. Install cabinets without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

G. Install cabinets with no more than 1/8 inch in 120-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.

H. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

I. Caulk all cabinets and countertops to adjacent wall surfaces.

J. Accurately scribe and fit scribe strips, trim strips, and filler panels to irregularities of adjacent surfaces, maximum gap opening 0.025". Plastic laminate overlay trim shall not be used to close caps.

K. Secure cabinets permanently to floor using anchors spaced at maximum of 30" o.c., minimum of two for each unit while maintaining 3/4" clearance between the back of cabinet and the exterior wall.

L. Bolt adjoining cases together, maximum width of joints 1/32".

M. Fasten tops to bases with screws driven through base cabinet top frame into bottom of countertop.

N. Scribe all backsplashes and aprons and caulk.

O. Blocking, Bucks, and Nailers: Install plumb, level and true with joints flush, fastened securely in place.

P. Furring and Stripping: Install plumb and level, shim to provide true finish surface.

Q. Install color-matched sealant at unfinished joints with other materials.

R. Install wall-shelving standards on solid backing or with toggle bolts into steel studs or masonry or TEK screws into concrete.

1. Do not install wall-shelving standards into gypsum wallboard only.
2. Space standards as required to support indicated loading but not less than 5-plf based on shelf material provided.

S. Do not install cabinetry or millwork closer than 24" to ceilings in fully sprinklered buildings or such that installation obstructs any fire sprinkler head.

T. Glazing: Field glazing shall be with dry type glazing gaskets sized to eliminate gaps and prevent loose glazing installations.

3.3 SPECIAL INSTALLATION PROCEDURE / ADJUSTMENT PROCEDURES

A. Provide all items and accessories as required for a total and complete installation in every respect.

B. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of any items indicates all conditions are satisfactory and acceptance of previous Work by other Contractors.

C. Adjust cabinets and hardware so that doors and drawers operate smoothly.

3.4 CLEANING

A. All modular cabinet surfaces shall be cleaned of construction spoils, dirt, spills, dust, and stains. The modular cabinet manufacturer shall recommend cleaning solvent. Clean all surfaces, edges, and cabinet interiors.

B. Remove and dispose of all packing materials and related construction debris.

C. Protection: Protect casework from damage during construction until date of Substantial Completion, replace damaged work.

END OF SECTION 06 41 16

SECTION 07 21 00 – THERMAL INSULATION

PART I – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Extruded polystyrene foam-plastic board (XPS).
   b. Mineral wool batt.
   c. Mineral wool board

1.3 REFERENCES

A. ASTM C209 – Standard Test Methods for Cellulosic Fiber Insulating Board.
B. ASTM C236 – Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box.
C. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
D. ASTM C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
E. ASTM C612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
F. ASTM C665 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
G. ASTM C726 – Standard Specification for Mineral Wool Roof Insulation Board
H. ASTM C764 – Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation (loose min wool).
I. ASTM C1289 – Standard Specification for Faced Rigid Cellular Polyisocyanorate Insulation Board (polyis).
J. ASTM D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
K. ASTM E96 – Test Method for Water Vapor Transmission of Material.
L. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
M. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.
N. ASTM E136 – Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750o C.
O. UL 723 – Test for Surface Burning.
P. NFPA 255 – Test of Surface Burning Characteristics of Building Materials.
Q. FBC – Florida Building Code.
R. ASHRAE Handbook.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated including performance.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

C. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Insulation Protection: Do not expose to sunlight except to necessary extent for period of installation and concealment. Protect against ignition at all times and do not deliver materials to project site before installation time.

1.8 WARRANTY

A. Provide written warranty from the manufacturer that the actual thermal resistance of the extruded polystyrene insulation will not vary by more than 10% from its published thermal resistance.

B. Warranty period is 15-years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer shall be one of the following in each category however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. CertainTeed Corporation
2. Johns Manville
3. Owens Corning
4. Knauf Insulation
5. Dow Chemical Co.
6. Atlas Roofing Corp.

2.2 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD (XPS)

A. Basis of Design: "Styrofoam Square Edge" as manufactured by Dow Chemical Co.

B. Extruded Polystyrene Board: Unfaced, ASTM C578, Type IV with maximum flame-spread of 15 and smoke-developed indexes of 165, respectively, per ASTM E 84.

1. Minimum R-Value 5 per inch of thickness.
2. Thickness: Total thickness shall be 1", 2", and as indicated on drawings.

C. Provide in gypsum wall board exterior wall cavities and as indicated on drawings.

2.3 MINERAL WOOL BATT

A. Unfaced Mineral Wool Batt: ASTM C665, Type I, Class 1 with maximum flame-spread of 25 and smoke-developed indexes of 50, respectively, per ASTM E 84.

1. Loose fill density: 4 – 6 lbs.cu. ft.
2. Thickness: Total thickness shall be 3 1/2" and as indicated on drawings.

2.4 MINERAL WOOL BOARD

A. Unfaced Mineral Wool Board: ASTM C612, Type II, Class 1 with maximum flame-spread of 25 and smoke-developed indexes of 50, respectively, per ASTM E 84.

1. Loose fill density: 4 - 6 lbs.cu. ft.
2. Thickness: Total thickness shall be 3 1/2" and as indicated on drawings.

2.5 EXTERIOR INSULATION SYSTEMS

A. Exterior Insulation Under Stucco

1. Basis of Design: "Stucco Shield II," ASTM C1289 Type 2, Class 2, 1", 2" thickness. and as indicated on plans.

B. Exterior Insulation Under Metal Wall Panels

1. Basis of Design: "RBoard'" ASTM C1289 Type 2, Class 2, 1", 2" thickness, and as indicated on plans.

2.6 ACCESSORIES

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.

1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
4. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates as recommended by insulation manufacturer.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

C. Steel Wire: Electroplated wire to be utilized where other anchorage methods are not compatible with conditions, type and size to suit application.

D. Wire Mesh: Galvanized steel hexagonal wire mesh to be utilized where other anchorage methods are not compatible with conditions, type, and size to suit application.

E. Insulation for Miscellaneous Voids: Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to rain at any time.

C. Extend insulation to envelop entire building to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION ON INTERIOR FACE OF EXTERIOR WALL

A. Board Insulation: Install spindle-type anchors spaced as recommended by manufacturer. Fit insulation tight to obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

3.4 INSTALLATION OF BATT INSULATION IN FRAMED CONSTRUCTION

A. Batt Insulation: Install in cavities formed by framing members and where indicated according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

B. Miscellaneous Voids: Install loose fill insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

3.5 DRAFT STOPPING

A. Provide draft stopping in any concealed space of the extruded insulation at the ceiling line, at locations where interior wall(s) intersect or abut the exterior wall, at no more than 20' intervals in large rooms with walls over 10', and as required by FBC.

1. Draft stopping shall be solid minimum 22-gauge metal strip.
2. Anchor draft stopping independent of the extruded insulation.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

Martin County School District
District Administrative Offices
New Boardroom Tenant Improvement

SECTION 07 42 33 – PHENOLIC WALL PANELS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Exterior solid phenolic cladding panel system and accessories as required for a complete drained and back-ventilated rainscreen system.

1. Fascia.
2. Horizontal soffits.

B. Interior solid phenolic cladding panel system and accessories.

1.3 RELATED SECTIONS

A. Section 05 50 00 - Metal Fabrications; additional sub framing, Z girts to accommodate exterior insulation is not in the scope of Section 07 42 33.

B. Section 07 20 00 - Insulation; exterior insulation, if required for NFPA 285 compliance, is not included in the scope of Section 07 42 33.

C. Section 08 41 00 - Entrances and Storefronts.

D. Section 09 29 00 - Gypsum Board.

1.4 REFERENCES

A. ASTM International (ASTM):
1. ASTM B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
2. ASTM D 635 - Standard Test Method for Small Scale Burning.
3. ASTM D 1929 - Standard Test Method for Ignition Temperature.
4. ASTM D 2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
5. ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
6. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
7. ASTM E 119 - Standard Test Method for Fire Rated or Fire Resistive Construction.

8. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors Under the Influence of Wind Loads.

B. National Fire Protection Association (NFPA):
1. NFPA 268 - Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
2. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Submit plan, section, elevation, and perspective drawings necessary to describe and convey the layout, profiles and product components, including edge conditions, panel joints, fixture location, anchorage, accessories, finish colors, patterns andtextures.

D. Code Compliance: Documents showing product compliance with local building code shall be submitted prior to the bid. These
documents shall include, but not be limited to, appropriate Evaluation Reports and/or test reports supporting the use of the product. Alternate materials must be approved by the architect of record prior to the bid date.

E. Engineering Calculations: Submit engineering calculations as required by the local building code, showing that the installed panels and attachments system meets the wind load requirements for the project.

F. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns. Please note that samples are only representative for color and pattern and not for thickness or edge finish. Metallic colors may also show a slight fluctuation in appearance do to the metal flake orientation from batch to batch.

G. Verification Samples: For each finish product specified, two samples a minimum of 3.5 inches by 3.5 inches (89 mm by 89 mm) representing actual product, color, and patterns. Sample edges may vary from field panel edges.

H. Operation and Maintenance Data: Submit operation, maintenance, and cleaning information for products covered under this section.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary panel products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.

1. Products covered under the Work listed in this section are to be manufactured in an ISO 9001 certified facility.

B. Installer Qualifications: All products listed in this section are to be installed by a single installer trained and approved by the manufacture or representative.

C. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

D. Mock-Up: Provide a mock-up for evaluation of the product and application workmanship.

1. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

E. Pre-installation Meetings: Conduct pre-installation conference to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. During transportation, use stable, flat pallets that are at least the same dimension as the sheets.
2. Materials shall be packaged to minimize or eliminate the possibility of damage during shipping. Items such as wooden side boards, wooden lid, and spacers or protective sheeting between panels shall be used to protect the panels from surface and/or edge damage.

B. Storage:

1. Store products in an enclosed area protected from direct sunlight, moisture and heat. Maintain a consistent temperature and humidity.
2. Store products in manufacturer's unopened packaging until ready for installation.
3. Stack panels using protective dividers to avoid damage to decorative surface.
4. For horizontal storage, store sheets on pallets of equal or greater size as the sheets with a protective layer between the pallet and sheet and on top of the uppermost sheet.
5. Do not store sheets, or fabricated panels vertically.

C. Handling:

1. Remove protective film within 24 hours of the panels being removed from the pallet.
2. When moving sheets, lift evenly to avoid dragging panels across each other and scratching the decorative surface.
3. Remove all labels and stickers immediately after installation.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimumresults. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Field Measurements: Verify actual measurements/openings by field measurements performed by the installer prior to release for fabrication. Recorded measurements to be indicated on shop drawings based on field measurements provided by the installer. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.9 WARRANTY

A. Warranty: At project closeout, provide manufacturer's limited ten year warranty covering defects in materials. Warranty only available when material installed by an installation contractor trained and approved by the manufacturer's representative.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Trespa International B.V.; P.O. Box 110, 6000 AC Weert Wetering 20, 6002 SM Weert The Netherlands; www.trespa.com.

B. Acceptable Manufacturer's Representative: Trespa North America, Ltd.; 12267 Crosthwaite Cir., Poway, CA 92064. ASD. Toll Free
Tel: (800) 4-TRESPA. Tel: (858) 679-2090. Fax: (858) 679-9568. Email: info.northamerica@trespa.com. Web: http://www.trespa.com/na.

C. Substitutions: Not permitted.

D. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.2 WALL PANELS

A. Solid Phenolic Wall Panels: Trespa Meteon by Trespa International as represented by Trespa North America, LTD.

1. Color: As selected by the Architect from manufacturer's standard color palette.
2. Finish: Satin sheen.
3. Panel Core: Fire retardant (FR) black core.
4. Panel Thickness: 1/2 inch (13 mm).
5. Physical Properties:
   a. Modulus of Elasticity: 1,300,000 psi (9000 N/mm2) minimum, ISO 178.
   b. Tensile Strength: 10,100 psi (70 N/mm2) minimum, ISO 527-2.
   c. Flexural Strength: 14,500psi (120 N/mm2) minimum, ISO 178.

d. Thermal Conductivity: 2.1 BTU/inch/ft2.hr.°F, EN 12524.
e. Structural Performance (ASTM E330):
   1) Panels shall be designed to withstand the Design Wind Load based upon the local building code, but in no case less than 15 pounds per square foot (psf). Wind load testing shall be done in accordance with this standard to obtainthe following results:
   2) Normal to the plane of the wall, the maximum panel deflection shall not exceed L/175
   3) Normal to the plane of the wall between supports, deflection of the aluminum sub-framing members shall not exceed L/175 or 3/4 inch, whichever is less
      a) At 1-1/2 times design pressure, permanent deflection of framing members shall not exceed L/100 of span length and components shall not experience failure or gross permanent distortion.
      b) If system tests are not available, mock ups shall be constructed and tests performed under the direction of an independent third party laboratory which show compliance to the minimum standards listed above.

6. Fire Performance:
   a. Flame Spread: Class A, ASTM E 84.
   b. Smoke Development: Less than 450, ASTM E 84.
   c. Ignition Temperature: Greater than 650 degree F (350 degree C) above ambient, ASTM D1929.
   d. Burning Classification: CC1 or CC2, ASTM D635.
   e. When required for compliance with local building codes, the wall cladding assembly shall show no degradation of the rating of Fire Resistant Assemblies, ASTM E119.
   f. When required for compliance with local building codes, the wall cladding assembly including cladding and non-cladding elements such as, but not limited to, specific weather resistive barriers and/or exterior insulation materials, shall meet the performance requirements of NFPA 285. Performance shall be determined by actual testing in accordance with NFPA 285or through an equivalency analysis provided by a recognized fire protection expert.
   g. When required for compliance with local building codes, the wall cladding assembly shall not ignite when exposed to a radiant heat energy source, NFPA 268.
7. Finish Performance: Electron Beam Cure resin in conformance with the following general requirements:
   a. Color: As selected by the architect/engineer from manufacturer's standard colors or a custom color to be matched by the panel supplier.
   b. Humidity Resistance: No formation of blisters when subjected to condensing water fog at 100% relative humidity and 100 degree F (38 degree C) for 3000 hours, ASTM D 2247.
   c. Salt Spray Resistance: Corrosion creepage from scribe line (1/16 inch (1.6 mm) max.) and minimum blister rating of 8 within the test specimen field, ASTM B117.
   d. Weather Exposure: Accelerated - 3000 hours in Atlas Type Weatherometer using cycle of 90 minutes light and 30 minutes diminished light and demineralized water with a maximum color change of 5 Delta E units from the original color according to ASTM D-2244, with the exception of Uni-Colors A12.3.7 / A18.3.5 / A04.1.7, which will not deviate more than 10 Delta E units from original color according ASTM D-2244.
   e. Color Stability: The decorative surface comply with, classification, 4 - 5 measured with the grey scale according to ISO 105 A02-93 according to test method EN 438-2:29.
   f. Microbial Characteristics: Will not support micro-organic growth (ISO 846).

B. Mounting System:

1. TS210-285 - Concealed fastening over fixed depth aluminum sub-framing tested and meeting the performance requirements of NFPA 285.
2. TS220-285 - Concealed fastening over variable depth aluminum sub-framing tested and meeting the performance requirements of NFPA 285.
3. Other installation systems - Include test documentation showing compliance with the performance criteria set forth in the specification and in accordance with the local building code.

C. Aluminum Sub Structure: Aluminum sub-structure designed to withstand structural loading due to wind load and the dead load of the panel, painted as required to conceal behind the open joinery of the attachment system.

1. Extrusions, including corner closures, joint closures, and vent screens, formed members, sheet, and plate shall conform with the recommendations of the manufacturer.

D. Extruded Aluminum Trim: Color as specified in the finish schedule.

E. Fasteners (Concealed/Exposed): Fasteners shall be non-corrosive and as recommended by panel manufacturer. Exposed fasteners shall be colored to match panels where required by the Architect.

2.3 FABRICATION

A. Panels: Solid phenolic impregnated kraft paper wall panels with no voids, air spaces or foamed insulation in the core material. Accessory items in accordance with manufacturer's recommendations and approved submittals

B. Panel Weight: 8 mm (2.4 lb/ft2), 10 mm (3 lb/ ft2), 13 mm (3.8 lb/ ft2).

C. Panel Bow: = 2 mm / m (= 0.079 inch/39.38 inches).

D. Panel Dimensions: Field fabrication shall be allowed where necessary but shall be kept to an absolute minimum. All fabrication shall be done under controlled shop conditions when possible.

E. Appearance: Panel lines, breaks, and angles shall be sharp, true, and surfaces free from warp and buckle

PART 3 – EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Surfaces to receive panels shall be even, smooth, dry, and free from defects detrimental to the installation of the panel system. Notify Contractor in writing of conditions detrimental to proper and timely completion of the work.

C. Confirm exterior sheathing is plumb and level, with no deflection greater than 1/4 inch (6 mm) in 20 feet (6096 mm).

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 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.

3.3 INSTALLATION

A. Install solid phenolic wall panels and sub-frame system in accordance with manufacturer's instructions.

B. Install solid phenolic wall panels plumb and level and accurately spaced in accordance with manufacturer's recommendations and approved submittals and drawings.

C. Anchor panels and sub-framing securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary movement and structural support.

D. Fasten solid phenolic wall panels with fasteners approved for use with supporting substrate.

E. Do not install panels or component parts which are observed to be defective or damaged including, but not limited to: warped, bowed, abraded, scratched, and broken members.

F. Do not cut or trim component parts during installation in a manner that would damage the finish, decrease the strength, or result in visual imperfection or a failure in performance. Return component parts with require alteration to the shop for re-fabrication or replacement.

G. Install corner profiles and trim with fasteners appropriate for use with adjoining construction as indicated on the Contract Drawings and as recommended by manufacturer.

3.4 ADJUSTING AND CLEANING

A. Remove masking or panel protection as soon as possible after installation. Any masking intentionally left in place after panel installation on an elevation, shall become the responsibility of the General Contractor to remove.

B. Adjust final panel installation so that all joints are true and even throughout the installation. Panels out of plane shall be adjusted with the surrounding panels to minimize any imperfection.

C. Repair panels with minor damage. Remove and replace panels damaged beyond repair as a direct result of the panel installation. After installation, panel repair and replacement shall become the responsibility of the General Contractor.

D. Clean finished surfaces as recommended by panel manufacturer. After installation cleaning, cleaning during construction shall become the responsibility of the General Contractor.

END OF SECTION

SECTION 07 52 00 – MODIFIED BITUMEN MEMBRANE ROOFING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Multi-ply modified bitumen roofing system over sloping rigid insulation.
   2. System to be torch applied.

1.3 REFERENCES

A. ASTM D41 – Standard Specification for Asphalt Primer for Used in Roofing, Damp-proofing, and Waterproofing
B. ASTM D312 – Standard Specification for Asphalt Used in Roofing
C. ASTM D2178 – Standard Specification for Asphalt-Impregnated Glass Felt used in Roofing and Waterproofing
D. ASTM E96 – Standard Test Method for Water Vapor Transmission of Materials
E. ASTM E108 Standard Test Methods for Fire Test of Roof Coverings
F. ASCE 7 – Minimum Design Loads for Buildings and Other Structures
G. NRCA – Roofing and Waterproofing Manual, Current Edition
H. UL – Fire Hazard Classifications
I. UL – Roofing System & Material Guide
J. Florida Building Code (FBC)

1.4 SUBMITTALS

A. Product Data: Submit specifications, installation instructions, and general recommendations from manufacturers of roofing system materials, for type of roofing required.
   1. Include data substantiating that materials comply with requirements, including list of materials proposed for use and manufacturer's product data sheets for other products.
   2. Provide sample copies of specified warranties, including evidence of application for warranty from manufacturer.
   3. Include complete manufacturer’s instructions for periodic inspection and maintenance of roofing system in closeout documentation.
B. Shop Drawings: Submit complete installation details showing roof configuration, sheet layout, seam locations, flashing, roof slopes, details at each different perimeter condition and special conditions.
   1. Provide fastening pattern layout in compliance with ASCE 7.
   2. Provide a copy of product approval for the system, per FBC requirements.
C. Samples: Submit 12" x 12" square of membrane system.
D. Certificates included with closeout documents:

1. Submit Manufacturers certification that materials and components furnished conform to specified requirements and that materials furnished are compatible for decks indicated.
2. At completion of work, submit manufacturer's certification that roofing system installation is in accordance with Manufacturer's warranty requirements.

E. Safety Provisions:
1. Submit a complete detailed schedule of special safety provisions implemented to insure the health and safety of the people.
2. Work shall not start without the Owner's agreement of the following provisions:
a. A plan for a dust free operation;
b. A plan for the sequencing of work and the removal of debris from the site during and after construction.
c. A fall protection plan indicating the contractor plans for complying with OSHA's requirements.

F. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

G. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

H. Indicate relative dollar value of recycled content product to total dollar value of product included in project.

I. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.

J. Approvals: Manufacturer submit documentation that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.5 ENVIRONMENTAL REQUIREMENTS AND SUBMITTALS

A. Criteria
1. Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
2. Product Data for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
3. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

B. Products.
1. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
2. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
3. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Contact Adhesive: 80 g/L.
f. Other Adhesives: 250 g/L.
g. Nonmembrane Roof Sealants: 300 g/L.
h. Sealant Primers for Nonporous Substrates: 250 g/L.

i. Sealant Primers for Porous Substrates: 775 g/L.

C. Certification
1. Submit manufacturer's documentation substantiating the requirements for each type of materials as indicated per specification section as certifications and other indicated documentation.

1.6 QUALITY ASSURANCE

A. Manufacturer:
1. Obtain primary roofing materials from a single manufacturer, with at least 10-years of documented experience in the roofing material business.

B. Installer: Shall be a Company specializing in installation of bituminous roofing, minimum five-years of continuous documented experience operating under the same name, with extensive experience in the application of roofs of similar size and type and approved in writing by manufacturer of accepted roofing system.
1. The job supervisor shall have minimum 5-years of documented experience in supervising projects of this size and scope.

C. All work shall conform to NRCA Roofing and Waterproofing Manual, and to manufacturers' instructions.

D. Requirements of Regulatory Agencies:
1. Underwriter's Laboratories, Inc.: Class A fire hazard classification.
2. Roofing system shall meet current ASCE 7 wind requirements for the roofing system.
3. Roofing system shall be designed to meet requirements in accordance with Figure 1609B, Florida Building Code.
4. Roofing system shall be designed and installed in accordance with FM Global Loss Prevention Data Sheets when these requirements are the most stringent.

E. Pre-Installation Conference:
1. Prior to installation of roofing system, conduct a pre-installation site conference after submittal approval.
2. Attendance: Owners Representative, Architect, Contractor, Job Superintendent, Subcontractors, and Manufacturer’s Representative related to roofing work.
3. Agenda: Review project conditions, application, coordination with other work, and protection of completed roofing.

F. Inspections:
1. Provide on-site weekly inspections by Owner’s representative during and after installation of roofing system.

G. Emissivity:
1. Provide minimum 0.9 emissivity as tested in accordance with ASTM E408.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers or packages with labels intact and legible, including required fire resistance classification labels.

B. Store and handle material per manufacturer's requirements.

C. Store rolled goods on end on clean raised platforms with a breathable weather protective covering, such as canvas, when stored outdoors (Polyethylene or other non-breathable plastic coverings are not acceptable).

D. Provide continuous protection of materials against wetting and absorption; remove wet materials from project site.

E. Rooftop Storage: Disperse material evenly across the roof to avoid concentrated loading.

1.8 PROJECT CONDITIONS

A. Proceed with roofing work only if existing and forecasted weather conditions permit work in accordance with manufacturers' recommendations and warranty requirements.
B. Do not apply roofing membrane to damp deck surface.

1.9 WARRANTIES

A. Installer's Warranty: Provide a written five-year warranty (starting from date of the total project's substantial completion) signed by the roofing Installer and the Contractor agreeing to replace or repair defective components and workmanship of the total roofing system.
   1. Including roofing membrane, flashing, insulation, and roofing accessories as required to maintain the total roofing system in a watertight condition at no expense to the Owner.
B. Manufacturer's Warranty:
   1. Provide written warranty signed by the Manufacturer of the primary roofing materials agreeing to replace or repair defective roof membrane and flashing materials and workmanship as required maintaining the roofing system in a watertight condition at no expense to the Owner for a period of 20-years after date of Final Completion of the entire Project.
   2. In addition, provide written warranty signed by the manufacturer of primary roofing materials agreeing to allow Owner to make emergency repairs to roof without voiding manufacturer's warranty.
      a. In conjunction with issuance of the above warranty, include.
         i) Instructions detailing preventative maintenance required to maintain the warranty.
         ii) Provide a list of substances, which may damage the membrane.
         iii) Specifications on repair of the membrane Owner may do without voiding warranty.
      b. Warranty shall include coverage for damage to building resulting from failure of roof system to resist penetration of water with no dollar limit to the value of repairs or replacements covered.
      c. The built-up roofing membranes and insulation as well as all accessories and appurtenances shall comprise the "Roofing System" and shall be part of a single source warranty.
C. Provide at a minimum one in progress inspection with the Manufacturer's Representative and the Owner's Representative.
D. Manufacturer's Certification:
   1. Submit written certification signed by the manufacturer stating that the roofing system manufacturer will provide warranties, inspection and Report Services specified herein.
   2. NOTE: Submit warranty terms with the post-bid package.
E. Provide acceptance letter from the roofing manufacturer that this specification meets the requirements of the 20-year warranty and that no criteria specified herein will impact such warranty.

1.10 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
   1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
C. Provide an installed roofing membrane and base flashing system that does not permit the passage of water and will withstand the design pressures calculated in accordance with the most current revision of ASCE 7.
D. Manufacturer shall provide all primary roofing materials that are physically and chemically compatible when installed in accordance with manufacturers current application requirements.
E. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:
   1. Uplift Pressures: As indicated on structural plans (Pa/sq. m).
F. Solar Reflectance Index: Not less than an initial index of not less than 81 and an aged index of not less than 75 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
G. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
H. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
I. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

1.11 APPROVALS: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the architect in writing prior to bidding.
   1. Soprema
B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.
   1. Firestone
   2. Johns Manville (Modified Bitumen Roofing with “G” Granule on Cap Sheet)

2.2 ROOFING SYSTEM

A. Membrane Characteristics: Base sheet and one layer of inter-ply sheet and cap sheet.
   1. Cap sheet shall have minimum solar reflectance index (SRI) of 86 initial.
   2. Roof covering shall be Class A fire rating.
   3. Base Sheet: Sopra G bitumen and SBS thermoplastic polymer complying ASTM D4601, Type II.
   4. Inter-ply Sheet: Soprelene Flam 180 bitumen and SBS thermoplastic polymer complying with ASTM D6164, Type I, Grade S.

5. Cap Sheet: Sopralene Flam 180 FR GR SG granular surface bitumen and SBS thermoplastic polymer cap sheet ASTM D6164, Type I, Grade G. Granules shall be bright white materials, factory or field applied coatings of the granules will not be permitted.
6. Primer: Standard of roofing manufacturer.
7. Insulation cover Board: "Securock Gypsum Fiber Roof Board", ½" thick as manufactured by United States Gypsum.
8. Concrete Parapet Primer: Elastocol 500
9. Wall Flashing: Match field sheets.

2.3 ACCESSORIES

A. Roof System Vents: Manufacturer's standard spun aluminum one-way venting.
B. A.R.B.S Roof Expansion Joint System.
C. A.R.B.S Metal Cant System as vented cant system.
D. Low Profile Roof Expansion Joint System
   1. Sheet EPDM reinforced with closed cell urethane backing.
   2. Roof expansion joint: Manville Expando-O-Flash at Style CF withFS-5000-F fire barrier or as required by expansion joint manufacturer.
   3. Roof to wall joint: Manville Expando-O-Flash at Style CF/EJ with FS-5000-F fire barrier or as required by expansion joint manufacturer.
   4. Exterior vertical and horizontal wall surface joints above roof deck: Manville Expando-O-Guard WS with FS-5000-W fire barrier or as required by expansion joint manufacturer.
   5. Intersections and Transitions: Provide expansion joint manufacturers standard and custom intersections, transitions, and miscellaneous items to provide a complete expansion joint system. All items provided shall be a standard of the expansion joint manufacturer.

PART 3 – EXECUTION

3.1 PRE-INSTALLATION REQUIREMENTS

A. Do not start the installation of accessories or membrane without the presence of the Manufacturer's Technical Representative. This requirement shall not be waived.
   1. Due to the incompatibility of various materials with the roofing membrane, the Representative shall inspect the substrate and shall have a barrier applied for complete separation and protection of the roofing membrane and accessories.
B. Install all vents, drains, curbs, nailers, blocking, insulation, and projections through the roof before starting membrane installation.
   1. These items may be installed after the membrane installation only with Architect's written approval, proper provision for re-inspection, and continued warranty protection.
C. All conduits to curb mounted equipment shall be installed inside the curbs.
D. Curbs shall be a minimum 12" high above the finished roof.

3.2 COVER BOARD INSTALLATION

A. Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.
B. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.

C. Install cover board with long joints of cover board in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with cover board.
   1. Cut and fit cover board within 1/4 inch of nailers, projections, and penetrations.
D. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.
   1. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
E. Proceed with installation only after unsatisfactory conditions have been corrected.
F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.3 PREPARATION OF SUBSTRATE

A. Insulation and underlayment board:
   1. The applicator shall carefully inspect all surfaces of insulation and cover board, and assure all surfaces are satisfactory prior to beginning installation.
   2. Beginning insulation installation constitutes acceptance of substrate without recourse.
B. Roofing Membrane: The manufacturer's Technical Service Representative shall carefully inspect the substrate receiving the roofing and provide a written report.
C. Install all nails, blocking, vertical surfaces, etc. prior to proceeding with membrane installation.
D. Verify that all units are properly secured in place prior to proceeding with membrane installation.

3.4 INSTALLATION OF ROOFING MEMBRANE SYSTEM

A. Install membrane over insulation and underlayment board in accordance with accepted roofing manufacturer's specification and recommendations, and as specified below.
   1. Phased construction of roofing membrane is strictly prohibited.
B. Apply one-base sheet one-interply and one-cap sheet.
C. Complete installation of modified roofing system up to line of termination of day's work.
   1. Install temporary water cut-offs of plastic cement and base sheet strips at end of each day's work.
   2. Remove upon resumption of work.
D. Base Flashing:
   1. Install in accordance with requirements of roofing system manufacturer.
   2. Install where roofing system abuts vertical surfaces and at other locations detailed.
E. Roof Edging:
   1. Prior to application of metal edging treatment, extend roofing felts up over tapered edging and secure to wood nailer with base felt extended and folded back over ply felts.
   2. After metal edging is in place, flash as recommended by roofing manufacturer.
F. Flashings: Install metal flashings in such a manner as to prevent leaks.
G. Venting: Provide aluminum one-way vent stacks for every 900 s.f. of roof area or as recommended by manufacturer.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide periodic inspections of roof application by qualified technical representative of roofing manufacturer.

3.6 CLEANING

A. Clean up debris, excess materials, and equipment and remove from site.
B. Remove bitumen from surfaces other than those requiring bituminous roof coatings.
C. Remove bituminous markings from finished surfaces.

3.7 PROTECTION

A. Provide special protection or avoid heavy traffic on completed work when ambient temperature is above 80°F.
B. Restore to original condition or replace work or materials damaged during handling of bitumen and roofing materials.
C. Do not transverse any walkways where new work has been completed where traffic must continue over finished roof membrane, protect surfaces.
D. Do not throw or drop debris from roof, use chutes, or high lift trucks.

END OF SECTION 07 52 00

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Flashing, counter-flashing, roofing grounds and nailers, and fabricated sheet metal items for roofing intersections with vertical surfaces, copings, curbs, gutters, eaves, roof drains, scuppers, vents, and other roof penetrations.

1.2 RELATED SECTIONS

A. Section 01 25 13 – Product Substitution Procedures.
B. Section 01 31 00 – Project Coordination.
C. Section 01 33 00 – Submittal Procedures.
D. Section 01 42 00 – References.
E. Section 01 45 00 – Quality Control.
F. Section 01 66 00 – Product Storage and Handling.
G. Section 01 78 00 – Closeout Submittals.
H. Section 03 52 16 – Lightweight Insulating Concrete.
I. Section 06 10 00 – Rough Carpentry.
J. Section 05 31 23 – Steel Roof Decking.
K. Section 07 11 13 – Bituminous Dampproofing.
L. Section 07 52 00 – Modified Bituminous Membrane Roofing
M. Section 07 61 13 – Standing Seam Metal Roofing.
N. Section 07 72 00 – Roof Accessories.
O. Section 07 92 13 – Elastomeric Joint Sealants.

1.3 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, abbreviations, definitions, and acronyms.
B. ANSI-SPRI/ES-1.
C. American Society for Testing and Materials (ASTM):
   1. ASTM A240/A240M-15a: Standard Specification for Heat-resisting Chromium and Chromium-nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
   2. ASTM A653/A653M-13: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process
   3. ASTM A755/A755M-15: Standard Specification for Steel Sheet, Metallic-Coated by the Hot Dipped Process (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
   4. ASTM D4586/D4586M-07(2012)e1: Standard Specification for Asphalt Roof Cement, Asbestos Free.
   5. ASTM B32-08(2014): Standard Specification for Solder Metal (Lead Free).
D. Florida Building Code (FBC), 5th Edition.
E. National Roofing Contractors Association (NRCA) “Roofing and Waterproofing Manual” Detail for installation of units.

F. Sheet Metal and Air-Conditioning Contractor's National Association, Inc. (SMACNA): Architectural Sheet Metal Manual", latest Edition. Details for fabrication of units, including flanges and installation to coordinate with type of roofing indicated.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Submit Shop Drawings on flashing and sheet metal work.
C. Samples:
   1. Submit 8" (203 mm) x 8" (203 mm) square samples of each specified sheet materials to be exposed as finished surfaces.
   2. Submit each samples of factory fabricated products exposed as finished work, complete with specified factory finish.

1.5 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.
B. Regulatory Requirements: Ensure flashing and sheet metal complies with requirements of Florida Building Code, NRCA, SMACNA, and ANSI-SPRI/ES-1.
C. Coordinate application of flashings with application of roofing, protruding material, and roof accessories to provide a complete weather tight installation under provisions of the specified warranty requirements.
D. Perform work in accord with referenced standards and manufacturer's printed installation instructions.

1.6 PRE-INSTALLATION MEETING

A. Comply with Section 01 31 00 – Project Coordination.
B. Meeting Format:
   1. Pre-installation meeting shall occur after approval of Shop Drawings by Contractor/CM and accepted by AE.
   2. Meeting shall convene minimum of one week before starting work.
   3. Required Attendees:
      a. Contractor/CM.
      b. Roof flashings installer.
      c. Roofing and roofing equipment manufacturers.
      d. Installers of deck or substrate construction to receive roofing work.
      e. Installers of roof-top mechanical, plumbing, or electrical items or other work in and around roofing that must precede or follow roofing work
      f. Other subcontractors associated with work.
      g. Architect.
      h. Owner's Project Manager.
   4. Contractor/CM shall make arrangements for meeting and notify parties required to attend.
   5. Agenda shall include:
      a. Review preparation and installation procedures and coordinating and scheduling required with related work.
      b. Review roof, roof equipment, doors, and window system requirements (drawings, specifications, and other contract documents).
      c. Review Shop Drawings and associated submittals.
      d. Review manufacturer's technical materials.

e. Review and finalize construction schedule related to work and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays
f. Review required inspection, testing, certifying and material usage accounting procedures.
g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including temporary roofing.
h. Meeting may be combined with roofing pre-installation meeting.

1.7 WARRANTIES

A. Comply with Section 01 78 00 – Closeout Submittals.
B. Provide installer's five (5) year written warranty for flashings indicated.
   1. Flashings shall resist design wind speeds required by Florida Building Code, Chapter 16, in which installer agrees to repair or replace flashing components of roofing system that fail in materials or workmanship within specified warranty period.
   2. Flashing failures shall include water leaks, fasteners, accessories, flashing and sheet metal, grounds/nailers, gutters and downspouts, scuttles and vents, curbs, and other flashing components of roofing system.
C. See Roofing Specifications for additional warranties that shall also apply.
D. Warranty shall be a term type, with no conditions, exclusions, including exclusions of remedies by Owner, deductibles, or limitations on coverage amount. Conditions, exclusions, or dollar limits.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufactured flashing and sheet metal products are to contain recycled content.
B. Sheet Material:
   1. Type 302 or 304 stainless steel, 22 gage, complying with ASTM A167.
   2. Flashing for Pipes, Conduits, and Round Equipment Supports: Type 304 stainless steel, 26 gage, 2B, complying with ASTM A240.
   3. Solder: Per ASTM B32.
C. Fastening Devices:
   1. Stainless steel fasteners compatible with metal and roofing system. Use of powder-activated fasteners is prohibited.
   2. Attach sheet metal to wood with exposed fastenings: No. 10 x 1-1/4" (31.8mm) pan head stainless steel sheet metal screws. Provide neoprene sealant washers and stainless steel washers under screw heads.
   3. Attachment of sheet metal to masonry or concrete: No. 10 x 1-1/4" (31.8mm) pan head stainless steel masonry screws. Provide neoprene sealant washers and stainless steel washers under screw heads.
   4. Roofing Cement: Plastic roofing cement complying with requirements of ASTM D2822 or as appropriate and as recommended by roofing manufacturer.

2.2 ACCESSORIES

A. Roof Drain Flashing: Minimum 4 lb. (1.82 Kg) per ft² lead sheet flashing, 36" (91.44 cm) x 36" (91.44 cm) installed in accord with NRCA specifications.
B. Cants:
   1. Pre-fabricated 16-gage, galvanized, minimum 4" (101 mm) vertical height, formed at 45° angle to walls and parapets.
   2. Manufacturer: Concrecel USA; Product: ARBS (Alternative Roof Blocking System).
   3. Substitutions: Comply with Section 01 25 13 - Product Substitution Procedures.
C. Copings:
   1. Fabricate in approximately 10' (3 m) sections using sheet 22-gage stainless steel to detail as indicated.
   2. Provide continuous 16-gage stainless steel outer hold-down cleat with punched holes at 6" (152 mm) on center and face fasten at inward facing parapet components with removable fasteners as required for sheet metal.
   3. Provide 8" (203 mm) wide joint covers.
   4. Manufacturer: SBC Industries, North Miami, Florida.
   5. Substitutions: Comply with Section 01 25 13 - Product Substitution Procedures.
D. Curb to Duct Flashing and Counter Flashing:
   1. Fabricate from stainless steel to fit duct curbs and ducts projecting from curbs.
   2. Provide 4" (101 mm) vertical flange to cover top edge of bituminous base flashings. Form flange bottom towards curb, with ¼" (6.3 mm) bottom edge bent ¼" (6.3 mm) out and hemmed.
   3. At top of curbs bend metal 90° and extend horizontally over to duct, then bend upward and extend vertically not less than 3" (71.2 mm) from top edge of flashing out 3/8" (9.5 mm) to receive sealant.
   4. Provide for field soldered lap joints at corners and 1" (25.4 mm) lap joints at horizontal miter splices.
E. Edge Drips:
   1. Fabricate using sheet 22-gage stainless steel drip edge to detail indicated, in not over 10' (3 m) sections.
   2. Provide continuous 16-gage stainless steel continuous cleat with punched holes spaced as necessary. If cleat extends 6" (152 mm) or more below top fastener, provide second row of punched holes spaced as necessary.
   3. Provide 4" (101 mm) roof flange and extend bottom drip not less than 1" (25.4 mm) below bottom of roof sheathing, with bottom ¾" (19 mm) kick-out to drip water away from finish wall.
   4. Manufacturer: Concrecel USA; Product: ARBS (Alternative Roof Blocking System).
   5. Substitutions: Request for substitutions shall be in accord with Section 01 25 13 - Product Substitution Procedures.
F. Pipes, Conduits, Wires, and Round Equipment Supports Penetrating Roofing or Resting on Roofing:
   1. Type 304 stainless steel, 26-gage, complying with ASTM A240.
   2. Form tubular stainless steel sleeves sized to shape of penetration, not less than 8" (202 mm) above finished roofing with 4" (101 mm) wide base flange welded to water-tight to sleeve.
   3. Shop punch flanges.
   4. Seal flashing and cover with protective umbrella.
   5. Pre-manufactured roof penetration seals.
      a. Manufacturer: SBC Industries, North Miami, Florida.

6. Substitutions: Request for substitutions shall be in accord with Section 01 25 13 - Product Substitution Procedures.

G. Sanitary Vent Stack Flashings:
1. 4 lb. (1.82 Kg) per ft² lead flashing.
2. Form tubular lead flashing sleeve not less than 8" (202 mm) high with diameter ½" (12.7mm) larger than vent stack.
3. Provide 4" (101 mm) wide flange soldered water-tight.
4. Provide vandal-proof vent covers.

H. Scuppers:
1. Fabricate using stainless steel to profiles and details shown.
2. Lock seam corners, solder water-tight and hem outer exposed edges.
3. Provide 4" (101 mm) wide minimum flanges formed to fit cants, decks and vertical wall surface.
4. Shop punch flanges for fastenings at 6" (152 mm) on center.

I. Stucco Stop with Counter-flashing (2-piece):
1. Fabricate in approximately 10 ft sections using sheet stainless steel to details indicated.
2. Provide receiver with 1.5" wall flange, 0.75" sloping stucco stop, and 0.75" flange bend downward with 0.50" hem.
3. Shop punch wall flange for fastening.
4. Provide shop fabricated soldered corner splices extending 4" each way.
5. Provide counterflashing with 1.5" 45° top flange with 0.35" kick back at top and 4" bottom flange formed inward ¾" towards wall with hemmed 0.25" kick at bottom.
6. Provide 1.5" x 4" storm cleats.
7. Manufacturer: Subject to compliance with requirements, provide products by following manufacturer:
   a. SBC Industries, North Miami, Florida.
8. Substitutions: Request for substitutions shall be in accord with Section 01 25 13 - Product Substitution Procedures

J. Stucco Top with Counter-flashing (1-piece for re-roofing):
1. Fabricate in approximately 10 ft. sections using sheet stainless steel to details as indicated.
2. Provide counterflashing with 0.50" 45° leg for sealant with 1.5" wall flange with a 4" bottom flange formed inward 0.75" towards wall with hemmed 0.50" kick at bottom.
3. Shop punch wall flange for fastening.
4. Provide shop fabricated soldered corner splices extending 4 inches each way.
5. Manufacturer: Subject to compliance with the specified requirements, provide products by the following manufacturer:
   a. SBC Industries, North Miami, Florida.
6. Substitutions: Substitutions: Request for substitutions shall be in accord with Section 01 25 13 - Product Substitution Procedures

K. Surface Mounted Flashing (1-piece):
1. Fabricate in approximately 10 ft. sections using sheet stainless steel to detail as indicated.
2. Provide flashing with 1.50" wall flange with 0.25" kick at top to receive sealant, 0.50" 135° sloping top flange and 4" bottom flange formed inward 0.75" towards wall with hemmed 0.50" kick at bottom.
3. Shop punch wall flange for fastening to meet wind loads per FBC
4. Provide shop fabricated corner splices extending 4".
5. Manufacturer: Subject to compliance with the specified requirements, provide products by following manufacturers:
   a. SBC Industries, North Miami, Florida.

6. Substitutions: Request for substitutions shall be in accord with Section 01 25 13 - Product Substitution Procedures

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not proceed with work until conditions detrimental to proper and timely completion of work have been corrected in acceptable manner.

3.2 INSTALLATION

A. Lap, rivet, lock, or seal joints, as field conditions require.
B. Provide necessary reinforcement, miscellaneous fittings, and accessories.
C. Apply flashing and sheet metal work including miscellaneous fittings and accessories to even, smooth, sound, thoroughly clean and dry surfaces that are free from defects that might affect application. Prime metal flanges that receive bitumen under provisions of FBC and manufacturer's requirements.
D. Perform soldering work slowly, with properly heated coppers to thoroughly heat seam material and sweat solder through full width of seam that shows no less than 1" of evenly flowed solder. Solder under provisions of ASTM B 32.
   1. Start soldering immediately after application of flux.
   2. Solder flat locked seam.
E. Isolate dissimilar metals with accepted isolation paint or other accepted materials.
F. Make flashing and sheet metal work water and weather tight, with lines, arises and angles sharp and true and plane surfaces free from waves and buckles.
G. Provide sufficient fasteners and related hardware to ensure a complete and weather tight system.
H. Base Flashings at Aluminum Walkway Covers Abutting Concrete and Masonry:
   1. Set flashing tight against wall and with roof flange set on aluminum deck in bed of sealant.
   2. Secure roof flanges to metal deck with No. 10 x 0.50" stainless steel sheet metal screws at 6" on center maximum. Provide sealant washers and stainless steel washers under screw heads.
I. Cants Strips: Install at transitions of roof membrane with flat vertical surfaces.
J. Copings:
   1. Secure outer hold-down cleat to woodblock at 6 inches on center with ring shank roofing nails.
   2. Install coping over cleat. Allow 0.125" space between each coping section.
   3. Secure inside face of coping with removable grommet type fasteners.
   4. Provide 1" to 12" slope at coping to inner parapet wall.
   5. Install joint covers in full bed of sealant.
K. Curb to Duct Flashing and Counterflashing:
   1. Install flashings after ducts through curbs are in place and after bituminous base flashings are completed.
   2. Place flashings in place on curbs and solder corners and corner miter laps water-tight.
   3. Secure counterflashings to vertical edge of curb nailers with No. 10 stainless steel sheet metal screws through sealant washers at not over 12" on center.
   4. Secure vertical upturned duct flashing to duct with No. 10 stainless steel sheet metal screws through sealants washers at not over 6" on center.

5. Seal joint between flashings and ducts with sealant per Section 07 92 13 – Elastomeric Joint Sealants.

L. Edge Drips:
1. Install continuous 20 gage stainless steel cleat.
2. Set 22 gage stainless steel edge drip roof flanges in full bed of roofing cement over completed roofing.
3. Lap splices 4” minimum and seal top horizontal surface laps with cold bitumen.
4. Stagger nails at flange to roof deck at 4” on center.
5. Cover roof flanges with 2-ply felt stripping set in full bed of roofing cement.
6. Locate drip bottom not less than 0.75” away from finished vertical surfaces.

M. Roof Drains:
1. Prime roof drain flanges before applying roof felts.
2. Set lead in full bed of cold bitumen over intermediate plies or cap sheet.
3. Strip lead cover with 2 layers of roofing felts in solid coats of hot bitumen.

N. Roof penetration materials at pipes, conduits and round equipment supports.
1. After preliminary examination install conical sealant cover with sealant.

O. Sanitary Vent Stack Flashings:
1. Install in accord with NRCA specifications.

P. Scuppers:
1. Set scuppers in full bed of roofing cement over completed base flashing and roof membrane.
2. Secure to masonry walls and concrete decks with stainless sheet metal screws in lead shields at 6” on center.
3. Secure to wood nailers with stainless steel sheet metal screws at 6” on center.

Q. Stucco Stop with Counterflashing (2-piece):
1. Set receiver on masonry and concrete walls where indicated.
2. Lap spices 4 inches minimum and seal laps with sealant.
3. Secure to wall with No. 10 x 1.25” minimum Tap-Con screws 12” on center maximum.
4. Check for membrane/bitumen seal on top of felt flashing before counterflashing installation.
5. Attach storm cleats at 30” on center and with 1 cleat at each joint.
6. Insert counterflashing into receiver, and secure tightly with storm cleats.

R. Surface Mounted Flashing (1-piece):
1. Set on masonry and concrete walls over base flashing where indicated.
2. Lap splices 4” minimum and seal laps with sealant.
3. Secure to wall with No. 10 x 1-1/4 inch Tap-Con pan head screws at 12 inches on center maximum. Provide neoprene sealant washers and stainless steel washers.
4. Where corrugated metal wall occurs, place premolded neoprene filler strip on wall immediately above top of metal base flashing.
    a. Set filler strip in sealant and seal abutting edges of filler strip with sealant.
    b. Place counterflashing over filler strip set in sealant and secure flashing to metal wall through filler strip with No. 10 x appropriate length stainless steel sheet metal screws at 6 inches on center maximum and centered on wall flutes.
    c. Provide sealant washers and stainless steel washers under screw heads.
5. Check for membrane/bitumen seal on top of felt flashing before flashing installation.

END OF SECTION

SECTION 07 84 13 – PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Penetrations in fire-resistance-rated walls.
   b. Penetrations in horizontal assemblies.
   c. Penetrations in smoke barriers.

1.3 REFERENCES

A. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
B. ASTM E119 – Standard Test Method for Fire Tests of Building Construction and Materials.
C. ASTM E814 – Standard Test Method of Fire Tests of Through Penetration Firestop.
D. ASTM E1966 – Standard Test Methods for Fire Tests of Joints.
E. FM (Factory Mutual) - Fire Hazard Classifications.
F. UL – Fire Hazard Classifications.
G. UL 1479 – Fire Tests of Through-Penetration Firestop.
H. UL 2079 – Tests for Fire Resistance of Building Joint Systems.
I. WH (Warnock Hersey) - Certification Listings.
J. UL 263 – Fire Tests of Building Construction and Materials.
K. UL 723 – Test for Surface Burning Characteristics of Building Materials.
L. UL 1479 – Fire Tests of Through-Penetration Firestops.
M. NFPA – National Fire Protection.
N. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Shop Drawings:

1. Submit shop drawings showing layout, profiles, and product components.
2. Include Independent laboratory with system classification number on shop drawings.

D. Provide written documentation of applicator’s qualifications, including reference projects of similar scope and complexity, with current phone contacts of references for verification.

E. Certification from sealant manufacturers that their products are suitable for the use indicated and comply with specification requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of penetration firestopping.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Use adequate numbers of skilled workers thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for proper performance of the work of this section.

C. Applicator Qualifications:

1. Applicator shall have at least 3-years experience in installing materials of types specified and shall have successfully completed at least 3-projects of similar scope and complexity.
2. Manufacturer approved applicator.
3. Applicator shall designate a single individual as project supervisor who shall be on site at all times during installation.

D. Single source responsibility for firestopping materials:

1. Obtain Firestop materials from single manufacturer for each different product required.

2. Manufacturer shall instruct applicator in procedures for each material.

E. Regulatory Requirements:

1. Firestop System installation shall meet requirements of ASTM E-814 and provide a fire rating equal to that of the construction it penetrates.
2. Proposed Firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
3. For those Firestop applications not having an UL or third party tested system available through any manufacturer.
   a. Prior to installation the manufacturer may submit to the authorities having jurisdiction for their consideration an engineering judgment derived from similar independently tested system of similar design.
   b. Manufacturer’s engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

C. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

D. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

1.8 SYSTEM DESCRIPTION

A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.

B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated as determined per ASTM E814, UL 1479 but not less than that equaling or exceeding the fire resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where specified by codes or where the following conditions exist:

1. Where firestop systems protect penetrations located outside of wall cavities.
2. Where firestop systems protect penetrations located outside fire resistive shaft enclosures.

3. Where firestop systems protect penetrations located in construction containing doors required to have a temperature rise rating.
4. Where firestop systems protect penetrating items larger than a 4 inch diameter nominal pipe or 16 square inch in overall cross sectional area.

D. Fire Resistive Joint Sealants: Provide joint sealants with fire resistance ratings indicated, as determined per ASTM E119, UL 1479 and UL 2079 but not less than that equaling or exceeding the fire resistance rating of the construction in which the joint occurs.

E. For firestopping exposed to traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions and will meet load requirements.

1. For piping penetrations for plumbing and wet pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not required removal of insulation.

F. For through-penetration firestop systems exposed to view, provide products with flame spread of less than 25 and smoke developed ratings of less than 450, as determined per ASTM E 84.

G. Firestopping Materials: ASTM E119, ASTM E814, UL 263 or UL 1479 to achieve fire rating.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer shall be one of the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Specified Technologies Inc.
2. Hilti, Inc.
3. 3M Fire Protection Products.
4. Tremco, Inc.; Tremco Fire Protection Systems Group.
5. USG Corporation.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

1. All materials shall comply with ASTM E814 or E119 (UL 1429), and shall be manufactured of nontoxic, non-hazardous, asbestos free materials, and unaffected by water or moisture when cured.
2. Primers: Conform to manufacturer's recommendations for primers required for various substrates and conditions.
3. Backup Materials: Backup materials, supports, and anchoring devices shall be provided as required by UL testing.

B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire resistance rated systems. Accessories include but are not limited to the following items:

1. Permanent forming/damming/backing materials must be noncombustible and may include the following:
   a. Semi-refractory fiber (mineral wool) insulation.
   b. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
   c. Joint fillers for joint sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

C. Use only firestopping products that have been UL 1479 or ASTM E814 tested for specific fire rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

2.3 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Fire-resistance-rated walls include fire walls fire-barrier walls smoke-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Horizontal assemblies include floors floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

2.4 ACCESSORIES

A. Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:
   a. Slag-wool-fiber or rock-wool-fiber insulation.
   b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   c. Fire-rated form board.
   d. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

B. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.

C. Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. Intumescent fiberglass bags for sealing cable tray openings.

E. Surface Sealer: Single-component, silicone sealant flexible firestop. Provide at joints over mineral wool filler and as indicated.

1. Manufacturers: The basis of design product “Fire Barrier 100NS” manufactured by 3M. Equal or better performing products of other manufacturers will be considered for acceptance by the Architect.

2.5 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

2.6 ENVIRONMENTAL

A. Data: Submit manufacturer’s product data for sealants. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

B. Certification: Submit manufacturer’s certification that products comply with Bay Area Resources Board, reg. 8, rule 51.

C. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
2. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage”.
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.

4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Construction Manager Contractor will engage a qualified testing agency to perform tests and inspections of penetration firestopping systems according to ASTM E 2174, Standard Practice for On-Site Inspection of Installed Fire Stops.

B. Where deficiencies are found or penetration firestopping systems are damaged or removed due to testing, repair or replace penetration firestopping systems so they comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements, and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Joint sealers

1.3 JOB CONDITIONS

A. This Contractor shall inspect the job conditions as he finds them, and his starting of the work constitutes approval of all conditions.

1.4 QUALITY ASSURANCE

A. All manufacturer items must be factory labeled, on the material or its container.
B. Manufacturer shall have a minimum of 10-years experience specializing in specified item.
C. Applicator shall be Sealant Manufacturer approved with 5-years successful experience.
   1. Applicator shall also agree to employ only skilled tradesmen for the Work.
D. Obtain elastomeric materials only from manufacturers that if requested, will send a qualified technical representative to the project site for advising the Installer of proper procedures and precautions for the use of the materials.
E. Contractor shall hold a pre-caulking meeting at the project site with the Architect and all involved parties to review conditions, materials, colors, and other requirements.

1.5 REFERENCES

A. ACI 504 R – Guide to Joint Sealants for Concrete Structures
B. ASTM C834 – Standard Specification for Latex Sealants
C. ASTM C919 – Standard Practice for Use of Sealants in Acoustical Applications
D. ASTM C920 – Standard Specification for Elastomeric Joint Sealants
E. ASTM C 1193 – Standard Guide for Use of Joint Sealants
F. ASTM D1056 – Standard Specification for Flexible Cellular Materials – Sponge or Expanded Rubber
G. SWRI (Sealant, Waterproofing and Restoration Institute) – Sealant and Caulking Guide Specification.
H. California South Coast Air Quality Management District (SCAQMD) #1168

1.6 SUBMITTALS

A. Submit manufacturer's detailed technical data for materials, fabrication, and installation, including catalog cuts of bond breakers, backer rods, and accessories.
   1. Submit full color samples for Architect selection.
B. Certificates from the manufacturers of joint sealants attesting that their products comply with the specification and are suitable for the use indicated.
C. Product Data: Unless otherwise indicated, submit the following for each type of product provide under work of this Section:
   1. Local/Regional Materials:
      a. Sourcing Location(s): Indicated location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
      b. Manufacturing Location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
      c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
      d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight or each component per unit of product.
   2. VOC Data:
      a. Architectural Sealants:
         i) Submit manufacturer’s product data for sealants. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.
         ii) Submit manufacturer’s certification that products comply with Bay Area Resources Board, reg. 8, rule 51.
D. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
B. Store and handle materials in compliance with manufacturer’s requirements to prevent their deterioration or damage due to moisture, temperature, contaminants, or other causes.

1.8 WARRANTY

A. The Contractor shall furnish written guarantee that work executed under this section is free from defects of material and workmanship for a period of 5-years from date of substantial completion of the entire project.
   1. Include coverage that he will immediately and at his own expense, repair and replace all such defects as may develop during the term of this guarantee.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer shall be one of the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product.
   1. DAP, Inc., Dayton, Ohio
   2. Dow Corning Corp., Midland, Michigan
   3. General Electric Co., GE Silicones, Waterford, New York
   4. Pecora Corp., Harleysville, Pennsylvania
   5. Sonneborn Building Products Div., Minneapolis, Minnesota
   6. Tremco, Inc., Beachwood, Ohio
   7. Hilti Construction Chemicals, Tulsa, Oklahoma

B. Contractor may request other products or manufacturers for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product.
   1. The "Substitution Request Form" and complete technical data for evaluation must accompany requests for Architect's approval.
   2. All materials for evaluation must be received at least 10-days prior to bid due date.

C. Toxicity/IEQ:
   1. Comply with applicable regulations regarding toxic and hazardous materials, and as specified. Sealants must meet or exceed requirements of Bay Area Resources Board, reg. 8, rule 51.
   2. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.

D. Backer Rods: Provide composite backer rods.

2.2 MATERIALS

A. General
   1. The term “Acceptable Standard” when used within this Section, refers to the manufacturer and product listed, specified as to type and quality required for this project.
   2. Contractor shall supply a single resource responsibility for joint sealer materials.
      a. Obtain joint sealer materials from a single manufacturer for each different product required.
   3. Compatibility: Provide joint sealers, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and final experience.

B. Caulking Compounds (Acrylic Latex Sealant)
   1. Latex rubber modified, acrylic emulsion polymer sealant compound; manufacturer’s standard, one part, non-sag, mildew resistant, acrylic emulsion sealant complying with ASTM C 834, formulated for accepting paint. (Product recommended for exposed interior locations involving joint movement of less than 5%).
   2. Acceptable Standard
      a. “Sonolac”; Sonneborn Building Products, Inc
      b. “Acrylic Latex Caulk 832”; Tremco, Inc
      c. “Acrylic Latex Caulk with Silicone”; DAP

C. One-Part Elastomeric Sealant (Silicone)

1. One component elastomeric sealant complying with ASTM C 920, Class 25, Type NS (non-sag), unless manufacturer recommends Type S (self-leveling) for the application shown.(general caulking , glazing applications).
    a. Acceptable Standard
        i) "Dow Corning 791; Dow Corning Corp.
        ii) "Omniseal"; Sonneborn Building Products, Inc.
        iii) "Spectrem 2; Tremco, Inc.
2. One component mildew resistant silicone sealant used around countertops, backsplashes, and other wet interior locations.
    a. Acceptable Standard
        i) "Dow Corning 786", Dow Corning Corp.
        ii) "Sanitary 1700"; General Electric
3. One-component high movement joints (+100/-50) use sealants in locations indicating high movement.
    a. "Dow Corning 790"; Dow Corning Corp.
    b. "Spectrem 1"; Tremco, Inc.

D. Elastomeric Sealants (Polyurethane) – Precast concrete & Tilt-Up Concrete Panels
1. One component polyurethane sealant, complying with ASTM C 920, Type S, Grade NS (non-sag), Class 25 (expansion and control joints, precast concrete panel joints, tilt-up concrete panel joints, perimeter caulking, flashing and sheet metal conditions).
    a. Acceptable Standard
        i) "Sonolastic NP 2"; Sonneborn Building Products, Inc.
        ii) "Dymonic": Tremco, Inc.
        iii) "Dynatrol I"; Pecora Corp.
2. Multi- component polyurethane sealant, complying with ASTM C920, Type M, Grade N(non-sag) Class 25 (same uses as in previous item)
    a. Acceptable Standard
        i) "Sonolastic NP 2" Sonneborn Building Products, Inc.
        ii) "Dymeric 511"; Tremco, Inc.
        iii) "Dynatrol II"; Pecora Corp.
3. Multi-component epoxidized polyurethane sealant complying with ASTM C 920, Type M, Grade NS, Class A (same uses as described in item 1, also used on fire resistance rated joint design details.)
    a. Acceptable Standard
        i) "Dymeric"; Tremco, Inc.
        ii) "DynaTrol II"; Pecora Corp.

E. One-part self-leveling polyurethane sealant (for traffic areas)
1. One component polyurethane self-leveling sealant, complying with ASTM C 920, Type S, Grade P, Class 25.
    a. Acceptable Standard
        i) "Sonolastic SL 1"; Sonneborn Building Products, Inc.
        ii) "NR-201 Urexpan"; Pecora Corp.
2. Two component polyurethane self-leveling sealant, complying with ASTM C920, Type M, Grade P, Class 25.
    a. Acceptable Standard
        i) "Sonolaastic SL 2"; Sonneborn Building Products, Inc.
        ii) "NR-200 Urexpan": Pecora Corp.
        iii) "THC900/THC901": Tremco, Inc.

F. Flexible Polyurethane Security Sealant (for use on interior joints, perimeter of fixtures, penetrations, vents, doors, windows, and similar openings).

1. Two component polyurethane sealant, complying with ASTM C 920, Grade NS, Class 12.5, with a Shore A Hardness of 55, Type M.
    a. Acceptable Standard
        i) “Dynaflex”, Pecora Corp.
        ii) “Ultra”, Sonneborn Building Products, Inc.

G. Miscellaneous Materials
1. Provide joint cleaner and joint primer sealer as recommended by the sealant or caulking compound manufacturer.
2. Sealant backer rod shall be compressible rod stock, polyethylene foam; polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam, or other materials as recommended by sealant manufacturer.
    a. Where plans indicate a 2" building expansion joint, provide an expanding foam secondary sealant, “BackerSeal” as manufactured by Emseal Joint Systems, Ltd., or Apolytite Standard as manufactured by Polytite Manufacturing Corporation, behind sealant in lieu of standard backer rod.
3. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer substrate tests and field tests.
4. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaners of type acceptable to manufacturer of sealant and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in service performance.
5. Masking Tape: Provide non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints.

PART 3 EXECUTIONS

3.1 INSPECTION

A. This Contractor shall notify the General Contractor, when he has completed his work and is ready for A/E inspection.
B. Verify that substrate surfaces and joint openings are ready to receive work.
C. Verify that joint backing and release tapes are compatible with sealant.
D. Clean and prime all joints in accordance with manufacturer’s instructions.
E. Remove loose materials and foreign matter that might impair adhesion of sealant.

3.2 INSTALLATION

A. Install all products in strict accordance to all manufacturers' recommendations.
B. Measure joint dimensions and size materials to achieve required width/depth ratios.
C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.
D. Install bond breaker where joint backing is not used.
E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
F. Apply sealant within recommended application temperature ranges.
    1. Consult manufacturer when sealant cannot be applied within ranges.
G. Tool joints concave.
H. Tilt-up concrete wall panel joints; clean joints free of moisture, dust, sealers and form release agents using a wire brush and rag without solvents to clean concrete.
    1. Exterior wall joints

a. Seal both sides (outside and inside) with an exterior joint system consisting of a foam-backer rod (set into the joint for the entire length of the joint cavity) and cover with a urethane or other acceptable joint sealant material (sealant depth should be one-half the joint width, max. ½" depth) tool joint material in place.
b. Protect sealant material during painting of walls.

2. Interior wall joints
   a. In fire resistance rated walls
      i) Seal both sides of joint with a fire-stopping sealant, encapsulating the ceramic blanket protection material, finish joint similar to that of the exterior wall joint described above.
   b. In non-fire resistance rated walls
      i) Seal exposed concrete panel joints
      ii) Concealed (furred) concrete panel joints need not be sealed

3.3 ADJUSTMENT AND CLEANING

A. After installation, thoroughly clean all exposed surfaces and restore all damaged material to its original condition, or replaced with new material.

3.4 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality:
   1. Temporary ventilation: Provide temporary ventilation during work of this Section.
      a. Coordinate interior application of joint sealants with interior finishes schedules.

END OF SECTION

SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Steel Doors.
   b. Steel Frames.

1.3 REFERENCES

A. ANSI A117.1 – Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
B. ASCE 7 – Minimum Design Loads for Buildings and other Structures.
C. ASTM A36/A36M – Standard Specification for Carbon Structural Steel.
D. ASTM A53/A53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
E. ASTM A123/A123M – Standard Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
F. ASTM A153/A153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
G. ASTM A568/A568M – Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
H. ASTM A591/A591M-98 – Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight [Mass] Applications.
I. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
J. ASTM C764 – Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation.
K. ASTM C1363 – Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
L. ASTM E413 – Classification for Determination of Sound Transmission Class.
M. ASTM E2074 – Standard Methods of Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
N. DHI (Door Hardware Institute) – The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
O. NFPA 80 – Fire Doors and Windows.

P. NFPA 252 – Fire Tests for Door Assemblies.
Q. SDI-100 – Standard Steel Doors and Frames.
R. UL 10B – Fire Tests for Door Assemblies.
S. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: Details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

B. Shop Drawings: Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

1. Provide schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.
2. Indicate coordination of glazing frames and stops with glass and glazing requirements.
3. Shop drawings for exterior door assemblies shall be signed and sealed by a licensed engineer registered in the State of Florida.
4. Calculations for wind load design for exterior door assemblies shall be stamped, sealed, and signed by a Professional Engineer in the State of Florida verifying compliance with ASCE/SEI 7-02.

C. Label Construction Certification: For door assemblies required to be fire-rated and exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials, and construction equivalent to requirements for labeled construction.

D. Obtain approval of shop drawings prior to proceeding with manufacturing.

E. Approval for Exterior Doors

1. Manufacturer shall submit documentation that product complies with large and small missile impact criteria and have been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements and submit documentation.

1.5 CLOSEOUT SUBMITTALS

A. Provide inventory of doors, frames, and hardware in an exportable (i.e. Excel).

1.6 QUALITY ASSURANCE

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications Standard Steel Doors and Frames" ANSI/SDI-100 and as herein specified.

B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies whose fire resistance characteristics have been determined per ASTM E2074 and which are labeled and listed by UL, Factory Mutual, Warnock Hersey, or other testing and inspecting organization acceptable to authorities having jurisdiction.

C. Hollow metal supplier shall be a qualified direct distributor of products to be furnished. In addition, the distributor shall have in their regular employment an A.H.C./C.D.C. who will be available at reasonable times to consult with the Architect regarding matters affecting the door and frame openings.

D. Preparation/Field Verification:

1. Verify that Shop Drawings have been successfully submitted, reviewed, and returned.
2. Verify door frames are in proper location and have been properly anchored in accordance with Specifications and SDI 105 Recommended Erection Instruction for Steel Frames.
3. Verify that frames comply with indicated requirements for type, size, location and swing characteristics and that they have been installed with plumb jambs and level heads.
4. Verify that the correct door hardware has been delivered and doors have been prepped correctly.
5. Proceed with installation of doors only after unsatisfactory conditions have been corrected. Installation of doors and hardware indicates all conditions are satisfactory.

E. Exterior door and window assembly installations shall be weather tight and leak proof.

F. Contractor Qualifications: Employ only experienced Contractors (Installers) skilled in the successful installation of specified materials and assemblies on similar projects for not less than five (5) years.

G. Manufacturer's Qualifications: Employ only manufacturers who make the specified products as a regular production item.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish.

B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new Work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

C. Store doors and frames vertically at building site under cover. Place units on minimum 4-inches high wood blocking. Avoid use of non-vented plastic or canvas shelters that could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inches spaces between stacked doors to promote air circulation.

1.8 PERFORMANCE

A. Structural Performance: Provide door and frame assemblies capable of withstanding wind pressures calculated according to the following:

1. Basic Wind Speed:
   a. Comply with the Florida Building Code with the applicable Supplement and as indicated on the structural drawings.
2. Importance Factor:
   a. Comply with the Florida Building Code with the applicable Supplement and as indicated on the structural drawings.
3. Approval for Exterior Doors
   a. Manufacturer shall certify that product complies with large and small missile impact criteria and have been tested and conform to Miami Dade County, N.O.A. or Florida Product Approval.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Steelcraft; an Ingersoll-Rand company.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.

1. Quality Engineering.
2. Ceco Door Products; an Assa Abloy Group company.
3. Curries Company; an Assa Abloy Group company.
4. Firedoor Corporation.

C. Florida Product Approvals

1. Hollow Metal Single Flush Door – NOA 17-0426.02
2. Hollow Metal Double Flush Door – NOA 17-0426.04
3. Hollow Metal Single Glazed Door – NOA 17-0426.01
4. Hollow Metal Double Glazed Door – NOA 17-0426.03
5. Borrowed Lights – NOA 16-1206.06
6. Transom sidelights – NOA 15-0930.06

2.2 DOOR TYPES

A. Exterior Door Material: Commercial quality carbon steel conforming to ASTM A568, hot-dipped A60 Galvannealed steel conforming to ASTM A653 or hot dipped G60 galvanized steel. All exterior doors to be galvannealed or hot dipped.

B. Interior Door Material: Commercial quality carbon steel conforming to ASTM A568, hot-dipped A40 Galvannealed steel conforming to ASTM A653 or hot dipped G40 galvanized steel.

C. The following door types shall conform to the Steel Door Institute Standards as described in SDI 100.

D. Exterior Doors

1. Door face sheets shall be formed from one sheet of metal with no face seams. The top and bottom of the door shall be closed with a flush mounted U-channel (not inverted) full width steel closure treatment fabricated from the same gauge as the door.
2. Core Material
   a. Rigid Polystyrene – R-value 2.36 per ASTM C1363.
   b. Mineral (Equipment rooms and rooms with electrical panels.)
3. Provide 1-3/4 inch thick doors and in a size width of doors indicated, as required, where full mortise continuous gear hinges are scheduled.
4. Face sheets shall be hot-dipped galvannealed steel sheets conforming to ASTM A653, Commercial Steel (CS) Class B coating, mill phosphatized.
5. Provide doors complying with requirements indicated by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level and other indicated requirements.
   a. Rating: Extra Heavy Duty.
   b. Classification: Level 3.
   c. Physical Performance: Level A
   d. Edge: Model 1 – Full Flush
   e. Steel: 16-gauge.
   f. Finish: G60 or A60.

E. Lock edge of doors shall be beveled 1/8 inch in 2 inches.

F. Hardware Preparation:

1. Provide minimum hardware reinforcing gauges as required in ANSI/SDI A250.6.
2. Doors and frames shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, and flush bolts, as required in ANSI/DHI A115 and ANSI/SDI A250.6.
3. Doors shall be reinforced for specified surface-mounted hardware. Perform drilling and tapping as required.
4. Locate hardware in accordance with ANSI/SDI A250.8.
5. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:
   a. Hinges: Minimum 7-gauge by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
   b. Pivots: Minimum 7-gauge by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
   c. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 14-gauge.
   d. All Other Surface-Mounted Hardware: Minimum 14-gauge.
6. Hardware preparation shall comply with Miami-Dade NOA or Florida Product Approval.

2.3 FRAME TYPES

A. Frames for exterior door openings.

1. Frames for exterior use shall be fabricated from 16 gauge minimum, G 60 galvanized sheet steel or A60 galvannealed sheet steel.

B. Frames for interior door openings and borrowed lights.

1. Frame for interior use shall be fabricated from 16 gauge G 40 galvanized sheet steel or A40 galvannealed sheet steel.

C. Welded Frames: Frames shall be welded with exposed surfaces, dressed smooth and flush. Provide a temporary spreader bar securely fastened to the bottom of each frame.

1. Frames for exterior use shall have mitered corners with frames welded continuously on the full frame profile and ground smooth to appear seamless.
2. Frames for interior use shall have mitered corners with frame faces welded and ground smooth to appear seamless.
3. Welded frames shall be smooth, even, and have no blemishes or irregularities in finish or surface on all exposed sides and planes.
4. Headers and jambs shall be secured at corners either by external welding with seamless face joints.
5. Frames shall be provided with temporary spreader bars for shipping and handling purposes.
6. Knockdown and drywall type frames shall not be used unless dictated by specific project conditions leaving no other reasonable alternative.
7. Mullions and transom bars shall be joined to adjacent members by welding. Face joints shall be welded and ground smooth (seamless).
8. Frames shall be provided with a minimum of three anchors per jamb suitable for the adjoining wall construction. Frames over 7’-6” shall be provided with additional wall anchors as required.
9. In additions, frames shall be provided with minimum 18-gauge base anchor. For existing masonry wall conditions that will not accept base anchor, an additional jamb anchor shall be provided.
10. Frames shall be furnished in manufacturer’s standard factory-applied coat of rust-inhibiting primer complying with ANSI/SDI A250.10 for acceptance criteria.
11. Provide 7-gauge universal steel hinge reinforcement and prepare for 4½" x 4½" standard or heavy weight template hinges.
12. Strike jambs 14-gauge reinforcement

D. Frames for paired doors shall be furnished with a stationary center mullion where indicated.

2.4 FRAME ANCHORS

A. Use steel anchors sized to accommodate frame jamb depth and face dimension on frames.

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
    a. Jamb Anchor Locations: Locate jamb anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 30 inches o.c., to match coursing, and as follows:
        i) Two anchors per jamb up to 60 inches high.

ii) Three anchors per jamb from 60 to 90 inches high.
iii) Four anchors per jamb from 90 to 120 inches high.
iv) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Post-installed Expansion Anchors for In-place Concrete or Masonry: Minimum 3/8" diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall with throat reinforcement plate welded to frame at each anchor location.

2. Stud-Wall Type: Manufacturer's adjustable type compression anchors at drywall locations. Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
   a. Jamb Anchor Locations: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 30 inches o.c. and as follows:
      i) Three anchors per jamb up to 60 inches high.
      ii) Four anchors per jamb from 60 to 90 inches high.
      iii) Five anchors per jamb from 90 to 96 inches high.
      iv) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

B. Sleeve anchors shall be fire rated for the types of openings required.

C. Floor Anchors: Provide floor angle clip type anchors formed from same material as frames, minimum thickness of 16-gauge for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

1. Anchors to receive 2 fasteners per jamb and welded to bottom of each jamb.
2. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated as approved by shop drawings.

D. Masonry and Concrete Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

2.5 DOOR ACCESSORIES

A. Lites

1. Glazed Lites: Furnish 20-gauge metal glazing beads of the same type of finish for lites in interior and exterior doors, hollow metal frames and transoms, side lights, interior glazed panels, and other locations where beads are indicated in pressed steel frames.
   a. Secure stops with countersunk flat or oval head machine screws spaced uniformly not more than 9" o.c. and not more than 2" from each corner.
   b. Exterior glazing beads shall be installed on the exterior side of the frame with tamper-resistant screws to comply with wind loading.

B. Plaster Guards: Provide 26-gauge steel plaster guards or mortar boxes, welded to the frame, at back of door hardware cutouts where mortar or other materials might obstruct hardware operation.

C. Door Silencers: Drill stops and install 3 silencers on strike jambs of single swing frames and 2 silencers on heads of double swing frames.

D. Acoustical Door Seals: Provide frame perimeter gasket #303-S and automatic floor bottom #PDB441-E in a finish to match door hardware and as manufactured by Pemko. Provide at mechanical room doors and additional locations as indicated.

E. Drip Edge: Provide drip cap at all exterior frames exposed to the elements with no building overhangs to keep rain from hitting the top of the door.

1. Drip Cap: Drip #346 with clear anodized finish as manufactured by Pemko.
   a. Manufacturer is as indicated however equal or better performing products of other manufacturers will be considered for acceptance by the Architect.

2.6 FRAME ACCESSORIES

A. Removable Mullion: Provide removable steel mullion with single operation keyed mortise cylinder at paired door locations indicated. The unit shall be self-locking when re-installed without use of cylinder key. The assembly shall be large missile impart rated with document approval.

2.7 FIRE DOORS AND FRAMES

A. Provide approved and labeled hollow metal fire doors and frames at locations indicated in Door Schedule. Approved doors, frames, and hardware shall be constructed and installed in accordance with requirements of NFPA 80 and tested by UL (Underwriter's Laboratories, Inc.) or WH (Warnock Hersey) for the class of door opening indicated in schedules.

B. Labeled metal frames are required for labeled doors.

C. All labels shall be metal, attached to the frame where required by code. Stamped labels will not be acceptable. Labels shall not be painted.

2.8 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

D. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Supports and Anchors: Fabricate of not less than 18-gauge galvanized sheet steel.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

H. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize in compliance with ASTM A153, Class C or D as applicable.

I. Loose Fill Mineral Wool: Nodulated mineral fiber loose fill density, 4-6 lbs. cu. Ft., ASTM C764, Type I, Class 1 with maximum flame-spread of 25 and smoke-developed indexes of 50, respectively, per ASTM E 84.

J. Bituminous Paint: Cold-applied non-fibered asphalt emulsion complying with ASTM D1227, Type 2 formulated for 30 mill thickness per coat minimum.

1. Exterior frames shall be coated completely on the inside and at points in contact with masonry or concrete with bituminous mastic coating.
2. Interior frames set in masonry or concrete walls shall be coated completely on the inside and at points in contact with masonry or concrete with bituminous mastic coating.
3. Interior frames in partition walls shall be coated on the inside with bituminous mastic coating up to 1 foot above the floor.

2.9 FABRICATION, GENERAL

A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Accurately form metal to required sizes and profiles. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify Work that cannot be permanently factory assembled before shipment, to assure proper assembly at the project site. Lock edges of doors shall be beveled 1/8 inch in 2 inches.

B. Panels and edge channels of exterior doors shall be fabricated from galvanized sheet steel. Panels and edge channels of interior doors shall be fabricated from cold rolled sheet steel. Sizes, types, and assemblies shall be as indicated on the Drawings, Door Hardware Schedule, and as specified.

C. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold rolled or hot rolled steel (at fabricator's option).

D. Exposed Fasteners: Provide countersunk, tamper-resistant, flat Phillips heads for exposed screws and bolts.

E. Provide minimum 12-gauge frame head reinforcement for closers, surface, and concealed overhead stop and holders, removable mullions, flush bolts, and top latch of vertical rod exit devices.

F. Hardware Preparation

1. Prepare hollow metal units to receive mortised and concealed door hardware, including cutouts, reinforcing, drilling, and tapping in accordance with final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 "Specifications for Door and Frame Preparation."
2. Locate finish hardware as shown on final shop drawings, or if not shown, in accordance with recommended hardware locations specified in "S.D.I. 100-98, Recommended Specifications, Standard Steel Doors and Frames," as published by the Steel Door Institute.
3. Reinforce all steel frames to receive surface mounted closers, whether or not scheduled to receive them.
4. Reinforce hollow metal units to receive surface applied hardware. Drilling and tapping for surface applied door hardware may be done at project site.
5. Hollow metal units shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, and flush bolts, as required in ANSI/DHI A115 and ANSI/SDI A250.6.
6. Locate hardware in accordance with ANSI/SDI A250.8.
7. Hardware Reinforcement: Fabricate reinforcement plates from same material as hollow metal units to comply with the following minimum sizes:
   a. Hinges: Minimum 7-gauge by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
   b. Pivots: Minimum 7-gauge by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
   c. Provide minimum 12-gauge frame head reinforcement for closers, surface, and concealed overhead stop and holders, removable mullions, flush bolts, and top latch of vertical rod exit devices.
   d. Provide minimum 14-gauge reinforcement for surface exit devices, floor check hinges and strike jambs.
   e. Provide minimum 16-gauge reinforcement for pull bars.
8. Hardware preparation shall comply with Miami-Dade NOA or Florida Product Approval.

G. Shop Painting

1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."
2. Clean, treat, and shop paint all surfaces of fabricated hollow metal doors and frames, including galvanized surfaces plus back prime of all hollow metal door frames.
3. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before the application of the shop coat of paint.
4. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive field applied paint.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.

B. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames," unless otherwise indicated.

1. Set frames prior to construction of enclosing walls and ceilings. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
2. Install fire-rated frames in accordance with NFPA Standard No. 80.
3. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In closed steel stud partitions, attach wall anchors to studs with screws.
4. Set frames in position; plumb, align, and brace securely until permanent anchors are set. Anchor bottom of frames to floors with expansion bolts or with power fasteners. Where frames require ceiling struts or other structural overhead bracing, they shall be anchored securely to ceilings or structural framing above, as indicated or specified.
5. The finished work shall be rigid, neat in appearance, and free from defects. Form molded members straight and true with joints coped or mitered, well formed, and in true alignment. Welded joints on exposed surfaces shall be dressed smooth so they are invisible after finishing.
6. Provide filler plate at all hardware preps, such as hinge and strike preps, that are unused.
7. Exterior frames shall be filled completely with grout after installation of frame.
8. Interior frames set in masonry or concrete walls shall be filled completely with grout after installation of frame.
9. Coordinate installation of frames to allow for solidly filling space between frames and masonry or concrete with grout. Take precautions including bracing frames to ensure that frames are not deformed or damaged by grout forces.
10. Solidly pack mineral-fiber insulation inside metal stud partitions frames.
11. Set exterior door lite frames in full bed of sealant and do not over tighten screws. Bent or deformed exterior lite frames will be replaced.
12. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Door Installation: Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI-100.

1. Install fire-rated doors with clearances as specified in NFPA Standard No. 80-07.

D. Provide all items and accessories as required for a complete installation in every respect.

E. Corrosion Protection: Coat surfaces that will come into contact with grout, concrete, masonry, wood, or dissimilar metals and as indicated with a heavy coat of bituminous paint.

3.2 GENERAL INSTALLATION PROVISIONS

A. Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

3.3 SPECIAL COLORS

A. Hollow metal door frames at the floor joint shall have caulking color that matches the hollow metal frame color.

3.4 ADJUST AND CLEAN

A. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

B. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.

C. Final Adjustments: Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

3.5 FIELD QUALITY CONTROL

A. Damaged work will be rejected and shall be replaced with new work at no additional cost to the Owner or Architect.

B. After installation, protect doors and frames from damage during subsequent construction activities.

3.6 FIELD QUALITY CONTROL

A. Damaged work will be rejected and shall be replaced with new work at no additional cost to the Owner or Architect.

B. After installation, protect doors and frames from damage during subsequent construction activities.

C. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections.

D. Testing Services: Testing and inspecting of representative areas of hollow metal assemblies shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.

E. Test Area for Each Individual Building:

1. 10% of the total openings.
2. Perform a minimum of two tests in areas as directed by Architect.

F. Test Types:

1. Water Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

G. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

END OF SECTION 08 11 13

SECTION 08 14 16 – FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
    a. Solid-core doors and transom panels with wood-veneer faces.
    b. Factory finishing flush wood doors.
    c. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 REFERENCES

A. ASTM D 1037 – Standard Test Method for evaluating properties of Wood-Based Fiber and Particle Panel Materials.
B. ASTM E152 – Methods of Fire Tests and Door Assemblies.
C. ASTM E413 – Classification for Determination of Sound Transmission Class.
D. ASTM E2074 – Standard Methods of Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
E. ASTM F476 – Standard Test Method for Security of Swinging Door Assemblies.
F. AWI – Quality Standards of the Architectural Woodwork Institute.
G. WDMA – Window & Door Manufacturers Association.
H. HPMA HP – Hardwood and Decorative Plywood.
I. ANSI A115.1 W Series, Wood Door Hardware Standards.
J. NFPA 80 – Fire Doors and Windows.
K. NFPA 252 – Standard Method of Fire Tests for Door Assemblies.
L. UL 10B – Fire Tests of Door Assemblies.
M. UL 10C – Fire Tests for Door Assemblies – Positive Pressure.
N. Warnock Hersey – Certified Listings for Fire Doors.
O. WDMA Industry Standards 1.S.I-A-97 – Window and Doors Manufacturer Association.
P. Window and Door Manufacturers Association – WDMA I.S.1-A Architectural Wood Flush Doors.
Q. Window and Door Manufacturers Association – WDMA I.S. 10 Industry Standard for Testing Cellulosic Composite Materials for Use in Fenestration Products.
R. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking, cutouts, undercuts and mortises and holes for hardware.
2. Dimensions for Undercuts.
   Requirements for veneer matching.
3. Fire-protection ratings for fire-rated doors.

C. Samples:

1. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
   a. Provide samples for each species of veneer and solid lumber required.
   b. Provide set of three (3) samples showing full ranges of color and grain to be expected in the finish work.
   c. Finish veneer-faced door samples with same materials proposed for factory-finished doors.
2. Lite and frame sections, 6 inches long, for each material and finish specified.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

B. Quality Standard Compliance Certificates: AWI or WDMA Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body and is a certified participant in AWI's or WDMA's Quality Certification Program.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

C. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

1. Provide AWI or WDMA Quality Certification Labels indicating that doors comply with requirements of grades specified or provide a letter of certification.
2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.

D. Contractor Qualifications: Employ only experienced Contractors (Installers) skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five years.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door top and bottom rail with opening number used on Shop Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during remainder of construction period.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
   b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
   c. Delamination of veneer from core.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

1.10 PERFORMANCE

A. Fire Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

B. Smoke Control Door Assemblies: Comply with NFPA 105.

1. Smoke "S" Label: Doors to bear “S” label and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

C. Security Comply with ASTM F476-84 Level 40.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer shall be one of the following in each category however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Flush Wood Door
   a. Algoma Hardwoods, Inc.
   b. Eggers Industries
   c. Graham Wood Doors; an Assa Abloy Group Company
   d. Ipik Door Company
   e. Marshfield Door Systems, Inc.
   f. Mohawk Doors; a Masonite Company
   g. Oshkosh Door Company
   h. Vancouver Door Company
   i. VT Industries, Inc.

2.2 FLUSH WOOD DOORS

A. Solid-Core Doors:

1. Core: Structural composite lumber core, either glued wood stave or structural lumber AWI Type SLC-5 or SLC-7 or WDMA equivalent.
   a. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
2. Construction: Indicated number of plies with stiles and rails bonded to core then entire unit abrasive planed before faces are applied.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
   a. Screw Withdrawal, Face: 700 lbf
   b. Screw Withdrawal, Edge: 400 lbf per WDMA T.M.-10.
4. STC Rating: Doors shall have an STC rating of 30 minimum with perimeter seals.

B. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

1. Temperature-Rise Limit: Where indicated, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
3. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:

a. 5-inch top-rail blocking.
b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
c. 5-inch midrail blocking, in doors indicated to have armor plates.
d. 5-inchmidrail blocking, in doors indicated to have exit devices.

4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
5. Pairs: Provide formed-steel edges and astragals with intumescent seals.
   a. Finish steel edges and astragals with baked enamel.

C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

D. Astragals for Fire Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge specifically for double doors.

2.3 VENEER-FACED DOORS

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade AA, A faces.
2. Species: Select white birch maple Red Oak White Oak (Wood shall be clear, heartwood, noticeable dark wood, dark spots and streaks are not allowed).
3. Cut: Rotary cut (rotary only available in birch) Rift cut Plain sliced.
4. Thickness: 1 3/4"
5. Match between Veneer Leaves: Book match.
6. Assembly of Veneer Leaves on Door Faces: Running match (available in A grade only), Balance match
7. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions, balanced match finish.
8. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (3 m) or more.
9. Transom Match: Continuous match.
10. Exposed Vertical and Top Edges: Same species as faces - edge Type A, minimum 1 1/8” after trimming.
11. WDMA I.S.1-A Aesthetic Grade, Heavy Duty Performance Grade.
12. Adhesive: Interior use, Type II.

2.4 LITE FRAMES

A. Wood frames for Lite Openings in Wood Doors: Vision panel sizes shall be as indicated on Drawings.

1. Wood Species: Same species as, or compatible with, door faces.
2. Profile: Flush rectangular frames.
3. At 20-minute, fire-rated, wood-core doors, provide wood frames and metal glazing clips approved for such use.

B. Wood-Veneered Frames for Lite Openings in Fire Doors: Manufacturer's standard wood veneered noncombustible frames matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

1. Coordinate frame size to conform to fire glass thickness.

C. Metal Frames for Lite Openings in Wood Doors: All vision panels shall be of a size as indicated on drawings with manufacturer's standard metal frames.

D. Metal frames for Lite Openings in Fire Doors: Manufacturer's standard metal frames approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

1. Coordinate frame size to conform to fire glass thickness.

E. Frames to have countersunk holes and tamper proof fasteners.

F. Color: As selected by the Architect.

2.5 ACCESSORIES

A. Mullion: Mullions shall be manufacturer's standard wood profile to coordinate with wood bead profile and match finish. Mullions shall be true full depth mullions not applied and at locations indicated on drawings.

B. Acoustical Door Seals: Provide frame perimeter gasket #303-S and automatic floor bottom #PDB441-E in a finish to match door hardware and as manufactured by Pemko. Provide at Mechanical Room doors, and additional locations as indicated.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings: Factory cut and trim openings through doors.

1. Lite Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Specification Section "Glazing".
3. Louvers: Factory install louvers in prepared openings.

2.7 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory door finish:

1. Grade: Premium.
2. Finish: WDMA TR-4 conversion varnish or WDMA TR-6 catalyzed polyurethane.
3. Staining: Stain shall be as selected by the Architect.
4. Effect: Filled finish.
5. Sheen: Satin.

C. Shop Priming:

1. Doors for Opaque Finish: Shop prime faces, edges of cutouts, and mortises with one coat of wood primer specified in Specification Section “Interior Painting.”

2.8 ENVIRONMENTAL

A. Certification: Submit FSC certification numbers, identify each certified product on a line-item basis.

B. Ureaformaldehyde: No ureaformaldehyde products shall be added or allowed in any products.

C. Adhesives: For adhesives, including printed statement of VOC content.

D. Composite Wood: For composite-wood products, documentation indicating that product contains no urea formaldehyde.

E. Recycled Content: Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with an average recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 20 percent.

F. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

1. Use adhesive that has a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Contact Adhesive: 250 g/L.

H. Submit manufacturer's certification that products comply with VOC limits when calculated according to 40CFR 59, Subpart D (EPA Method 24).

I. Submit manufacturer's product data for adhesives. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.

J. Submit Green Seal Certification to GS-36 and description of the basis of certification.

K. Submit manufacturer's certification that products comply with SCAQMD #1168. Submit manufacturer's certification that products comply with SCAQMD Rule 1168 in areas where exposure to freeze/thaw conditions and direct exposure to moisture will not occur. In areas where freeze/thaw conditions do exist or direct exposure to moisture can occur, submit manufacturer's certification that products comply with Bay Area AQMD Reg. 8, Rule 51 for containers larger than 16 oz with California Air Resources Board (CARB) for containers 16 oz or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Specification Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.

2. Install smoke- and draft-control doors according to NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 32 13 – SLIDING ALUMINUM-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Suspended sliding aluminum-framed glass doors.

1.3 REFERENCES

A. ANSI Z97.1 – Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
B. CPSC 16 CFR 1201 – Safety Standard for Architectural Glazing Materials
C. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
D. ASTM B244 – Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments.
E. ASTM C1048 – Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
F. NFPA 101 – Life Safety Code.
G. NAAMM – National Association of Architectural Metal Manufacturers.
   1. Metal Finishes Manual for Architectural and Metal Products.
H. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum.
I. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

B. Shop Drawings: For sliding aluminum-framed glass doors.

1. Include plans, elevations, sections, and details.
2. Detail attachments to other work, and between units, if any.

3. Include hardware and required clearances.

C. Samples: For sliding aluminum-framed glass doors and components required, prepared on Samples of size indicated below:

1. Main Framing Member: 12-inch-long section with glazing bead, and factory-applied finish.
2. Hardware: Full-size units with factory-applied finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For manufacturer's special warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating sliding aluminum-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

B. Installer Qualifications: An installer acceptable to sliding aluminum-framed glass door manufacturer for installation of units required for this Project.

1.7 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of sliding aluminum-framed glass doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including excessive deflection.
   b. Faulty operation of movable panels and hardware.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: Three (3) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. SpacePlus – A Division of the Sliding Door Company.

2.2 SLIDING ALUMINUM-FRAMED GLASS DOORS

A. Description: Frames and door panels fabricated from aluminum extrusions complying with AAMA Standards.

B. Framing Members: Extruded aluminum standard of manufacturer.

C. Beams and Columns: Extruded aluminum 2" x 4" x 0.102" thick minimum.

D. Top Track: Extruded aluminum with 0.064" minimum thickness with single channel.

E. Door Stiles and Rails: Extruded aluminum 1.5" sight line with minimum 0.051" thickness.

F. Mullions: Surface applied 1" wide mullions in pattern indicated on the Drawings.

G. Door Style: Trio configuration, divided horizontally into multiple lites.

2.3 GLAZING

A. Glass and Glazing: Manufacturer's standard glazing system.

B. Glass: ASTM C 1036, Type 1, q3, Category II safety glass complying with testing requirements in 16 CFR 1201.

1. Glass: Monolithic clear tempered 1/4" (5mm) thick glass, ASTM C1048, Kind FT

C. Safety Glazing Labeling: Permanently mark safety glazing with certification label. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

2.4 HARDWARE

A. Handle: Manufacturer’s standard aluminum handle in a brushed silver finish.

B. Upper Carriages: Vinyl roller carriages with steel bearings.

C. Lock: Manufacturer’s standard aluminum push lock in chrome plated finish.

D. Door Stop: Provide door stop at the head or bottom track.

2.5 ACCESSORIES

A. Fasteners: Noncorrosive and compatible with door members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

B. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for sliding aluminum-framed glass doors.

C. Adhesive: Clear construction grade silicone adhesive.

2.6 MATERIALS

A. Extruded Shapes: ASTM B211, Alloy 6061

B. Glass: ASTM C1036, Type 1, Category II

2.7 FABRICATION

A. Fabricate sliding aluminum-framed glass doors in sizes indicated. Include a complete system for assembling components and anchoring doors.

B. Fabricate sliding aluminum-framed glass doors that are reglazable without dismantling panel framing.

C. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

D. Factory-Glazed Fabrication: Glaze sliding aluminum-framed glass doors in the factory where practical and possible for applications indicated. Comply with requirements in specification section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440.

2.8 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

B. Black Anodic Finish: Class II, AA-M12C22A31 Mechanical Finish, nonspecular as fabricated Chemical Finish, etched Anodic Coating, clear coating 0.04mil or thicker complying with AAMA 611. Complying with paint manufacturer's written instructions for cleaning, preparing, pretreating and apply coating to exposed metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of threshold substrate, and operational clearances.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.

B. Install sliding aluminum-framed glass doors level, plumb, square, true to line, without distortion, without warp or rack of frames and panels, and without impeding thermal movement; anchored securely in place to structural support; and in proper relation to adjacent construction.

C. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Lubricate hardware and moving parts.

B. Adjust hardware for proper alignment, smooth operation, and without unnecessary force or excessive clearance.

C. Clean exposed surfaces immediately after installing sliding aluminum-framed glass doors. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, excess sealants, glazing materials, dirt, and other substances.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

E. Protect sliding aluminum-framed glass door surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances contact sliding aluminum-framed glass door surfaces, remove contaminants immediately according to manufacturer's written instructions.

F. Refinish or replace sliding aluminum-framed glass doors with damaged finishes.

G. Replace damaged components.

END OF SECTION 08 32 13

SECTION 08 33 00
ROLLING COUNTER FIRE SHUTTERS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Manual automatic closing rolling counter fire doors.
B. Related Sections:
   1. 05 50 00 Metal Fabrications. Door opening jamb and head members.
   2. 06 10 00 Rough Carpentry. Door opening jamb and head members.
   3. 08 31 00 Access Doors and Panels. Access doors.
   4. 08 70 00 Hardware. Padlocks. Masterkeyed cylinder.
   5. 09 91 00 Painting. Field painting.
   6. Division 26. Electrical wiring and conduit, fuses, disconnect switches, connection of operator to power supply, installation of control station and wiring, and connection to alarm system.
C. Products That May Be Supplied, But Are Not Installed Under This Section:
   1. Control station
   2. Electrical disconnect
   3. Annunciators
   4. Primary and control wiring
   5. Conduit and fittings

1.2 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. Provide doors with Underwriters' Laboratories, Inc. label for the fire rating classification, 3/4 hr
   2. Provide doors with Underwriters' Laboratories, Inc. label for “Leakage Rated Assembly” or “S” label demonstrating product tested to UL 1784.
      a. Comply with NFPA 105 air leakage requirements

1.3 SUBMITTALS

A. Reference Section 01 33 00 Submittal Procedures; submit the following items:
   1. Product Data
   2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
   3. Quality Assurance/Control Submittals:
      a. Provide proof of manufacturer ISO 9001:2015 registration
      b. Provide proof of manufacturer and installer qualifications - see 1.4 below
      c. Provide manufacturer's installation instructions
   4. Closeout Submittals:
      a. Operation and Maintenance Manual
      b. Certificate stating that installed materials comply with this specification

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer Qualifications: ISO 9001:2015 registered and a minimum of five years experience in producing counter fire doors and smoke control units of the type specified
2. Installer Qualifications: Manufacturer's approval

1.5 DELIVERY STORAGE AND HANDLING

A. Reference Section 01 66 00 - Product Storage and Handling Requirements
B. Follow manufacturer's instructions

1.6 WARRANTY

A. Standard Warranty: Two years from date of shipment against defects in material and workmanship
B. Maintenance: Submit for owner’s consideration and acceptance of a maintenance service agreement for installed products

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Manufacturer:
1. Cookson: 1901 South Litchfield Road, Goodyear, AZ 85338.
Telephone: (800) 233-8366.
a. Model: ERC10
2. Cornell
3. Clopay Building Products
4. Amarr

2.2 MATERIALS

A. Curtain:
1. Slat Configuration:
a. Galvanized Steel with Finish as Described Below: No. 1F, interlocked flat-faced slats, 1-1/2 inches (38 mm) high by 1/2 inch (13 mm) deep, minimum 22 gauge ASTM A 653, Commercial Quality, galvanized steel with plain steel bottom bar and vinyl astragal.
b. Stainless Steel: No. 1F, interlocked flat-faced slats, 1-1/2 inches (38 mm) high by 1/2 inch (13 mm) deep, minimum 22 gauge AISI type 304 #4 finish stainless steel with stainless steel bottom bar and vinyl astragal.
2. Finish:
a. GalvaNex™ Coating System (Stock Colors):
1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding baked-on base coat and gray baked-on polyester enamel finish coat.

B. Endlocks:
1. Fabricate continuous interlocking slat sections with high strength galvanized steel endlocks riveted to slats per UL requirements.

C. Guides:
1. Configuration & Finish:
a. Steel: Minimum 12 gauge formed shapes.
1) Powder Coat (Stock Colors): Zirconium treatment followed by a gray baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.

D. Counterbalance Shaft Assembly:
1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.
2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.

E. Brackets:
1. Fabricate from reinforced steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
2. Finish:
a. Powder Coat (Stock Colors): Zirconium treatment followed by a gray baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.

F. Hood and Mechanism Covers:
1. 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets as required to prevent excessive sag.
2. Finish:
a. GalvaNex™ Coating System (Stock Colors):
1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding baked-on base coat and gray baked-on polyester finish coat.

2.3 OPERATION

A. Manual Operation:
1. AlarmGard Advanced Manual Chain Fire Door Operators: Electrically activated, manually operated, 115 volt AC system with planetary gear reduction, a transformer with 24v secondary output and an internal failsafe release mechanism.
a. Door assembly to be manually operated by chain hoist.
b. Provide an internal electrical failsafe release device that requires no additional wiring, external cables or mounting locations.
c. Electrically activate automatic closure by notification from central alarm system.
d. Provide an internal solenoid brake mechanism to hold the door at any position during normal door operation.
e. Delay automatic closure after notification for no more than ten seconds.

f. Control automatic closure speed with an internal, totally enclosed, variable rate centrifugal governor without the use of electrical pulsation, constant rate viscosity, oscillation type or other exposed governing devices.
g. Maintain automatic closure speed at an average of 12” (304mm) per second.
h. Electrically reset internal failsafe release device and door operating system upon restoration of electrical power and upon clearing of the alarm signal without requiring human supervision.
i. Provide minimum #50 roller chain from operator output shaft to the door drive shaft.
j. Install system only with manufacturer supplied or specified fasteners.
k. Ensure that manual resetting of spring tension, release devices, linkages or mechanical dropouts will not be required.
l. Notify electrical contractor to supply and install the appropriate disconnect switch, all conduit and wiring per the door system wiring instructions.
m. Drop test and reset door system twice by all means of activation and comply fully with NFPA 80 Section 5.

2.4 ACCESSORIES

A. Locking:
1. None
B. Fire Emergency Annunciator:
1. Voice Warning Module fire emergency annunciator to give advanced warning that fire shutter is about to close, activating warning signal upon alarm.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.
B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.
C. Commencement of work by installer is acceptance of substrate

3.2 INSTALLATION

A. Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports.
B. Comply with NFPA 80 and follow manufacturer's installation instructions.

3.3 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

3.4 FIELD QUALITY CONTROL

A. Site Test: Test doors for normal operation and automatic closing. Coordinate with authorities having jurisdiction to witness test and sign Drop Test Form.

3.5 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.
B. Remove surplus materials and debris from the site.

3.6 DEMONSTRATION

A. Demonstrate proper operation to Owner's Representative.
B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION

SECTION 08 41 13 – ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Exterior storefront system.
   b. Exterior curtainwall system.
   c. Interior storefront system.

1.3 REFERENCES

A. AA (Aluminum Association) – Designation System for Aluminum Finishes.
B. AAMA Series number 11 – Design Wind Loads for Buildings and Boundary Layer Wind Tunnel Testing.
C. AAMA 101 – Standard Specification for Window, Doors, and Skylights.
D. AAMA 200 – Standard Practice for the Installation of Windows with Frontal Flanges for Surface Barrier Masonry Construction.
E. AAMA 502-08 – Voluntary Specification for field Testing of Newly Installed Fenestration Products.
F. AAMA 511 – Voluntary Guideline for Forensic Water Penetration Testing of Fenestration Products.
G. AAMA 612 – Voluntary Specification for Anodized Architectural Aluminum.
H. AAMA 701/702 – Combined Voluntary Specifications for Pile Weather-stripping and Replaceable Fenestration Weatherseals.
I. AAMA 1503.1 – Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
J. AAMA 2604 – Voluntary Specification, Performance Requirements and Test Procedure for Superior Performing Organic Coating on Aluminum Extrusions and Panels.
K. AAMA 2605 – Voluntary Specification, Performance Requirements and Test Procedure for Superior Performing Organic Coating on Aluminum Extrusions and Panels.
L. ASCE 7 – Minimum Design Loads for Buildings and other Structures.
M. ASTM A123/A123M – Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
N. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

O. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
P. ASTM C509 – Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
Q. ASTM D2000 – Standard Classification System for Rubber Products in Automotive Applications.
R. ASTM D2287 – Standard Specification for Non-Rigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.
S. ASTM E283 – Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen.
T. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
U. ASTM E331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
V. 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.
W. ASTM F588 – Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.
X. FBC – Florida Building Code.

1.4 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Samples: For units with factory-applied finishes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.

4. Glazing.
5. Flashing and drainage.

E. Delegated-Design Submittal: Submit design calculations, analysis data and shop drawings indicating compliance with dedicated design requirements signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

F. Approval: Manufacturer submit documentation that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Energy Performance Certificates: For glazed storefront systems, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each glazed storefront system.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

D. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed storefront systems to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

C. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum storefront and entrance systems that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.

D. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

E. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

F. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

G. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

1. Provide NFRC-certified glazed aluminum storefront systems with an attached label.

H. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

I. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

1.9 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

B. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

C. Review and discuss the finishing that is required to be coordinated with the finishing of other aluminum work for color and finish matching.

D. Review, discuss, and coordinate the interrelationship with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.

E. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.

F. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.10 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.11 WARRANTY

A. Warranty: Standard form in which manufacturer and installer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration caused by thermal movements.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   d. Adhesive or cohesive sealant failures.
   e. Water leakage through fixed glazing and framing areas.
   f. Failure of operating components.
2. Warranty Period for installer: Two (2) years from date of Substantial Completion.
3. Warranty Period for manufacturer: Five (5) years from date of Substantial Completion.
4. Warranty Period for Anodized finish: Ten (10) years from date of Substantial Completion.

1.12 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

1.13 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Movements of supporting structure indicated on drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:
   a. Deflection exceeding specified limits.
   b. Thermal stresses transferring to building structure.
   c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.

d. Glazing-to-glazing contact.
e. Noise or vibration created by wind and by thermal and structural movements.
f. Loosening or weakening of fasteners, attachments, and other components.
g. Sealant failure.
h. Failure of operating units.

B. Structural Loads:

1. Wind Loads: Basic wind speed, importance factor and exposure category shall be as indicated on drawings.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches and shall also comply with the impact certification requirements.
2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch, whichever is smaller and shall comply with the impact certification requirements.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. Wind Loads: Basic wind speed, importance factor and exposure category shall be as indicated on drawings.
2. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches or 3/4".

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas to comply with manufacturers testing of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).

F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

G. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

H. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
   a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
   b. Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).
   c. Interior Ambient-Air Temperature

I. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45.

J. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x deg F.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).
3. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

K. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having the following sound-transmission characteristics:

1. Sound Transmission Class (STC): Minimum 32 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413 and ASTM E 1332.

L. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated if design exceeds limitations of the impact certification and provide additional elements as required to meet design loads.

M. Approvals: Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. YKK AP American, Inc.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.

1. Kawneer
2. EFCO

2.2 EXTERIOR CURTAINWALL

A. Curtain Wall System Basis of Design: YKK AP YHC 300 OG Curtain Wall System.

B. Curtain Wall Framing System:

1. Description: Framing System shall be thermally improved. Horizontal and vertical members shall have a nominal face dimension of 3 inches, depth as indicated on the shop drawings. Framing system shall provide a flush glazed appearance on all sides with no protruding glass stops.
2. Glazing: Manufacturer's standard silicone compatible EPDM glazing gaskets to inhibit water infiltration at the exterior and Dow Corning® 995 Structural Silicone Sealant with fixed stops at the interior; interior spacers are to be silicone.

2.3 MATERIALS

A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.

B. Aluminum Sheet:

1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050" (1.27 mm) minimum thickness.

2.4 ACCESSORIES

A. Manufacturer's Standard Accessories:

1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel fasteners. Joint fasteners may be concealed.
2. Sealant: Non-skinning type, AAMA 803.3
3. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; exterior glazing silicone compatible EPDM gaskets, in accordance with ASTM C 864, designed to lock into gasket reglet, interior by means of silicone spacer and structural silicone adhesive.
4. Glazing Adhesive: Dow Corning® 995 Structural Silicone.

2.5 RELATED MATERIALS (Specified In Other Sections)

A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.

2.6 FABRICATION

A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure and sealed in accordance with manufacturer's recommendations.

1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.
2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.7 FINISHES AND COLORS

A. YKK AP America Anodized Plus® Finish:

CODE	DESCRIPTION
YKIN	Black Anodized Plus

B. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:

1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612. Aluminum extrusions shall be produced from quality controlled billets meeting AA-6063-T5.
   a. Exposed Surfaces shall be free of scratches and other serious blemishes.
   b. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.
   c. The anodized coating shall comply with all of the requirements of AAMA 612: Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.
   d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

C. Finishes Testing:

1. Apply 0.5% solution NaOh, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOh; Do not clean area further.
2. Submit samples with test area noted on each sample

2.8 STOREFRONT SYSTEM – EXTERIOR

A. Storefront System: YKK AP YHS 50 FS Impact Resistant and Blast Mitigating Storefront System.

B. Storefront Framing Systems:

1. Description: Center set, exterior or interior flush glazed; jambs and vertical mullions continuous; head, sill, intermediate horizontal attached by screw spline joinery. Continuous and wept sill flashing.

2. Components: Manufacturer's standard extruded aluminum mullions, entrance doors, framing, and indicated shapes, perimeter anchor fillers and steel reinforcing as required.
3. Glazing: Manufacturer's standard glazing stops with EPDM glazing gaskets to prevent water infiltration at the exterior and Dow Corning® 995 Structural Silicone Sealant with fixed stops at the interior.

2.9 MATERIALS

A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.

B. Aluminum Sheet:

1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050" (1.27 mm) minimum thickness.

2.10 ACCESSORIES

A. Manufacturer's Standard Accessories:

1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners.
2. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; Glazing gaskets in accordance with ASTM C 864.
3. 0.050” Aluminum Sill Flashing End Dams featuring 3 point attachment.

2.11 RELATED MATERIALS (Specified In Other Sections)

A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.

2.12 FABRICATION

A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure and sealed in accordance with manufacturer's recommendations.

1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.
2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.13 FINISHES AND COLORS

A. YKK AP America Anodized Plus® Finish:

CODE	DESCRIPTION
YK1N	Black Anodized Plus®

B. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:

1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612. Aluminum extrusions shall be produced from quality controlled billets meeting AA-6063-T5.
   a. Exposed Surfaces shall be free of scratches and other serious blemishes.
   b. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.
   c. The anodized coating shall comply with all of the requirements of AAMA 612: Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.
   d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

C. Finishes Testing:

1. Apply 0.5% solution NaOh, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOh; Do not clean area further.
2. Submit samples with test area noted on each sample.

2.14 STOREFRONT SYSTEM – INTERIOR

A. Storefront System: YKK AP YES 40 FS Storefront System.

B. Storefront Framing System:

1. Description: Center rabbet, exterior flush glazed; jambs and vertical mullions continuous; head, sill, intermediate horizontal attached by screw spline joinery.
2. Components: Manufacturer's standard extruded aluminum expansion mullions, 0-15 degree hinged mullions, 90 degree corner posts, flexible corner posts, three way corner post, 93-170 degree flexible corner posts, entrance door framing, and indicated shapes.

2.15 MATERIALS

A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.

B. Aluminum Sheet:

1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050" (1.27 mm) minimum thickness.

2.16 ACCESSORIES

A. Manufacturer's Standard Accessories:

1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners.
2. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; Glazing gaskets in accordance with ASTM C 864.
3. 0.050 Aluminum Sill Flashing End Dams must have 3 point attachment.

2.17 RELATED MATERIALS (Specified In Other Sections)

A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.

2.18 FABRICATION

A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure and sealed in accordance with manufacturer's recommendations.

1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.
2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

2.19 FINISHES AND COLORS

A. YKK AP America Anodized Plus® Finish:

CODE	DESCRIPTION
YK1N	Black Anodized Plus®

B. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:

1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612. Aluminum extrusions shall be produced from quality controlled billets meeting AA-6063-T5.
   a. Exposed Surfaces shall be free of scratches and other serious blemishes.
   b. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.
   c. The anodized coating shall comply with all of the requirements of AAMA 612: Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.
   d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.

2. CASS Corrosion Resistance Test, CASS 240/ASTM B368 Test Method.
3. Other AAMA 2605 Performance Tests specified in these specifications, such as: 7.3 Dry Film Hardness; 7.8.2 Salt Spray Resistance; 7.9.1.2 Color Retention, South Florida; 7.9.1.4 Gloss Retention, South Florida.

C. Finishes Testing:

1. Apply 0.5% solution NaOh, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOh; Do not clean area further.
2. Submit samples with test area noted on each sample.

2.20 ENTRANCE DOOR SYSTEMS

A. Basis of Design: “50 H Monolithic, Impact Rated”

1. Exterior – “50 H”, 9/16” glazing, impact rated
   a. Florida Product Approval – FL 16554.4
2. Interior – “50 D” ¼” glazing

B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: Fabricate from extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops, and preformed gaskets.
   a. Provide nonremovable glazing stops on outside of door and frame.

2.21 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware for each entrance door to comply with requirements per the Florida Product Approval, the Florida Building Code and requirements indicated below, however the requirements of the Florida Product Approval and Florida Building Code shall take precedence.

1. Entrance Door Hardware Sets per Door Hardware Specification Section.
2. Opening-Force Requirements:
   a. Egress Doors: Not more than 8.5 lbf to open the door to its minimum required width.
   b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

B. Opening-Force Requirements:

1. Latches and Exit Devices: Not more than 5 lbf required to release latch.

C. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.

2. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

D. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed

E. Silencers: BHMA A156.16, Grade 1.

F. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch fasteners on mounting strip.

G. Door Pull: To Be Determined

1. Finish: Black Anodized

H. Door Operator: LCN 9150 Benchmark

1. Finish: Black Anodized.
2. Handling: Surface mount independent pair.
3. Handling: Non-handed
4. Electrically powered.

2.22 GLAZING SYSTEMS

A. Glazing: As specified in specification section “Glazing.”

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded, or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: As recommended by manufacturer for joint type.

1. Color: As selected by Architect from manufacturer's full range of colors.

2.23 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in specification section "Joint Sealants."

B. Bituminous Paint: Cold-applied, non-fibered asphalt emulsion complying with ASTM D1227, Type 2 requirements formulated for 30-mil (0.762-mm) thickness per coat.

2.24 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.25 SILL PAN AT EXTERIOR STOREFRONT

A. Provide .125 inch aluminum sill pan with 1/4" upturn at inside edge.

B. Finish shall match storefront system.

2.26 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.

D. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.

2. At exterior doors, provide weather sweeps applied to door bottoms.

E. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.27 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

B. Aluminum Surfaces: Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

E. Black Anodic Finish: Mechanical Finish, nonspecular as fabricated Chemical Finish, etched Anodic Coating, clear coating 0.7mils or thicker complying with AAMA 612. Complying with paint manufacturer's written instructions for cleaning, preparing, pretreating and apply coating to exposed metal surfaces.

F. Interior System: Black Anodic Finish: Mechanical Finish, nonspecular as fabricated Chemical Finish, etched Anodic Coating, clear coating 0.7mils or thicker complying with AAMA 612. Complying with paint manufacturer's written instructions for cleaning, preparing, pretreating and apply coating to exposed metal surfaces.

2.28 ENVIRONMENTAL

A. Recycled Content: Provide products with an average recycled content of metal products so 100% of postconsumer recycled content plus 50% of preconsumer recycled content is not less than 20 percent.

B. Adhesives: For adhesives and sealants used inside of the weatherproofing system, including printed statement of VOC content.

C. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

D. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.

C. Corrosion Protection: Coat concealed surfaces that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

E. Set continuous sill members and flashing in full sealant bed per specification section "Joint Sealants" to produce weathertight installation.

F. Sill Pan Installation: Install sill pan in full bed of sealant on concrete slab prior to installing system.

G. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

H. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

I. Install perimeter joint sealants as specified in specification section "Joint Sealants" to produce weathertight installation.

J. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping. Indicate entrance door hardware mounting heights on drawings or insert in subparagraph below.

1. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

K. Install glazing as specified in Specification Section "Glazing."

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 10 feet; 1/4 inch over total length.
2. Alignment:
   a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
   b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections.

B. Testing Services: Testing and inspecting of representative areas of glazed aluminum framed assemblies shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.

C. Test Area for Each Individual Building:

1. One bay area, but not less than 30 feet, by one story of glazed aluminum framed assemblies.
2. 5% of windows but not less than four windows,
3. Perform a minimum of two tests in areas as directed by Architect.

D. Test Types:

1. Air Infiltration: Areas shall be tested for air leakage as indicated on manufacturers test of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of not less than 6.24 lbf/sq. ft. and shall not evidence water penetration.

3. Water Spray Test (To be used if area is too big to accommodate a pressure chamber): Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

E. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

G. Aluminum framed assemblies will be considered defective if they do not pass tests and inspections.

H. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION 08 41 13

SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Hardware for wood and hollow steel doors.
   2. Lock Cylinders for gates, folding partitions, wire cages and doors.
   3. Thresholds.
   4. Gaskets.
   5. Screws, bolts, expansion shields and related prep work.
   6. Hardware layout templates.
   7. Keys key cabinet and Knox Box.

1.3 RELATED WORK

A. Section 01 25 13 – Product Substitution Procedures.
B. Section 01 31 00 – Project Coordination.
C. Section 01 33 00 – Submittal Procedures.
D. Section 01 42 00 – References.
E. Section 01 45 00 – Quality Control.
F. Section 01 74 00 – Cleaning and Waste Management.
G. Section 01 78 00 – Closeout Submittals.
H. Section 08 11 13 – Hollow Metal Doors and Frames.
I. Section 08 14 16 – Flush Wood Doors.
J. Section 08 41 13 – Entrances and Storefronts.

1.4 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, abbreviations, definitions, and acronyms.
B. ANSI A117.1 – Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
C. ANSI/NFPA 80 – Fire Doors and Windows.
D. AWI – Architectural Woodwork Institute.
E. BHMA – Builders' Hardware Manufacturers Association.
F. DHI – Door and Hardware Institute.
G. Florida Fire Prevention Code.
H. NAAMM – National Association of Architectural Metal Manufacturers.
I. NFPA 101 – Life Safety Code, 2008 Edition.
J. SDI – Steel Door Institute.

K. Florida Building Code (FBC)

1.5 COORDINATION

A. Coordinate hardware installation with other affected trades in accord with Section 01 31 00 – Project Coordination.

1.6 QUALITY ASSURANCE

A. Manufacturers: Company shall specialize in manufacturing door hardware with five years continuous experience.
B. Hardware Supplier: Company shall specialize in supplying institutional door hardware with five years continuous documented experience, approved by manufacturer.
C. Hardware Supplier Personnel: Employ Architectural Hardware Consultant (AHC) on project.

1.7 REGULATORY REQUIREMENTS

A. Conform to Florida Building Code for requirements applicable to fire rated doors, frames, and accessibility for physically disabled.
B. Conform to Florida Fire Prevention Code and applicable sections of NFPA 101.

1.8 CERTIFICATIONS

A. Architectural Hardware Consultant shall inspect complete installation and certify that hardware and installation has been furnished and installed in accord with manufacturer's printed instructions and as specified.
B. Provide two copies of certifications to Architect.

1.9 SUBMITTALS

A. Submit schedules, samples, parts lists, templates, installation instructions and product data per Section 01 33 00 – Submittals.
B. Submittals shall identify each door and each set number following numbering system noted on Drawings.
C. Manufacturing order shall not be placed until hardware schedule has been submitted and reviewed by Architect.
D. Furnish templates to facilitate work schedule.
E. Indicate locations and mounting heights of each type of hardware.
F. Submit samples of hinge, latch set, exit device, door closer, thresholds, illustrating style, color, and finish.
G. Project samples may be incorporated in Work.
H. Submit manufacturer, supplier, fabricator, and installer's qualifications in accord with Section 01 33 00 – Submittal Procedures.

1.10 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data in accord with Section 01 78 00 – Closeout Submittals.
B. Include data on operating hardware, and inspection procedures related to preventative maintenance.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and protect products in original packaging to site in accord with Section 01 66 00 – Project Storage and Handling Requirements.
B. Hardware Packaging
   1. Items shall be individually labeled and identified with door opening code and hardware group to match hardware schedule.
   2. Each item shall identify door location by number identified on Door Schedule.
C. Hardware manufacturers shall deliver via security shipping following items to District Maintenance Dept., 2485 SE Dixie Hwy., Stuart, FL 34996:
   1. Two copies of factory key biting schedule.
   2. Permanent building keys and construction key voiding devices.
D. Protect hardware from theft by cataloging and storing in secured area.

1.12 WARRANTY

A. Provide five-year warranty period in accord with Section 01 78 00 – Closeout Submittals for locksets, latch sets, exit devices hinges and items listed in the hardware schedule excluding overhead door closers.
B. Provide ten-year warranty period in accord with Section 01 78 00 – Closeout Submittals for overhead door closers.

1.13 MAINTENANCE MATERIALS

A. Provide special wrenches and tools applicable to different or special hardware component.
B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers not listed may submit requests for substitution except as noted in accord with Section 01 25 13 – Product Substitution Procedures.
B. Obtain each kind of hardware from one manufacturer.
C. Acceptable products and manufacturers are listed below:
   1. Hinges: Ives, Hager, Stanley, Bommer.
   2. Locks and Latches: Best Access (No Substitution Permitted).
   3. Cylinders, Keys, Keying: Corbin/Russwin (No Substitution Permitted).
   4. Exit Devices: Von Duprin (No Substitution Permitted).
   5. Removable Mullions: Von Duprin (No Substitution Permitted).
   6. Door Closers: LCN (No Substitution Permitted).
   7. Overhead Stops/Holders: Glen Johnson, Rixon.
   8. Wall/Floor Stops/Flush Bolts: Ives, Rockwood, Glen Johnson.
   9. Kick Plates: Ives, Rockwood, Quality.
   10. Thresholds/Weatherstripping: National Guard, Zero, Pemko.
   11. Silencers: Ives, Rockwood, Quality, Glen Johnson.
   12. Push/Pulls: Quality, Rockwood.
   13. Key Cabinet: Lund, Key Control, Telkey.

2.2 HARDWARE FINISH

A. Hardware shall have the following finishes:
   1. Exterior Hinges: Stainless Steel (32D).
   2. Interior Hinges/Locks/Exit Devices/Overhead Holders: Satin Chrome (26D).
   3. Door Closers: Aluminum.
   4. Flat Goods: Stainless Steel (32D) or Satin Chrome (26D).
   5. Thresholds: Mill Finish Aluminum.

2.3 HINGES AND PIVOTS

A. Exterior butts shall be stainless steel (32D). Butts on all out-swinging doors shall be furnished with non-removable pins (NRP). Size: 4½" wide x 4½" high, for exterior doors up to 42" wide and heavy weight 4½" wide x 4½" high hinges for doors over 42" wide.
B. Interior butts shall be steel, standard weight 4½" wide x 4½" high hinges doors up to 42" wide and heavy weight 4½" wide x 4½" high hinges for doors over 42" wide.
C. Doors less than 5'-0" high shall have two (2) butts. Furnish one (1) additional butt for each 2'-6" of height or fraction thereof.

2.4 KEYING

A. Pre-Order Meeting: Hardware supplier shall meet with District's Maintenance Lock Dept. Representative to establish keying order before lock order is placed.
B. Locks shall be construction master keyed using split key method keyed to School District's restricted keyway.
C. Hardware supplier shall meet with District's Maintenance Lock Dept. Representative will establish final count of locks and cylinders, and transmit release order to Best Access Systems Lock Company for production in amounts established with Hardware Supplier.
D. Construction keys in following quantities:
   1. 12 master keys
E. Supply permanent keys in following quantities:
   1. Six keys for each lock with maximum of 12 keys of keyed alike sets.
   2. Five master keys for each building or area grouping. Key groups include:
      a. Auditorium/Multipurpose/Stage (including adjacent support spaces).
      b. Food Service (including Kitchen and adjacent support spaces).
      c. Media Center (including adjacent support spaces).
      d. Administrative Offices (including adjacent support spaces).
      e. Classrooms, Resource Rooms and Labs (including adjacent storage area) subdivided into subgroups by floor level or building(s).
      f. Mechanical/Electrical Rooms.
      g. Custodial/Receiving Areas.
   3. Grand master keys shall be supplied based on size of facility as follows:
      a. Five (5) Grandmaster keys for Elementary Schools and Ancillary Projects.
      b. Ten (10) Grandmaster Keys for Middle Schools.
      c. Twenty (20) Grandmaster keys for High Schools.
   4. Keys shall be stamped "DO NOT DUPLICATE".
F. Key Function

1. Supply locksets with following key functions:

	Location	Function
a.	Passage	N
b.	Privacy	L
c.	Classroom/Office	R
d.	Storage/Mechanical Rm	D
e.	Electronic Lever Lockset	DEL

2.5 KEY CABINETS

A. Key Cabinet: Lund 1203 with pin tumbler lock.
B. Cabinet Size: Size for project keys plus 10% spare capacity.
   1. Horizontal metal strips for key hook labeling with clear plastic strip cover over labels.
   2. Finish: Baked enamel finish, gray color.
C. Attach key legend in key cabinet with 5-way cross-reference system indicating keyset number, FISH Room number, key code number, hook number and key description.

2.6 KEY VAULT

A. Recessed Key Vault: Knox Company, Series 4400 Know-Vault, Model 4400-R.
B. Key Vault shall be keyed to Owner's key system and will be Owner provided.
C. Manufacturer: Knox Company. Key box shall meet criteria of fire department having jurisdiction at project location.

2.7 CLOSER/MAGNETIC HOLD OPEN SYSTEM

A. LCN, Series No: 4041.
B. Furnish closer/electromagnet compete with required accessories necessary for complete working system.
C. Furnish two-year warranty.

2.8 LOCKSETS

A. Lever Lock: Best Access Lock Company, heavy duty cylindrical type, Best 93K Series, Lever Design 15D.
B. Electronic Lever Lock: Best Access Lock Company, heavy duty cylindrical type, Best 93KW7DEU, Lever Design 15D.

2.9 EXIT DEVICES

A. Von Duprin 98 Series in types and functions listed.
B. Devices shall be listed under "Panic Hardware" in accident equipment list of Underwriter Laboratories. Fire ratings shall be attached where indicated per UL requirements.
C. Exit devices shall be tested per ANSI/BHMA A156.3 by BHMA certified testing laboratory. Provide written certification of 1,000,000 cycle testing per Section 01 33 00 – Submittals.

D. Supply locksets with following key functions:

Location	Function
1. Non Fire Rated	19R NLP, 19R DT, or 19R BE with 560 strike as required.
2. Fire Rated	F19R SE or F19R BE with 570 strike as required.
3. Non Fire Rated (Pairs)	19R NLP, 19R DT, or 19R BE with 570 strike as required.
4. Fire Rated (Pairs)	F19R SE or F19R BE with 570 strike and F4023 mullion as required.
5. Fire Rated (Electronic)	ELX98l-F X 992L X 06 X 26D.
6. Non-fire Rated (Electronic)	SD ELL X 98NL X 990NL X 06 X 26D.
7. Power Supply	PS873B X 4TD

E. Electrical Power Transfer: EPT-10 X SP28.
F. Surface strikes shall be roller type with plate underneath to prevent movement and dead-latching feature to prevent latchbolt tampering.

2.10 DOOR CLOSERS

A. Door closers shall be LCN 4040/4041 Series with non-ferrous covers, forged steel arms, separate valves for adjusting backcheck closing and latching cycles and adjustable spring to provide up to 50% increase in spring power.
B. Furnish closers with parallel arm mounted on door openings into egress spaces, mounted to permit 180 degree door swing where wall conditions permit, and have non-hold open arms unless otherwise noted.
C. Door closer cylinders shall be high strength cast iron construction.
D. Door closers shall be tested in accord with ANSI/BHMA A156.4 by BHMA certified testing laboratory and attest in writing that closers have successfully completed one million cycles.
E. Door closers shall utilize temperature stable fluid capable of withstanding temperature ranges of 120˚ F (49˚C) to -30˚F (-34˚C), without requiring seasonal adjustment of closer speed to properly close door.
F. Closers for fire rated doors shall be provided with temperature stabilizing fluid complying with UCB 7-2 (1997) and UL 10C.
G. Door closers shall incorporate tamper resistant non-critical screw valves of V-slot design to reduce clogging form particles within closer.
H. Closers shall have separate and independent screw valve adjustments for latch speed, general speed, and hydraulic backcheck.
I. Backcheck shall be located to effectively slow swing of door at minimum of 10 degrees in advance of dead stop location to protect door frame and hardware from damage.

2.11 DOOR TRIM

A. Push/pull plates, armor plates, and kick plates shall be .050 gage stainless steel with US32D finish.
B. Plates shall be two (2”) less than door width with beveled edges, sized as follows:
   1. Push and pull plates shall be 4" wide x 16" high mounted 42” from door bottom.
   2. Armor plates shall be 36” high less than door width mounted 2” from door bottom.
   3. Kick plates 10" high x 2" less than door width mounted 2” from door bottom.

2.12 DOORSTOPS

A. Doorstops shall be furnished for doors to prevent door and hardware damage. Wall bumpers are preferred. Provide floor stops where wall bumpers are not practical. Where neither wall nor floor stops are practical, use surface mounted overhead stops as follows:
   1. Wall Stops: Ives WS407CVX Series.
   2. Floor Stops: Ives FS436 or FS438.
   3. Overhead Stops: Glynn Johnson 450 Series (Interior) and 900 Series (Exterior).

2.13 THRESHOLDS, WEATHERSTRIPPING AND SEALS

A. Thresholds and weatherstripping shall be as listed in Hardware Schedule.

2.14 DOOR SILENCERS

A. Door Silencers: Ives SR64 Two (2) per door pair and three (3) per single door frame.

2.15 AUTOMATIC FLUSH BOLTS, SURFACE BOLTS AND COORDINATORS

A. Door Bolts:
   1. Manufacturer; H. B. Ives.
      a. Non Fire-rated: 454-f26D 8”.
      b. Fire-rated: 456-B26D.
   2. Manufacturer: Glynn Johnson:
      a. Non Fire-rated: 1631 or 1632.
      b. Fire-rated: FB7 or FB8.
   3. Manufacturer; DCI.
      a. Non Fire-rated: 1008-US26D.
      b. Fire-rated: 842-US26D.
B. Coordinators:
   1. Manufacturer: Monarch, B-1277 with B-1278 opening bar.
   2. Manufacturer: H. B. Ives, 469-B26D with 478 carry bar.
   3. Manufacturer: DCI, 500 with carry bar.

2.16 OVERHEAD RAIN DRIP

A. Rain Drip: Pemko 346PW at exterior HM Steel door locations or as scheduled herein.

PART 3 – EXECUTION

3.1 INSPECTION

A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.
B. Beginning of installation shall indicate installer’s acceptance of existing conditions.

3.2 INSTALLATION

A. Install hardware in accord with manufacturer's instructions and requirements of DHI.
B. Use templates provided by hardware item manufacturer.

C. Mounting heights for hardware from finished floor to center line of hardware item:
   1. Locksets: 38".
   2. Push/Pulls: 42".
   3. Dead Locks: 48".
   4. Exit Devices: 40".
D. Conform to of Florida Bldg. Code: Accessibility, 5th Edition.
E. Set door thresholds in full bed of butyl rubber.

3.3 ADJUST AND CLEAN

A. Adjust and check operation of each item of hardware and door, to ensure proper function of every item.
B. Replace items that cannot be adjusted to operate freely and smoothly.
C. Final adjustment shall be made after ventilating systems are in operation.
D. Clean hardware and adjacent surfaces after hardware installation.
E. Instruct Owner's personnel in adjustment and maintenance of hardware and hardware finishes.

3.4 PROTECTION

A. Protect installed hardware from damage.
B. Replace damaged hardware.

3.5 HARDWARE SCHEDULE

A. Attached Schedule is furnished for guidance in preparing Bidder's cost proposal and should not be considered as totally inclusive.
B. Bidders shall use drawings to prepare hardware quantities. Variations between this schedule and drawings shall be communicated to Architect for resolution.
C. Quantities listed are for each pair of doors or for each single door.
D. Hardware Schedule was prepared by:

Allegion, PLC
3451 Technological Ave, Suite 7
Orlando FL 32817
Ph: 407-571-2000
Fax 407-571-2006

E. Index of Manufacturers:
   1. Corbin/Russwin: NGP.
   2. Glynn-Johnson: BLY.
   3. Hager: HAG.
   4. Ives: IVE.
   5. LCN Closers: LCN.
   6. Best: BES.
   7. Von Durprin: VON.
   8. Pemko: PEM
   9. B/O: Supplied by other trades.
F. Hardware Group Schedules

3.6 SCHEDULE

HARDWARE GROUP NO. 01 - EXTERIOR STOREFRONT - PAIR - CARD ACCESS/AUTO OPERATOR

101 132.1

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	MORT CYLINDER	1E SERIES	626	BES
2	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES

ALL HARDWARE, INCLUDING AUTOMATIC OPEREATOR, BY STOREFRONT SUPPLIER
VERIFY CYLINDER REQUIREMENTS WITH STOREFRONT SUPPLIER
CARD READER, POWER SUPPLY AND ALL ACCESS CONTROL ACCESSORIES BY DIV. 28 SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 02 - EXTERIOR STOREFRONT - SGL - CARD ACCESS

132.2

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	MORT CYLINDER	1E SERIES	626	BES
1	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES

ALL HARDWARE BY STOREFRONT SUPPLIER
VERIFY CYLINDER REQUIREMENTS WITH STOREFRONT SUPPLIER
CARD READER, POWER SUPPLY AND ALL ACCESS CONTROL ACCESSORIES BY DIV. 28 SYSTEMS INTEGRATOR

HARDWARE GROUP NO. 03 - EXTERIOR - SGL EXIT

119 125.2 131.2

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	HH-9975-L-NL-06-SNB	626	VON
1	EA	MORT CYLINDER	1E SERIES	626	BES
1	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	11A	A	ZER
1	SET	GASKETING	139A-S	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	328AA	AA	ZER
1	EA	GASKETING	475AA	AA	ZER
1	EA	DOOR BOTTOM	FAS-SEAL		STE
1	EA	THRESHOLD	566A-223	A	ZER

NOA 20-0310.08 BASIS OF DESIGN

HARDWARE GROUP NO. 04 - EXTERIOR - SGL
115
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	9K3-7 D 15D WS S3	626	BES
1	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	11A	A	ZER
1	SET	GASKETING	139A-S	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	328AA	AA	ZER
1	EA	GASKETING	475AA	AA	ZER
1	EA	DOOR BOTTOM	FAS-SEAL		STE
1	EA	THRESHOLD	566A-223	A	ZER

NOA 20-0310.08 BASIS OF DESIGN

HARDWARE GROUP NO. 05 - INTERIOR STOREFRONT - PAIR
125.1
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	MORT CYLINDER	1E SERIES	626	BES
2	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES

ALL HARDWARE BY STOREFRONT SUPPLIER
VERIFY CYLINDER REQUIREMENTS WITH STOREFRONT SUPPLIER

HARDWARE GROUP NO. 06 - INTERIOR STOREFRONT - SGL
131.1
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	MORT CYLINDER	1E SERIES	626	BES
1	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES

ALL HARDWARE BY STOREFRONT SUPPLIER
VERIFY CYLINDER REQUIREMENTS WITH STOREFRONT SUPPLIER

HARDWARE GROUP NO. 07 - INTERIOR PAIR - EXIT -RATED
117 133.1
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB	689	VON
2	EA	FIRE EXIT HARDWARE	98-L-F-06-SNB	626	VON
2	EA	RIM CYLINDER	12E SERIES	626	BES
1	EA	MORT CYLINDER	1E SERIES	626	BES
3	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES
2	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
2	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 08 - INTERIOR PAIR - EXIT - ELEC ROOM
120
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	RX-98-EO-264-CON	626	VON
1	EA	ELEC PANIC HARDWARE	RX-98-L-M996-06-FSE-CON-SNB	626	VON
1	EA	RIM CYLINDER	12E SERIES	626	BES
1	EA	MORT CYLINDER	1E SERIES	626	BES
2	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES
2	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	GASKETING	488SBK PSA	BK	ZER
2	EA	DOOR CONTACT	679-05HM	BLK	SCE

CARD READER, POWER SUPPLY AND ALL ACCESS CONTROL ACCESSORIES BY DIV. 28 SYSTEMS INTEGRATOR
WIRING DIAGRAM BY HARDWARE SUPPLIER

HARDWARE GROUP NO. 09 - INTERIOR PAIR - RECORDS
141.2
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	SET	AUTO FLUSH BOLT	FB41P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	ELEC CYLINDRICAL LOCK	9K3-7 D-EU 15D S3	626	BES
1	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES
1	EA	COORDINATOR	COR X FL	US28	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
2	EA	SILENCER	SR64	GRY	IVE
2	EA	DOOR CONTACT	679-05WD	BLK	SCE

ASTRAGAL BY DOOR SUPPLIER
CARD READER, POWER SUPPLY AND ALL ACCESS CONTROL ACCESSORIES BY DIV. 28 SYSTEMS INTEGRATOR
WIRING DIAGRAM BY HARDWARE SUPPLIER

HARDWARE GROUP NO. 10 - INTERIOR -SGL - RATED EXIT - CARD ACCESS
143
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-98-L-F-M996-06-FSE-CON-SNB	626	VON
1	EA	RIM CYLINDER	12E SERIES	626	BES
1	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	SILENCER	SR64	GRY	IVE
1	EA	DOOR CONTACT	679-05HM	BLK	SCE

CARD READER, POWER SUPPLY AND ALL ACCESS CONTROL ACCESSORIES BY DIV. 28 SYSTEMS INTEGRATOR
WIRING DIAGRAM BY HARDWARE SUPPLIER

HARDWARE GROUP NO. 11 - INTERIOR SGL - RATED - CARD ACCESS

133.2

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC CYLINDRICAL LOCK	9K3-7 D-EU 15D S3	626	BES
1	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR CONTACT	679-05HM	BLK	SCE

CARD READER, POWER SUPPLY AND ALL ACCESS CONTROL ACCESSORIES BY DIV. 28 SYSTEMS INTEGRATOR

WIRING DIAGRAM BY HARDWARE SUPPLIER

HARDWARE GROUP NO. 12 - INTERIOR SGL - CARD ACCESS

103	107.1	107.2	116	122	126
136	141.1	142			

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC CYLINDRICAL LOCK	9K3-7 D-EU 15D S3	626	BES
1	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	SILENCER	SR64	GRY	IVE
1	EA	DOOR CONTACT	679-05HM	BLK	SCE

CARD READER, POWER SUPPLY AND ALL ACCESS CONTROL ACCESSORIES BY DIV. 28 SYSTEMS INTEGRATOR

WIRING DIAGRAM BY HARDWARE SUPPLIER

HARDWARE GROUP NO. 13 - INTERIOR SGL - JANITOR

134

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	9K3-7 D 15D S3	626	BES
1	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 14 - INTERIOR SGL - OFFICE

110 111 112 113 114 137
138 139 140

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE LOCK	9K3-7 AB 15D S3	626	BES
1	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 15 - INTERIOR SGL - OPEN WORK

108

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	9K3-7 R 15D S3	626	BES
1	EA	IC CORE	1C-7 PIN - VERFY KEYWAY W/OWNER	626	BES
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 16 - INTERIOR SGL - RATED RESTROOM
135
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	9K3-0 L 15D S3	626	BES
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 17 - INTERIOR SGL - RESTROOM
104 109 128 129
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	9K3-0 L 15D S3	626	BES
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 18 - INTERIOR SGL - MULTI GANG RESTROOM
105 106
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8305 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 19 - INTERIOR SGL - DIAS
118
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	PIVOT SET	7255 SET	626	IVE
1	EA	ROLLER LATCH	RL1152	626	IVE
1	EA	PUSH PLATE	8200 3" X 12"	630	IVE
1	EA	LONG DOOR PULL	9266F 18" I	630-316	IVE
1	EA	CONCEALED CLOSER	6033 BUMP WMS	689	LCN

HARDWARE IS FOR BASIS OF DESIGN ONLY. FINAL HARDWARE SELECTION WILL NEED TO BE COORDINATED WITH THE MILLWORK SUPPLIER ONCE THE FINAL DOOR/WALL DESIGN IS ESTABLISHED

HARDWARE GROUP NO. 20 - SLIDING DOORS
123 124
Provide each SL door(s) with the following:
QTY DESCRIPTION CATALOG NUMBER FINISH MFR
ALL HARDWARE BY DOOR SUPPLIER

3.7 DOOR INDEX

Door Numbers	HwSet#
101	01
103	12
104	17
105	18
106	18
107.1	12
107.2	12
108	15
109	17
110	14
111	14
112	14
113	14
114	14
115	04
116	12
117	07
118	19
119	03
120	08
122	12
123	20
124	20
125.1	05
125.2	03
126	12
128	17
129	17
131.1	06
131.2	03
132.1	01
132.2	02
133.1	07
133.2	11
134	13

Door Numbers	HwSet#
135	16
136	12
137	14
138	14
139	14
140	14
141.1	12
141.2	09
142	12
143	10

END OF SECTION

SECTION 08 80 00 – GLAZING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
    a. Glazing for:
        i. Window units
        ii. Storefront systems
        iii. Curtain wall systems
        iv. Doors vision lites
        v. Interior borrowed lites
        vi. Fire-resistive lites
        vii. Spandrel glazing
        viii. Interior laminated safety glazing
        ix. Interior security glazing
        x. Acoustical glazing
        xi. Laminated acoustical safety glazing
        xii. Glass film
        xiii. Wall mirrors
        xiv. Composite closure panel
        xv. Glass Speaker Vent

1.3 REFERENCES

A. ASCE-7 – Minimum Design Loads for Buildings and other Structures.
B. ANSI Z97.1 – Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
C. ASTM C864 – Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
D. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
E. ASTM C1036 – Standard Specification for Flat Glass.
F. ASTM C1048 – Standard Specification for Heat Strengthened and fully Tempered Flat Glass.
G. ASTM C1172 – Standard Specification for Laminated Architectural Safety Glass.
H. ASTM C1349 – Standard Specification for Architectural Flat Glass Clad Polycarbonate.
I. ASTM C1376 – Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.

J. ASTM C 1503 – Standard Specification for Silvered Flat Glass Mirror.
K. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
L. ASTM E152 – Methods for Fire Test of Door Assemblies.
M. ASTM E163 – Methods for fire Test of Window Assemblies.
N. ASTM E283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen.
O. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
P. ASTM E1996 – Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
Q. ASTM E2025 – Standard Test Method for Evaluating Fenestration Components and Assemblies for Resistance to Impact Energies.
R. CPSC 16 CFR 1201 Safety Standards for Architectural Glazing Materials.
S. GANA – Glazing Manual.
T. GANA – Laminated Glazing Reference Manual.
U. FGMA – Sealant Manual.
V. NFPA 80 – Standard for Fire Doors and Fire Windows.
W. NFPA 252 – Standard Methods of Fire Test of Doors Assemblies.
X. NFPA 257 – Standards on Fire Test of Window and Glass Block Assemblies.
Y. LSGA – LSGA Design Guide."
Z. SIGMA – TM-3000 "Vertical Glazing Guidelines" and TB-3001 "Sloped Glazing Guidelines."
AA. SGCC – Safety Glazing Certification Council.
BB. FBC – Florida Building Code.

1.4 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's directions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated glass standard.

1.5 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Shop Drawings: Glazing Schedule of all openings indicating glass type, thickness, opening size and location. Schedule shall be submitted with shop drawings.

C. Glass Samples: For each type of glass product in a 12 inches square sample.

D. Glazing Accessory Samples: For sealants, in 12-inch lengths.

E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on drawings.

F. Approval: Manufacturer shall submit documentation that product complies with and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements and submit documentation.

1.6 INFORMATION SUBMITTALS

A. Qualification Data: For installers, manufacturers of laminated, insulating-glass units, low-e coatings, glass testing agency and sealant testing agency.

B. Product Certificates: For glass and glazing products, from manufacturer.

C. Product Test Reports: For glass and each type of glazing sealant and gasket indicated, evidencing compliance with requirements specified.

D. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

E. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.

F. Compatibility Test Report: From manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.

G. Draft Warranties.

1.7 PRE-INSTALLATION CONFERENCE

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.8 QUALITY ASSURANCE

A. Comply with applicable codes and regulations and with the Consumer Product Safety Commission CPSC 16 CFR 1201 and with applicable recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual."

B. Manufacturer Qualifications: Provide products from only manufacturers with at least five (5) years experience making the specified materials as a current catalog and regular production item.

C. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program. Employ only experienced Contractors (installers) skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five (5) years.

D. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

E. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
5. GANA Publications: "Laminated Glazing Reference Manual," and "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
    a. Provide labels showing glass manufacturer's identity, type of glass, thickness, and quality. Labels shall remain on glass until it has been set.

G. All clear tempered safety glass must have permanently affixed labels for verification.

H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, quality, and safety glazing standard with which glass complies.

1. Safety glass mirrors must have permanently affixed labels for verification.

I. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.

1. All fire rated glazing must have permanently affixed labels for verification.

J. Laminated-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1. Comply with applicable codes and regulations and with the Consumer Product Safety Commission CPSC 16 CFR 1201 and with applicable recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual."

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver glass to site in suitable containers that will protect glass from the weather and from breakage. Carefully store material, as directed, in a safe place where breakage can be reduced to a minimum. Deliver sufficient glass to allow for normal breakage. Glazing compounds shall arrive at the project site in labeled containers which have not been opened.

B. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

C. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

D. Protect glass edges from damage during handling and installation. Damaged glass is defined as glass with edge damage or other imperfections that could weaken the glass and impair performance and/or appearance if installed. Remove damaged glass and legally dispose of offsite.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.12 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: Five (5) years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: Five (5) years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

D. Manufacturer's Fire Glass Warranty: Submit manufacturer’s standard warranty but not less than five (5) years from Date of Substantial Completion.

E. Manufacturer's Mirror Warranty: Submit a written warranty executed by mirror manufacturer, agreeing to replace any mirrors that develop visible silver spoilage defects within a fifteen (15) year period of time.

1.13 PERFORMANCE REQUIREMENTS

A. General: Installed exterior glazing systems shall withstand thermal movement and wind and impact loads in compliance product approval without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. General: Installed interior glazing systems shall withstand manufacturers design parameters for thermal movement and impact loads without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain airtight; deterioration of glazing materials; or other defects in construction.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Glass Design: Glass thicknesses indicated on Drawings are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:

F. Minimum glass thickness, nominally, of lites in exterior walls is 6.0 mm (0.23 inch).

G. Tinted and heat-absorbing glass thicknesses for each tint indicated are the same throughout Project.

H. Minimum glass thicknesses of lites, whether composed of annealed or heat-treated glass, are selected so the worst-case probability of failure does not exceed the following:

1. 8 lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action. Determine minimum thickness of monolithic annealed glass according to ASTM E 1300. For other than monolithic annealed glass, determine thickness per glass manufacturer's standard method of analysis including applying adjustment factors to ASTM E 1300 based on type of glass.
2. 1 lite per 1000 for lites set over 15 degrees off vertical and under action of wind.

I. Specific hazardous locations: The following shall be considered specific hazardous locations for purposes of glazing.

1. Glazing in ingress and means of egress doors.
2. Glazing adjacent to a door and within the same wall plane as the door whose nearest vertical edge is within 24 inches of the door in a closed position and whose bottom edge is less than 60 inches above the floor or walking surface unless an intervening interior permanent wall is between the door and the glazing.
3. Glazing in fixed panels having a glazed area in excess of 9 square feet with the lowest edge less than 18 inches above the finish floor level or walking surface within 36 inches of such glazing, unless a horizontal member not less than 1-1/2 inches in width is located between 24 inches and 36 inches above the walking surface.

J. Impact Safety Rating: As required for the assembly in which glazing material is installed.

1. Glazing products that comply with Category I or II materials, except for hazardous and safety locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
2. Glazing products shall be permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.

K. Approvals: Manufacturer shall certify that product complies with and has been tested and approved for compliance with Miami Dade NOA or Florida Product Approval and applicable requirements.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer shall be the following in each category however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

B. Primary Glass: Provide products from one of the following:

1. Vitro Architectural Glass (Formally PPG)
2. Guardian
3. OldCastle
4. Pilkington
5. AFGD (American Flat Glass Distributors)

C. Architectural Glass Fabricators: Provide products from one of the following:

1. All of the above primary glass manufacturers.
2. Globe-Amerada Glass
3. Interpane High-Performance Glass Products
4. Tempglass
5. Viracon
6. Laminated Glass Corporation
7. Arch Amarlite

D. Plastic Interlayer Manufacturers, provide products from one of the following:

1. DuPont, Wilmington, Delaware
2. Saflex, St. Louis, Missouri

E. Fire Rated Glass:

1. SAFTI FIRST
2. Oldcastle Glass
3. Nippon Electric Glass Co., Ltd., distributed by Technical Glass Products.

F. Mirrors:

1. Arch Aluminum & Glass Co., Inc.
2. Gilded Mirrors, Inc.
3. National Glass Industries
4. Gardner Glass, Inc.

5. Guardian Industries

G. Glass Film

1. Decorative Films, LLC
2. Solex
3. Artscape

2.2 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

E. Pyrolytic-Coated, Low-Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.

F. Refer to requirements for glass units for performance characteristics of assembled units composed of tinted glass, uncoated, relative to visible light transmittance, U-values, shading coefficient, and visible reflectance.

2.3 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with product approval requirements.
3. Interlayer Color: Clear unless otherwise indicated.
4. All laminated architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.
5. Laminated Glass products to be fabricated free of foreign substances and air or glass pockets in autoclave with heat plus pressure.

B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with the following to comply with interlayer manufacturer's written instructions:

1. Polyvinyl butyral interlayer

2.4 INTERIOR LAMINATED SAFETY GLASS

A. Laminated Safety Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. All laminated architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.
3. Laminated Glass products to be fabricated free of foreign substances and air or glass pockets in autoclave with heat plus pressure
4. Laminated Safety 1/4" Thick Glass
   a. Glass Ply 1: 1/8" Clear FT
   b. Interlayer: 0.030” PVB
   c. Glass Ply 2: 1/8" Clear FT
5. Laminated Safety 1/2" Thick Glass
   a. Glass Ply 1: 1/4" Clear FT
   b. Interlayer: 0.030” PVB
   c. Glass Ply 2: 1/4" Clear FT

2.5 INTERIOR LAMINATED SECURITY GLASS

A. Laminated Security Glass: UL 972. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Laminated Glass products to be fabricated free of foreign substances and air or glass pockets in autoclave with heat plus pressure.
3. Laminated Security 7/16” Thick Glass:
   a. Glass Ply 1: 1/4" Clear FT
   b. Silicone and PIB: Black
   c. Interlayer: 0.090" Clear Sentry Glass Interply by Kuraray
   d. Glass Ply 2: 3/16" Clear HS

2.6 GLASS FILM

A. Decorative Film (DF1)

1. Basis of Design: “Solyx – SXJ–0545 Beach Grass Gradient” as manufactured by Decorative Films.
2. Height: 71"

B. Decorative Film (DF2)

1. Basis of Design: "Solyx – Transparent Color Film" as manufactured by Decorative Films.
2. Colors: To be selected by Architect from manufacturer's full range of polyester and vinyl colors.

C. Decorative Film (DF3)

1. Basis of Design: "Solyx – Color Sand Blast Film" as manufactured by Decorative Films.
2. Colors: To be selected by the Architect.

D. Decorative Film (DF4)

1. Film: "Privacy Series Window Film" as manufactured by 3M. Final selection will be by Architect.
   a. Visible Light Transmitted: 7%
   b. Visible Light Reflected – Interior: 64%
   c. Visible Light Reflected – Exterior: 18%
   d. Haze: N/A
   e. Thickness: 2 mil
   f. Silver reflective front, black non-reflective back.

2.7 WALL MIRRORS

A. Safety Glass Mirrors: Provide 1/4" thick annealed float glass mirrors with manufacturer applied safety backing applied to the back surface and complying with FS DD-G-1403, ANSI Z97.1-1984 CPSC16 CFR 1201 Category II.

B. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

C. Trim: As manufactured by Schluter Systems L.P. Provide brushed stainless steel trim "Quadec" No. Q150EB at top, sides and bottoms of mirrored wall.

1. Trim Adhesive: Trim manufacturers "Kerdi-Fix" adhesive.

D. Edge: Polished with edge sealer.

E. Mirror Glass Production and Fabrication

1. Glass Coating: Coat second surface of glass, unless otherwise indicated, with glass coating system complying with FS DD-M-00411 requirements and consisting of successive layers of chemically deposited silver, electrically or chemically deposited copper, and manufacturer's standard protective organic coating.

2.8 EXTERIOR GLASS TYPES

A. Glazing level

1. Level D: Unless indicated otherwise

B. Insulated Tinted Laminated Low E Coated Impact Resistant Glass for All Exterior Glazing unless noted otherwise,

1. Insulating Tinted Laminated Low E Coated Impact Resistant Glass
2. 1 5/16” VE3-2M insulating laminated coated glass
   a. Exterior Glass Ply: 1/4" Gray FT (Final tint color as selected by the Architect)
   b. Coating: Viracon VE-2M Low E on #2 surface
   c. Airspace: 1/2" airspace black finish
   d. Silicone and PIB: Black
   e. Interior Glass Ply 1: 1/4" Clear HS
   f. Interlayer: 0.090” Clear PVB or type of a kind and thickness as tested in a combined assembly NOA or Florida Product Approval. .180” Kuraray SentryGlas for Level E
   g. Interior Glass Ply 2: 1/4" Clear HS
3. Performance Requirements
   a. Visible Light Transmittance 33%
   b. Exterior (Vis-Out) Reflectance 6%
   c. Interior (Vis-In) Reflectance 9%
   d. Winter U-Value 0.29
   e. Summer U-Value 0.26
   f. Solar Heat Gain Coefficient 0.24
   g. Light to Solar Gain Ratio 1.38

C. Insulated Tinted Laminated Low E Coated Impact Resistant Glass for All Exterior Storefront Doors, Exterior Door Lites and Side Lites,

1. Insulating Tinted Laminated Low E Coated Hurricane Resistant Glass
2. 1" VE3-2M insulating laminated coated glass
   a. Exterior Glass Ply: 1/4" Tinted FT (Gray) – Final tint color as selected by the Architect.
   b. Coating: Viracon VE-2M Low E on #2 surface
   c. Airspace: 5/16" airspace black finish
   d. Silicone and PIB: Black
   e. Interior Glass Ply 1: 3/16" Clear HS
   f. Interlayer: 0.090" Clear PVB or type of a kind and thickness as tested in a combined assembly NOA or Florida Product Approval. 180” Kuraray SentryGlas for Level E
   g. Interior Glass Ply 2: 3/16" Clear HS
3. Performance Requirements
   a. Visible Light Transmittance 34%
   b. Exterior (Vis-Out) Reflectance 6%
   c. Interior (Vis-In) Reflectance 9%
   d. Winter U-Value 0.37
   e. Summer U-Value 0.38
   f. Solar Heat Gain Coefficient 0.25
   g. Light to Solar Gain Ratio 1.36

2.9 INTERIOR GLASS TYPES

A. Glass for Interior Non-Rated Doors, Sidelights, Transoms, Storefronts, and Windows: 1/4-inch thick clear tempered glass.

B. Glass for Interior Non-Rated Doors and Windows with Film: 1/4-inch thick clear tempered glass with film.

1. DF1: Decorative film
2. Locations: See drawings

C. Frosted glass for Interior Non-Rated Doors, Sidelights, Transoms, Storefronts, and Windows: 1/4-inch thick frosted clear tempered glass where indicted.

D. Glass for Interior Fire Rated Doors and Windows: Fire rated glazing to comply with rating requirements.

E. Large Mirrors: Where indicated on drawings.

F. Glass for interior laminated safety glass locations.

G. Glass for interior laminated security locations.

H. Glass for one-way glass locations.

2.10 FIRE-RESISTIVE GLAZING PRODUCTS

A. Fire-resistive glazing products with an exposed surface film are not acceptable.

B. Fire-Protection Rating: As required for the assembly in which glazing material is installed.

1. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
2. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

C. Impact Safety Rating: As required for the assembly in which glazing material is installed.

1. Glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
2. Glazing products shall be permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.

D. Temperature-Rise Rating: As required for the assembly in which glazing material is installed.

1. In exit enclosures, building codes usually require that fire-rated door assemblies have labels denoting the fire-protection rating, showing the time period and the maximum allowed temperature-rise limit of 450 deg F on the unexposed face of the door after 30 minutes of fire exposure.
2. When used in glazed walls, provide glazing that has a maximum transmitted temperature end point of not more than 450 deg F above ambient during standard fire-test exposure.

E. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

F. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

G. Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, clear tempered float glass; with intumescent interlayers; complying with testing requirements in 16 CFR 1201 for Category I materials for glass areas 9 SF or less and Category II for glass area over 9 SF.

1. Basis-of-Design: “Superlite ll-XL” as manufactured by SAFTI FIRST
   a. Interior: “SuperLite II-XL” as manufactured by SAFTI FIRST
   b. Exterior: “SuperLite II-XL-90” as manufactured by SAFTI FIRST
      i. Custom frame required with approved design provided by door manufacturer.
2. Products: Subject to compliance with requirements, provide one of the following:
   a. InterEdge, Inc., a subsidiary of AFG Industries, Inc.; Pyrobel.
   b. Pilkington Group Limited (distributed by Technical Glass Products); PyroStop.
   c. SAFTI FIRST, a division of O’Keeffe’s, Inc.
   d. Vetrotech Saint-Gobain; SGG Contraflam N2 or SGG Swissflam N2.
3. Rating: As indicated on the drawings and as required to comply with wall and door ratings.
4. Wire glazing is not permitted.

2.11 ACCESSORIES

A. Glass Speaker Vent

1. Basis of Design: “No draft speak thru vent - #834A” as manufactured by C.R. Laurence.
2. Satin anodized aluminum, 5 5/16” diameter.
3. Location as indicated on the drawings.

2.12 ELASTOMERIC GLAZING SEALANTS

A. General: Provide materials as recommended by the manufacturer for the required application and condition of installation in each case. Provide only compounds which are proven to be fully compatible with surfaces contacted.

B. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.13 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; non-staining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Glazing Sealant for Fire-Resistant Glazing Products: Identical to product used in test assembly to obtain fire-resistive rating.

2.14 GLAZING GASKETS

A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C542, black.

B. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C864.
2. EPDM, ASTM C864.
3. Silicone, ASTM C1115.
4. Thermoplastic polyolefin rubber, ASTM C1115.

2.15 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).

F. Compressible Filler Rod: Shall be closed-cell or waterproof jacketed rodstock of synthetic rubber or plastic foam with proven compatibility with sealants used. Rod shall be flexible and resilient with 5-10 PSI compression strength for 25 percent deflection.

2.16 FABRICATION OF GLASS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

B. Clean cut or flat grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

C. Grind smooth and polish exposed glass edges and corners.

2.17 ENVIRONMENTAL

A. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.

1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 100 > g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.

PART 3 – EXECUTION

3.1 STANDARDS AND PERFORMANCE

A. Watertight and airtight installation of each piece of glass required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors) without failure, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and air tight, deterioration of glazing materials, and other defects in the Work.

B. Protect glass from edge damage at all times during handling, installation, and operation of the building.

C. Glazing channel dimensions as shown are intended to provide for necessary minimum bite on the glass, minimum edge clearance, and adequate sealant thicknesses with reasonable tolerances. The glazier is responsible for correct glass size for each opening within the tolerances and necessary dimensions established.

D. Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing and their technical representatives except where more stringent requirements are shown or specified.

E. Comply with "Glazing Manual" by Flat Glass Marketing Association and the manufacturers of the glass and glazing materials except as shown and specified otherwise.

F. Inspect each piece of glass immediately before installation and eliminate those which have observable edge damage or face imperfections.

G. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw, and blow oriented in the same direction as other pieces.

3.2 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.4 GLAZING, GENERAL

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass from edge damage during handling and installation as follows:

1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
2. Remove damaged glass from Project site and legally dispose of offsite. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

D. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:

1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

J. Square cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Secure compression gaskets in place with joints located at corners to compress gaskets producing a weather tight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

C. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel weep systems until sealants cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's printed recommendations. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 MIRROR INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Aluminum J-Channels and Cleat: Fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
2. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.

3.9 PROTECTION AND CLEANING

A. Protect glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both faces in each area of Project not more than four (4) days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 08 80 00

SECTION 09 24 00 – CEMENT PLASTERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Exterior portland cement plasterwork.

1.3 REFERENCES

A. ASTM C91 – Standard Specification for Masonry Cement.
B. ASTM C150 – Standard Specification for Portland Cement.
C. ASTM C206 – Standard Specification for Finishing Hydrated Lime.
D. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes.
E. ASTM C473 – Standard Test Methods for Physical Testing of Gypsum Panel Products.
F. ASTM C847 – Standard Specification for Metal Lath.
G. ASTM C897 – Standard Specification for Aggregate for Job Mixed Portland Cement-Based Plasters.
H. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
I. ASTM C926 – Standard Specification for Application of Portland Cement Based Plaster.
J. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
K. ASTM C1177 – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
L. ASTM E72 – Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
M. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
N. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.
O. PCA (Portland Cement Association) – Plaster (Stucco) Manual.
P. GA-600 – Fire Resistance Design Manual.
Q. ML/SFA (Metal Lath / Steel Framing Association)–Specifications for Metal Lathing and Furring.
R. ASCE 7 – Minimum Design Loads for Buildings and other Structures.
S. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated submit copies of manufacturer' product specifications and installation instructions and other data as may be required to show compliance with these specifications.

B. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

C. Samples: For each type of finish coat indicated; 12 by 12 inches (305 by 305 mm), and prepared on rigid backing.

1.5 QUALITY ASSURANCE

A. Cement Plaster: Perform work in accordance with ASTM C926.

B. Allowable Tolerances: For flat surfaces, do not exceed 1/8" to 10'-0" for bow, warp, plumb, or level.

C. Applicator shall show proof of specializing in lath and plaster work for a minimum of five (5) years.

1.6 MOCKUP

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

B. Build mockups for each substrate and finish texture indicated for cement plastering, including accessories.

C. Size: 100 sq. ft. in surface area.

D. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

E. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRE-INSTALLATION MEETINGS

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

B. Installation of rusted furring members is not acceptable.

1.9 FIELD CONDITIONS

A. Maintain room temperatures at greater than 40 deg F for at least 48 hours before plaster application, and continuously during and after application.

B. Avoid conditions that result in plaster drying out during curing period. Distribute heat evenly; prevent concentrated or uneven heat on plaster.

C. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

1.10 PERFORMANCE

A. Fabricate vertical elements to limit finish surface to 1/240 deflection under lateral point load of 100 lbs.

B. Fabricate horizontal elements to limit finish surface to 1/240 deflection under superimposed dead loads and wind uplift loads.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer shall be one of the following and as indicated however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. ClarkDietrich Building Systems
2. Nile Building Products Co.
3. MarinoWare
4. Amico, A Gibraltar Industries Co.
5. Alabama Metal Industries
6. Steel Network, Inc.
7. MBA Building Supplies

2.2 PLASTER MATERIALS

A. Portland Cement: ASTM C 150, Type I.

B. Lime: ASTM C 207, Type S.

C. Perlite Aggregate: ASTM C 35.

D. Aggregate: Natural or manufactured sand, complying with ASTM C926.

E. Ready-Mixed Plaster: Mill-mixed portland cement, aggregates, and proprietary ingredients.

F. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, and proprietary ingredients, with integral color pigment.

1. Color as selected by the Architect.

2.3 TRIM ACCESSORIES

A. General: Comply with ASTM C 1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:

1. Material: Formed steel sheet 26-gauge zinc or hot-dip or electrolytic process zinc coated steel sheet coated 26-gauge minimum.
2. External- (Outside-) Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized-zinc coating.
3. Material: Extruded aluminum 0.40 mils minimum in mill finish
4. Cornerbeads: Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
5. Casing Beads: Square-edged style; with expanded flanges.
6. Control Joints: One-piece-type, pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
7. Weep Screed: One-piece weep screed with 3-1/2" mounting flange with “V” shaped bottom element with drainage holes.
8. Perimeter Soffit Vent: 3” wide continuous by depth to match soffit material depth with one up leg and one down leg for perimeter mounting where indicated. Item number WPM-75-V-300.
9. Manufacturers are as indicated however equal or better performing products of other manufacturers will be considered for acceptance by the Architect.
    a. Clark Dietrich Building Systems
    b. MarinoWare
    c. Amico, A Gibraltar Industries Co.
    d. Alabama Metal Industries
    e. Fry Reglet Corporation

2.4 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in portland cement plaster.

C. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.

D. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter unless otherwise indicated.

E. Underlayment: Glass-reinforced 15# asphaltic impregnated felt complying with ASTM D6757.

2.5 LATHING MATERIALS

A. General: Lath shall be manufactured to meet ASTM C847 with ASTM A653/A653M, G60 hot-dip galvanized zinc coating.

B. Diamond-Mesh Lath: Self-furring diamond mesh with dimples or raised ribs, G-60 zinc galvanized and weighing not less than 3.4 pounds per sq. yd.

C. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.

D. Glass Fiber Mesh: Shall be Type 207A, Perma Tite glass mesh 10 by 10 construction, white resin coated, conforming to ASTM D1668, Type III, self-adhering. Acceptable manufacturer: Perma Glass Mesh Corporation, Dover, Ohio.

E. Corner Mesh: Formed sheet steel; minimum 26-ga thick; expanded flanges shaped to permit complete embedding in plaster; minimum 4" size.

F. Strip Mesh: Expanded metal lath, minimum 26-ga thick 4" wide x 24" long.

2.6 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.

B. Basis of Design: “Master Builders (BASF)”

C. The following manufacturer’s subject to compliance with requirements are accepted and equal or better performing products of other manufacturers will be considered for acceptance by the Architect.

1. Quickrete Company
2. Titan Florida LCC

D. Exterior Cement Plaster for Use over Metal Lath:

1. Scratch Coat: Pre-blended mixture of portland cement, reinforcing fibers and manufacturers additional ingredients “Stucco Base”.
2. Brown Coat: Pre-blended mixture of portland cement, reinforcing fibers and manufacturers additional ingredients “Stucco Base”.
3. Finish Coat: Waterproofing cement based coating “MasterSeal - Waterproof Cement Based Coating #584”.
4. Admixture: Water based acrylic bonding and modifying admixture which shall be added to all coats “Acryl 60”.
5. Total vertical system thickness: 7/8”
6. Total horizontal system thickness: 3/4"

E. Exterior Cement Plaster for Use over Masonry and Concrete:

1. First Coat: Waterproofing cement based coating “MasterSeal - Waterproof Cement Based Coating #584”.
2. Finish Coat: Pre-blended mixture of portland cement, reinforcing fibers and manufacturers additional ingredients “Stucco Base.”
3. Admixture: Water based acrylic bonding and modifying admixture which shall be added to all coats “Acryl 60”.
4. Total system thickness: 5/8”

2.7 FINISHES

A. Framing Materials:

1. Galvanized to G40 for interior materials.
2. Galvanized to G60 for exterior materials.
3. Galvanized to G60 for materials in contact with other materials.

B. Hangers, Anchors, and Fastening Devices:

1. Galvanized to G40 for interior materials.
2. Galvanized to G60 for exterior materials.
3. Galvanized to G60 for materials in contact with other materials.

C. Stucco: Smooth finish.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Before plaster is applied, the surfaces to be plastered shall be carefully examined by the subcontractor. The Architect and General Contractor shall be notified of unsatisfactory surfaces or conditions. Application of stucco shall not proceed until unsatisfactory conditions have been corrected.

1. Concrete: Verify joints are cut flush and surface is ready to receive Work. Verify no bituminous, water repellent coatings, or form release agents are on concrete surfaces to receive stucco finish.
2. Concealed Supports, Blocking: Verify items have been installed in proper locations.
3. Mechanical and Electrical: Verify services within walls and soffits have been installed, tested, and approved.

D. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

C. Protect surfaces near stucco application from damage or disfiguration. Clean concrete surfaces of foreign matter. Thoroughly dampen surfaces before using acid solutions, solvent, or detergents to perform cleaning. Wash surfaces with clean water. Do not apply stucco until electrician has protected all boxes. Cover openings in wall, column, and soffit with wire lath prior to stuccoing. Secure covering for openings greater than 16 inches in their least dimension to properly anchored channels or other support. Conceal all piping, conduit, etc. which cannot be concealed in walls, columns or soffits with wire lath and stucco. Verify all surfaces to receive stucco are true and plumb. Chip back concrete as required and replace masonry where necessary to avoid thickness greater than indicated for finished systems. Patch all masonry joints and honeycombing in cast-in-place concrete to provide flush, true surfaces to receive stucco. Pressure clean all surfaces with pressurized water with machine providing a minimum of 3,500 p.s.i. with a turbo-nozzle capable of developing sufficient force to remove all foreign matter from masonry surfaces. Abrade all cast-in-place concrete surfaces to receive stucco to promote mechanical bond. On exterior masonry and concrete surfaces install temporary grounds and screeds as necessary to strike off stucco to true surfaces. No permanent corner beads, fabricated control joints, grounds or screeds shall be used on exterior masonry and poured concrete surfaces. On wire lath and interior applications, install corner beads, control joints, expansion joints and accessories indicated on drawings true and plumb using maximum lengths available. Anchor securely to substrate. Do not shim or bridge areas that are not plumb, true or straight.

D. Exterior Surfaces

1. Dampen exterior surfaces prior to the application of plaster and maintain in a moist condition throughout the course of application.

3.3 INSTALLING METAL LATH

A. Metal Lath: Install according to ASTM C 1063.

1. Partition Framing and Vertical Furring: Install self-furring-diamond-mesh lath.
2. Flat-Ceiling and Horizontal Framing: Install self-furring-diamond-mesh lath.
3. Exterior Soffits and areas with Vapor Barriers: Install paper backed lath.
4. Exterior walls with drainage mat: Install self-furring-diamond-mesh lath with 15# felt slip sheet.

B. Lathing Materials: Apply metal lath taut, with long dimension perpendicular to supports. Lap ends minimum one (1) inch. Secure end laps with tie wire where they occur between supports. Lap sides of diamond mesh lath together minimum 1-1/2 inches. Nest outside ribs of rib lath together. Continuously reinforce interior angles with corner mesh except where metal lath returns three (3) inches from corner to form the angle reinforcement, fasten at perimeter edges only. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place. Where dissimilar materials abut, and surfaces are to receive a continuous application of stucco, provide a continuous 8" wide strip of galvanized wire lath, lapping 4" to either side of joint.

C. Self-Furring Metal Lath: Lap one inch and tie at 6-inch vertical spacing.

D. Moisture Retention, Curing

1. Dampen previous stucco coats which have dried out prior to time for applications of next coat. Dampen with water as required for uniform suction. The Contractor is responsible for determining the most effective procedure for curing and time lapse between application of coats based on climatic and job conditions. Plaster which is cracked or crazed due to improper timing and curing will not be accepted. Remove and replace defective plaster, including plaster base materials if damaged during removal of defective plaster.

E. Portland Cement Plaster Stucco Lathing and Furring Installation Standard: Install lathing, furring materials indicated for Portland cement plaster to comply with ANSI A42.3.

F. Install supplementary framing, blocking, and bracing at terminations in work, for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, similar work to comply with details indicated, or if not otherwise indicated, to comply with applicable published recommendations of equipment manufacturers.

G. Where lathing and metal support system abuts building structure horizontally, where partition/wall work abuts overhead structure, isolate the work from structural movement sufficiently to prevent transfer of loading onto work from building structure. Install slip or cushion type joints to absorb deflections but maintain lateral support.

1. Frame both sides of expansion joints independently; do not bridge joints with furring, lathing, or accessories.

H. Coordinate installation of ceiling suspension system with installation of overhead structural system to ensure that inserts, other structural anchorage provisions have been installed to receive ceiling hangers in a manner that will develop their full strength, at spacing required to support ceiling.

1. Furnish concrete inserts, other devices required, to other trades for installations well in advance of time needed for coordination with other work.

I. Attach hangers to structure above ceiling to comply with ML/SFA "Specifications for Metal Lathing and Furring," with referenced standards, as per requirements of applicable building codes.

1. Do not attach hangers to metal deck tabs.

J. Comply with referenced lathing and furring installation standards for provisions, location of plaster accessories of type indicated. Miter or cope accessories at corners; install with tight joints, in alignment. Attach accessories securely to plaster bases to hold accessories in place and alignment during plastering.

3.4 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on drawings.

B. Reinforcement for External Corners:

1. Install lath-type, external-corner reinforcement at exterior locations.
2. Install cornerbead at exterior locations.

C. Control and Expansion Joints: Install control and expansion joints at locations indicated on Drawings.

1. At distances between control joints of not greater than 18 feet o.c. or as indicated on the drawings and required by applicable standards.
2. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
3. Where control joints occur in surface of construction directly behind plaster.
4. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.
5. Fully caulk “V” type control joints.
6. Expansion Joints: Install expansion beads at locations shown on the drawings.

D. Accessories:

1. Corner Beads: Install corner beads at horizontal and vertical corners.
2. Casing Beads: Install casing beads at locations where plaster meets other materials, and at terminations of stucco finishes. Butt and align ends.

3. Corner Opening Reinforcing: Install glass fiber mesh at 45 degrees at openings in the plane of the plaster surface such as doors and windows. Mesh strips shall be 4 inches wide and a minimum of 9 inches long, installed following manufacturer's recommendations.
4. At joints between concrete and wood, provide revel molding.
5. Install accessories to required lines and levels.

3.5 PLASTER APPLICATION

A. General: Comply with ASTM C 926.

1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Bonding Compound: Apply on masonry and concrete for plaster bases.

C. Plaster Finish Coats: Apply to provide finish to match Architect's sample.

3.6 INSTALLATION OF FENESTRATION OPENING FLASHING

A. Apply at jambs, head and sill of openings unless directed otherwise.

1. Do not apply at the bottom of openings where the bottom of the opening is the interior slab.

B. Apply full depth of opening and 2” onto the interior and exterior wall surface per manufacturer’s installation directions.

1. Apply to fill voids and depressions to produce a uniform flat plane.

C. Install wood buck if required with a continuous bead of sealant between the buck and the flashing with one bead at the front and one at the back.

3.7 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.8 TOLERANCES

A. Maximum Variation from True Position: 1/8" per 10'

B. Maximum Variation of any Member from Plane: 1/8"

3.9 CLEANING

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09 24 00

SECTION 09 29 00 – GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Gypsum Board.
   b. Gypsum Board Accessories.
   c. Tile Backing Panels.

1.3 REFERENCES

A. ASTM C645 – Standard Specification for Nonstructural Steel Framing Members.
B. ASTM C754 – Standard Specification for Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products.
C. ASTM C954 – Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
D. ASTM C1325 – Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
E. ASTM C1396 – Standard Specification for Gypsum Board.
F. ASTM E695 – Standard method for Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading.
G. ASTM D3273 – Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
H. ASTM D5420 – Standard Test Method for Impact Resistance of Flat Rigid Plastic Specimen by Means of a Striker Impacted by Falling Weight (Gardner Impact).
I. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.
J. ASTM C840 – Standard Specification for the Application and Finishing of Gypsum Board.
K. GA 201 – Using Gypsum Board for Walls and Ceilings.
L. GA-216 – Recommended Specifications for the Application and Finishing of Gypsum Board.
M. GA-600 – Fire Resistance Design Manual.
N. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: Submit copies of manufacturer's specifications and installation instructions for items required.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
2. Textured Finishes: Manufacturer's standard size, minimum 8" by 8" for each textured finish indicated and on same backing indicated for Work.

1.5 INFORMATION SUBMITTALS

A. Include data substantiating that materials comply with specified requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

D. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.7 FIELD CONDITIONS

A. Prior to and during installation, coordinate with work of other trades to facilities required openings and finishes.

B. Conduct pre-construction meeting with drywall contractor, architect, owner, project coordinator, and others involved with process.

1.8 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Mold Resistant Assemblies: Provide materials and construction identical to those tested according to ASTM D 3273 and achieving a mold resistance score of 10.

D. Perform gypsum board systems work in accordance with recommendations of ASTM C754, C840, and GA-216 except as otherwise specified in this section.

E. Regulatory Requirements:

1. Fire-rated Assemblies: Listed and rated by Underwriter's Laboratories, Inc. or generic fire resistance ratings listed in GA-600.
2. Fire-Hazard Classification: Listed and labeled by Underwriter's Laboratories, Inc.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. USG Corporation and manufacturer as indicated.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.

1. National Gypsum Company
2. Georgia Pacific
3. Certainteed Gypsum
4. Continental Building Products

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 GYPSUM BOARD

A. Gypsum Board: ASTM C1396/C1396M

1. Basis of Design: “Firecode Core Type X”

2. Core: 5/8 inch, Type X
3. Long Edges: Tapered

B. Moisture-Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Basis of Design: "Mold Tough Firecode Type X"
2. Core: 5/8 inch, Type X
3. Long Edges: Tapered

C. Fiber-glass - Mat Faced Gypsum Sheathing: Comply with ASTM C1396/C1396 M and ASTM C1177/C1177M, Type X.

1. Basis of Design: "DensGlass Sheathing Type X"
2. Thickness: 5/8 inch, Type X
3. Edges: Square
4. Surfacing: Fiberglass mat on face, back and long edges.

2.4 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M.

1. Core: 5/8 inch, Type X
2. Edges: Manufacturer's standards
3. Manufacturers and products are as indicated however equal or better performing.
   a. DensShield Tile Backer: Georgia-Pacific Gypsum LLC
   b. GlasRoc Tile Backer: CertainTeed Corp.

B. Cement Backer Board: ASTM C1325

1. Core: 5/8", Type X
2. Edge: Manufacturer's standard.
3. Manufacturers and products are as indicated however equal or better performing.
   a. Durock Cement Board; United States Gypsum Co.
   b. DonCrete Cementitious Tile Backer Board; Domtar Gypsum.

2.5 TRIM ACCESSORIES

A. Galvanized Trim: Corner bead, edge trim, and control joints complying with ASTM C1047 and requirements indicated below:

1. Material: Steel sheet zinc coated by hot-dip or electrolytic process, or steel sheet coated with aluminum or rolled zinc, 26-gauge minimum comply with ASDTM A653.
2. Provided trims in 10 foots lengths.
3. Shapes:
   a. Cornerbead.
   b. LC-Bead: J-shaped; exposed long flange receivers joint compound.
   c. L-Bead: L-shaped: exposed long flange receives joint compound.

d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
e. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

4. Manufacturers: Subject to compliance with requirements provide one of the following manufacturers products. Equal or better performing products of other manufacturers will be considered for acceptance by the Architect.
a. United States Gypsum
b. Clark Dietrich
c. MarionWare

B. Interior Aluminum Trim: Corner bead, edge trim, and control joints complying with ASTM C1047 and requirements indicated below:

1. Material: Extruded aluminum alloy 6063 T5, .050 inch thick comply with ASTM B221.
2. Provided trims in 10-foot lengths
3. Finish: Mill
4. Shapes:
a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. L-Bead: L-shaped; exposed long flange receives joint compound.
d. U-Bead: J-shaped; exposed short flange does not receive joint compound.

C. Reveals

1. Basis of Design: “Reveal Channel Screed” as manufactured by Fry Reglet.
a. Material: Extruded aluminum.
b. Size: As indicated on drawings.
c. Location: As indicated on drawings.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape Locations

1. Interior Paper-Faced Gypsum Board: Paper.
2. Interior Paper-Faced Gypsum Board: 10-by-10 glass mesh.
3. Exterior Gypsum Soffit Board: Paper.
4. Glass-Mat Gypsum Sheathing Board: 10-by-10 fiberglass mesh.
5. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling, Open Joints, and Damaged Areas: Use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners and trim flanges, use drying-type, all-purpose compound.
a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.

4. Finish Coat: For third coat, ready mix drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
6. Embedding, Fill and Finish Coat: For embedding mesh and finish coats on joints, fasteners, and trim flanges, use quick set compound without cellulous content.
7. Finish: Match existing

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

B. Screws for Gypsum Board (ASTM C1002): Phillips head galvanized steel Type self-drilling screws, length and type as required and recommended by gypsum board manufacturer.

1. Type S-12, Bugle head, self-tapping, rust-resistant, fine tread for heavy gauge steel.
2. Type S, bugle head, rust resistant, sharp point, and fine thread for light gauge steel or furring.

C. Joint Paper Tape: 2 inch wide paper tape with center crease and buffed on both sides, comply with ASTM C475.

D. Joint Mesh Tape: 2-1/2 inch wide, 10 by 10 self-adhering fiberglass reinforced joint tape comply with ASTM C475.

E. Spot Grout: ASTM C475, setting type joint compound recommended for spot grouting hollow metal door frames.

F. Asphalt Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), non-perforated.

G. Gypsum board sheathing sealants, caulk, tape:

1. Don Corning 795 or equivalent; Pecora 895 or equivalent.
2. Borden HPPG Elmer’s siliconized acrylic latex caulk or equivalent.
3. 2” wide 10 x 10 glass mesh quick tape or equivalent.

H. Adhesive: Adhesive for adhering gypsum board to masonry and concrete shall be as recommended by the gypsum board manufactures.

2.8 ACOUSTICAL MATERIALS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, non-staining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Sherwin Williams “Powerhouse Siliconized Acrylic Latex Sealant”
   b. Pecora Corporation “AC-20 FTR”
   c. USG Corporation “SHEETROCK Acoustical Sealant”
2. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E90.
3. Product has flame spread and smoke developed ratings of less than 25 per ASTM E84.
4. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

B. Sound-Attenuation Blankets

1. Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without facing membrane), unless noted otherwise.
2. Mineral-Fiber Type: Fibers manufactured from glass, slag wool, or rock wool.
   a. Where used in fire-resistance rated assemblies, mineral fiber types shall correspond with requirements of tested assemblies.
3. Attenuation Location: Install in stud walls in a thickness to match stud size and provide between mechanical rooms and adjacent interior spaces.

2.9 ENVIRONMENTAL

A. Adhesives: For adhesives used to laminate gypsum board panels to substrates, including printed statement of VOC content.
B. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 20 percent by weight.
C. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
D. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

F. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 20 percent by weight.
G. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Spot grout fill interior metal frames in gypsum wallboard partitions with gypsum board compound at hinge and strike locations. Fully fill interior frames with gypsum board compound at Mechanical room walls.

C. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Form control and expansion joints with space between edges of adjoining gypsum panels.

G. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch wide joints to install sealant.

H. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

I. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

J. Hold gypsum board 1/2" off of floor. Bottom of all gypsum board panels to slab shall receive a continuous bead of sealant with a smooth finish aligned with the finished face of the gypsum board.

K. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

L. Install acoustical blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

M. Install attenuation blankets in stud walls between mechanical rooms and adjacent interior spaces.

N. Install sound isolation barrier in two layers at stud walls between mechanical rooms and adjacent interior spaces and where indicated on the drawings.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on drawings.
2. Moisture- and Mold-Resistant Type: In areas subject to moisture and as indicated on drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 CONTROL JOINTS

A. Provide control joints in gypsum board partitions, bulkheads, ceilings, and soffits as follows:

1. Partition, furring, or column fireproofing abuts a structural element (except floor) or dissimilar wall or ceiling.
2. Ceiling or soffit abuts a structural element, dissimilar wall or partition or other vertical penetration.
3. Construction changes within plane of partition or ceiling.
4. Partition or furring run exceeds 40 feet, unless noted otherwise.
5. Ceilings with perimeter relief when dimensions exceed 50 feet in either direction.
6. Ceilings without perimeter relief when dimensions exceed 30 feet in either direction.
7. Soffits that exceed 30 feet in length.
8. Exterior soffits exceed 30 feet in either direction.
9. Wings of “L”, “U”, and “T”-shaped ceiling areas are joined.
10. Ceiling between two ends of walls.
11. Top corners of both sides of recessed door entries.
12. Expansion or control joints occur in the exterior wall.

13. Less than ceiling height frames should have control joints extending to the ceiling from both corners. Ceiling height door frames may be used as control joints. Treat window openings in same manner as doors.
14. USG Control Joint No. 093: Apply over face of gypsum board where specified. Cut to length with a fine-toothed hacksaw (32 teeth per inch). Cut end joints square, butt together, and align to provide neat fit. Attach control joint to gypsum board with fasteners spaced 6 inches o.c. maximum along each flange. Remove plastic tape after finishing with joint compound or veneer finish.
    a. Leave a 1/2 inch continuous opening between gypsum boards for insertion of surface-mounted joint.
    b. Interrupt wood floor and ceiling plates with a 1/2 inch gap, wherever there is a control joint in the structure.
    c. Do not attach gypsum board to steel studs on one side of control joint.
    d. Provide separate supports for each control joint flange.
    e. Provide an adequate seal behind control joint where sound or fire ratings are prime considerations.

3.5 APPLYING TILE BACKING PANELS

A. Tile Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations. Apply joint tape over gypsum board joints and finish with compound per manufacturer’s instructions.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

3.7 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Tile backing panels.
3. Level 3: Mechanical, Electrical Rooms, Storage Rooms, and where indicated.
4. Level 4: All other spaces unless indicated otherwise.
5. Level 5: None.

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

3.8 FINISHING GYPSUM BOARD ASSEMBLIES

A. Levels of Finish: The following levels of finish are established as a guide for specific final finishes in accordance with GA-214.

1. Level 0: No taping, finishing, or accessories required. This level of finish shall be used in temporary construction only.
2. Level 1: Joints and interior angles shall have tape embedded in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. This finish level shall be used in plenum areas above ceilings, in attics, in areas where the assembly is concealed.
3. Level 2: Joints and interior angles shall have tape embedded in joint compound, and one separate coat of joint compound applied over joints, angles, fastener heads, and accessories. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. This finish level shall be used where water resistant gypsum backing board (ASTM C630) is used as a substrate for tile only.
4. Level 3: Joints and interior angles shall have tape embedded in joint compound, and two separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Joint compound shall be smooth and free of tool marks and ridges. Note: It is recommended that the prepared surface be coated with a primer/sealer prior to the application of final finishes. See painting/wall covering specification in this regard. This final level shall be used in areas that are to receive heavy textured, thick (1/8 inch or greater) wall coverings.
5. Level 4: Joints and interior angles shall have tape embedded in joint compound, and three separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Joint compound shall be smooth and free of tool marks and ridges. Note: Prepare surface to be coated with a primer/sealer prior to the application of final finishes. This finish level shall be used where textured finishes, wall coverings, and painted (flat or eggshell) finishes are to be applied.
6. Level 5: Joints and interior angles shall have tape embedded in joint compound and three separate coats of joint compound applied over joints, angles, fastener heads, and accessories. A thin skim coat of joint compound, or a material manufactured especially for this purpose, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges. Note: Prepare surface to be coated with a primer/sealer prior to the application of finish paint. This finish level shall be used with semi-gloss or gloss painted finishes.

B. Use the following joint compound combination as applicable to the finish levels specified:

1. Embedding and First Coat: Setting type joint compound. Fill (Second) Coat: Setting type joint compound. Finish (Third) Coat: Ready mixed, drying type, all purpose or topping compound.

C. Provide Fire Rated/Smoke Barrier partition labeling as per signage specifications.

3.9 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 30 00 – TILING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
    a. Ceramic tile.
    b. Porcelain tile.
    c. Glass tile.

1.3 REFERENCES

A. ANSI/CTI A108/A118/A136.1 – Specification for the Installation of Ceramic Tile - A Collection of 20 ANSI/CTI A108 Series Standards on Ceramic Tile Installation: A108.1A-C, 108.4 -.13, A118.1-.10, ANSI A136.1.
B. ANSI/CTI A108.1 – Installation of Ceramic Tile with Portland Cement Mortar.
C. ANSI/CTI A108.3 – Quarry Tile and Paver Tile Installed with Portland Cement Mortar.
D. ANSI/CTI A108.4 – Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive.
E. ANSI/CTI A108.5 – Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
F. ANSI/CTI A108.6 – Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy.
G. ANSI/CTI A108.8 – Installation of Ceramic Tile with Chemical Resistant Furan Mortar and Grout.
H. ANSI/CTI A108.9 – Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.
I. ANSI/CTI A108.10 – Installation of Grout in Tile work.
J. ANSI/CTI A118.1 – Dry-Set Portland Cement Mortar.
K. ANSI/CTI A118.3 – Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive.
L. ANSI/CTI A118.4 – Latex-Portland Cement Mortar.
M. ANSI/CTI A118.6 – Ceramic Tile Grouts.
N. ANSI/CTI A118.8 – Modified Epoxy Emulsion Mortar/Grout.
O. ANSI/CTI A136.1 – Organic Adhesive for Installation of Ceramic Tile.
P. ANSI/CTI A137.1 – Ceramic Tile.
Q. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar.

R. ASTM C206 – Standard Specification for Finishing Hydrated Lime.
S. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes.
T. TCA CTI – (Tile Council of North America) - Handbook for Ceramic Tile Installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples: For tile, grout, and accessories involving color selection.

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches by 36 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Stone thresholds in 6-inch lengths.
5. Metal edge strips in 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed ANSI A137.1.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than five (5) years experience.

B. Manufacturer’s Qualifications: Experienced firm in the manufacture of products and/or systems similar to those required for this Project and with a record of successful in-service performance as well as sufficient production capacity to produce units as required.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

D. Installer’s Qualifications: Work done under this Section of the Specifications shall be performed by mechanics skilled and experienced in the class of Work involved having successfully installed not less than 5 projects of similar size and scope to work of this Project. Installer shall be familiar with special requirements as herein indicated and shall comply with requirements of authorities having jurisdiction.

E. Workmanship shall be in accordance with best trade practices, and surface shall be true to line and free from waves and other imperfections. Joints between tiles shall be maintained uniform and even and properly grouted.

F. Work shall comply with applicable requirements of the following:

1. Tile Council of North America (TCNA) Installation Guidelines.
2. ANSI A108 Series.

1.7 MAINTENANCE MATERIALS

A. Furnish extra materials described below that match products installed, packaged with protective covering for storage, and identified with labels describing contents.

B. Furnish quantity of full-size units equal to 2.0% of amount installed.

1.8 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.10 FIELD CONDITIONS

A. This Contractor shall inspect the job condition before starting, and his starting work constitutes approval of conditions.

B. All flooring variations less than 1/8” in 10 ft., chips, and cracks are the responsibility of the flooring subcontractor to feather/patch prior to the installation of tile.

C. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.11 WARRANTY

A. This Contractor shall fully guarantee all materials and labor under this section for a period of not less than 1-year from date of final acceptance of the building against all defects in both workmanship and materials, and he shall promptly correct and/or replace such faulty work if so notified.

1.12 PERFORMANCE

A. Tile installation shall comply with the “Handbook for Ceramic Tile Installation” by the Council of North America (TCNA).

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Refer to drawings.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.

1. Refer to drawings.

2.2 GENERAL

A. Provide tile conforming to ANSI A137.1.

1. Tile shall meet or exceed the ADAAG slip resistance coefficient of 0.42 or greater.

B. Refer to drawings for tiling designations and selections.

2.3 GLASS TILE

A. Refer to drawings for tiling designations and selections.

1. Basis-of-Design: “Color Wave” by Daltile.
2. Composition: Mosaic blend, consisting of matte, non-iridescent, and iridescent glass tiles.
3. Size: 1 by 1 inches
4. Thickness: 5/16 inch
5. Joint Width: 1/8 inch

6. Grout: Glass-filled, Pre-mixed, Urethane Grout as manufactured by Bostik.
7. Face: Smooth with square edges.
8. Color: See drawings for selection.

2.4 TILE TRIM

A. Refer to drawings for tiling designations and selections.

1. Trim in a size, color, and shade to match field tile.
2. Bull nose wainscot cap where required.
3. In a standard, square top, cove base at tile floors.
4. In a square top, set-on type, cove base at other floors.
5. Square edges at inside corners.
6. Bull nose edges at outside corners and jambs.

2.5 PROJECT COLORS AND PATTERNS

A. Colors, surface textures, and other appearance characteristics shall be as selected by the Architect. Selections shall be made from among manufacturer's standard products, regardless of differing price groupings.

B. Architect reserves the right to use a maximum of two (2) colors in each room/space at no additional cost.

C. Architect shall select colors of tile from full range of available colors / price groups for all selections unless indicated otherwise.

D. Architect shall select colors of grout from all available price groups.

2.6 MATERIALS

A. Anti-Fracture Membrane/Cleavage Membrane: As indicated on the drawings, and elsewhere as required for isolating the installation from cracking due to minor substrate movement and normal structural deflections. Membrane shall comply with ANSI A108.1, one layer of 15# felt with 3" overlaps at all seams.

B. Anti-Fracture Membrane/Cleavage Membrane: As required for isolating the installation from cracking due to minor substrate movement and normal structural deflections. Apply at crack locations.

1. Membrane: Liquid applied elastomeric membrane complying with ASTM C627 and ASTM D638 “Redgard Waterproofing and Crack Prevention Membrane” as manufactured by Custom Building Products.
2. Membrane: Liquid applied elastomeric membrane complying with ASTM C627 and ASTM E96 Method E “Mapelastic AquaDefense” as manufactured by Mapei Corporation.

C. Waterproof Membranes:

1. Install beneath tile at showers, group restrooms, single restrooms with drains and second floor restrooms.
2. General: Provide products that comply with ANSI A118.10.
3. Elastomeric Waterproofing: Liquid applied elastomeric membrane complying with ASTM C6267 and ASTM D638 "Redgard Waterproofing and Crack Prevention Membrane" as manufactured by Custom Building Products.
4. Membrane: Liquid applied elastomeric membrane complying with ASTM C627 and ASTM E96 Method E "Mapelastic AquaDefense" as manufactured by Mapei Corporation.

D. Self-Leveling Underlayment: Quick set type, as recommended by membrane manufacturer, required to provide a flat, level surface for direct receipt of tile and other floor coverings on dry, interior installations.

E. Latex Underlayment: Quick set type, as recommended by membrane manufacturer, as required providing positive drainage to floor drains.

F. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

G. Medium-Bed Modified Dry Set Mortar: Comply with ANSI A118.4, large tile

H. Mortar Bed Installations: As indicated on the drawings, and elsewhere as required for mortar bed or brown coat as the substrate for tile work; work to conform to ANSI A108.1.

I. Organic Tile Adhesives: ANSI A136.1 thinset bond type, use Type 1 in areas not exposed to prolonged moisture.

J. Urethane adhesive: Use for wet areas including showers, drying rooms, locker rooms, wet environmental instruction spaces, kitchens, and serving lines.

1. Manufacturer is as indicated however equal or better performing products of other manufacturers will be considered for acceptance by the Architect.
   a. QuartzLock2 Grout as manufactured by Bostok.

K. Epoxy Adhesives: Chemical Resistant Epoxy, Water-Cleanable Tile Setting Epoxy as required for setting tike as specified by ANSI A118.3 and ANSI A108.6. Product shall be "Latapoxy 300" as manufactured by Laticrete or approved equal. Provide in restrooms and where indicated.

1. Provide at showers and restrooms.

L. Unsanded Tile Grout: ANSI A118.7.

1. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients. Product shall be Laticrete 1600 as manufactured by Laticrete or approved equal.

M. Epoxy Grout: Chemical Resistant Epoxy, Water-Cleanable Tile Grouting Epoxy as required for grouting tile as specified by ANSI A118.3 and ANSI A108.6. Product shall be "SpectraLOCK Pro" as manufactured by Laticrete or approved equal. Provide in restrooms and where indicated.

1. Provide at showers and restrooms.

N. Glass-Filled Grout: As indicated, provide pre-mixed glass-filled urethane water-based grout.

1. Glass-filled, pre-mixed urethane grout as manufactured by Bostik

O. Elastomeric Joint Caulk: ANSI A108.01.3.7, provide in all joints between floors and walls and at joints between tile and dissimilar materials and as indicated on the Drawings.

2.7 ACCESSORIES

A. The Contractor to supply all necessary base, cap edge corner, trim, or accessory tiles required for a complete installation.

B. Edge Trim:

1. Basis of Design: The basis of design product "Schiene" is manufactured by Schluter. Equal or better performing products of other manufacturers will be considered for acceptance by the Architect.
2. Material: Extruded aluminum, satin nickel anodized aluminum finish, mechanically fastened, gluing is not permitted.
3. Provide at all edges unless indicated otherwise.

C. Corner Trim:

1. Basis of Design: The basis of design product "Jolly" as manufactured by Schluter. Equal or better performing products of other manufacturers will be considered for acceptance by the Architect.
2. Material: Extruded aluminum, satin nickel anodized aluminum finish, mechanically fastened, gluing is not permitted.
3. Provide at all outside corners unless indicated otherwise.

D. Grout Sealer: Manufacturer's standard product for cleaning, brightening, and sealing grout joints that does not change color appearance of grout.

1. Penetrating Sealer – for quarry and other Vitreous, Semi-Vitreous & Non – Vitreous Tile.
2. Manufacturers and products are as indicated however equal or better performing products of other manufacturers will be considered for acceptance by the Architect.
   a. Bonsal, W. R., Company; Exterior Grout Sealer.
   b. Bostik: Ceramaseal grout sealer.
   c. Jamo Inc. Matte finish penetrating sealer.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturer's written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

2.9 ENVIRONMENTAL

A. Adhesives: For adhesives and sealants, including printed statement of VOC content.

B. Urethane Crack Isolation Membrane and Tile-Setting Adhesive: One-part, liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

C. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Organic Adhesive: ANSI A136.1, Type I, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 – EXECUTION

3.1 INSPECTION

A. Prior to installing tile, inspect new surfaces that are to receive tile covering. Notify the Architect in writing of defects or conditions that will interfere with or prevent a satisfactory tile installation. Do not proceed with installation until such defects or conditions have been corrected.

1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.

B. The starting of installation work in a room or space shall imply acceptance of the surfaces to receive the tile in that space.

3.2 PREPARATION

A. Repair minor holes, cracks, depressions, and rough areas, using leveling and patching compounds as recommended by tile manufacturer.

B. Clear away debris, scrape up cementitious deposits from surface that would prevent bond, including curing compounds, paint, oils, waxes, and sealers. Broom clean or vacuum surfaces to be covered immediately before installation.

C. Field Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces:

1. Petroleum paraffin wax or grout release.

3.3 TILE INSTALLATION

A. Install tile, per TCA F113-90 sloping to floor drains, where applicable, in accordance with ANSI specification A-108.5.

B. General: Install tile to comply with requirements in the Ceramic Tile Floor Installation Schedule, including those referencing TCA installation methods and ANSI A108 series of tile installation standards.

C. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

D. Install wall tile trim per manufacturer's directions and locate joints at lower portion of wall.

E. Install edge trim where tile abuts other floor finishes.

F. Install marble thresholds edge trim at all openings to restrooms and where tile abuts other floor finishes.

G. Install marble thresholds where quarry tile abuts other floor finishes.

1. Provide maximum threshold height 1/4" for HDCP requirements.
2. A threshold up to 1/2" in height maybe installed, with edges beveled at 1:2 slope.

H. Provide a 1/8" joint between the tile, and the doorframe or other item of dissimilar material then use a sealant over the joint instead of grout.

1. Caulk the joints with caulking compound that matches grout.

I. Use masonry saw to cut tile unless Architect and Owner approve another method.

J. Floor tile in all rooms shall be epoxy grouted.

K. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

L. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions.

M. Cove base shall be installed flush with the adjacent floor tile and not on top of the floor tile.

3.4 LAYOUT

A. Locate expansion joints and other sealant filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installation of tiles.

1. Locate joints in tile surfaces directly above joints in concrete surfaces.
2. Prepare joints and apply sealants to comply with requirements of Specification Section - Joint Sealants.
3. Control joints locations and details shall comply with TCNA EJ171 recommendations.

B. Lay out tilework so as to minimize cuts less than one-half tile in size.

C. Locate cuts in both walls and floors so as to be least conspicuous.

D. Lay out tile wainscots to next full tile beyond dimensions shown.

E. Align wall joints to give straight, uniform grout lines, plumb and level.

F. Align floor joints to give straight uniform grout lines parallel with walls.

G. Make joints between tile sheets same width as joints within sheets so extent of each sheet is not apparent in finished work.

H. Porcelain tile can have large variances in sizing. Do not mix sizes and types of tiles in pattern areas. Joints that do not line up or joint widths that vary will be unacceptable.

3.5 WORKMANSHIP

A. Supply first-class workmanship in tilework.

B. Use products in strict accordance with recommendations and directions of manufacturer.

C. Proportion mixes in accordance with latest ANSI standard specifications.

D. Smooth exposed cut edges.

E. Be sure cut edges are clean before installing tiles.

F. Fit tile carefully against trim and accessories, also around pipes, electrical boxes, and other built-in fixtures so that escutcheons, plates, and collars will completely overlap cut edges.

G. When using glazed tile sheets, minimize tearing sheets apart by drilling pipe holes as much as possible.

H. Be sure tile work is free of grout film upon completion.

3.6 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with waterproofing manufacturer’s written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.7 ANTI-FRACTURE MEMBRANE/CLEAVAGE MEMBRANE

A. Install anti-fracture membrane/cleavage membrane to comply with manufacturer’s written instructions over cracks in the substrate.

3.8 GROUTING

A. Grouting shall be installed in accordance with ANSI A108.10 and the manufacturer's recommended procedures and precautions during application and cleaning, unless noted otherwise.

B. Where noted, for chemical-resistant epoxy grouts, comply with ANSI A108.6.

C. Rinse tilework thoroughly with clean water before and after using chemical cleaners.

3.9 GLASS TILE INSTALLATION

A. Glass tile may be susceptible to scratching in handling and installation, as well as use. Expect variation of color from production run to production run.

B. Installation: Only use adhesives with high adhesion and elasticity, which are especially recommended for installing glass. Make sure to get complete coverage. All substrates should be properly reinforced to be sure there is no movement. For mortar installations, the mortar bed has to be cured (less than 2% humidity) and has to have proper reinforcing.

C. Please refer to the TCNA HANDBOOK for more specific information regarding installation of glass tile.

D. Adhesives and Grouting: Any type of cement based adhesive and grout is suitable.

E. Sealing: No sealing is required.

F. Maintenance: Use a non-abrasive cloth and neutral detergents for cleaning. Avoid acid detergents, chemicals, and solvents.

3.10 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all tile surfaces so they are free of foreign matter.

1. Remove latex-Portland cement grout residue from tile as soon as possible.
2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure tile is without damage or deterioration at the time of Substantial Completion.

1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

E. All cleaning solutions and procedures to be in compliance with project IAQ Management Plan.

3.11 PROTECTION

A. The Contractor installing tile shall make such provisions as necessary to protect the tile against damage of any kind after installation. Damaged tile that appears in the finish work prior to turning the building over to the Owner is to be repaired or replaced by this Contractor without further cost to the Owner. Protect adjoining areas and surfaces and clean up everything at completion. Remove scrap, debris, and surplus material as it accumulates.

END OF SECTION 09 30 00

SECTION 09 50 00
ACOUSTICAL PANEL CEILINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Acoustical ceiling panels
   b. Exposed grid suspension system
   c. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings
   d. Perimeter Trim

B. Related Sections

1. Section 09 51 00 – Acoustical Ceilings
2. Section 09 20 00 – Plaster and Gypsum Board

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
7. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
8. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
9. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material
10. Armstrong Fire Guard Products

11. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
12. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems
13. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
14. ASTM E 1264 Classification for Acoustical Ceiling Products

B. International Building Code
C. ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality
D. NFPA 70 National Electrical Code
E. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures
F. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components
G. International Code Council-Evaluation Services Report - Seismic Engineer Report
   1. ESR 1308 - Armstrong Suspension Systems
H. International Association of Plumbing and Mechanical Officials - Seismic Engineer Report
   1. 0244 - Armstrong Single Span Suspension System
I. California Department of Public Health CDPH/EHLB Emission Standard Method Version 1.1 2010.

1.4 SYSTEM DESCRIPTION

A. Canopies/Architectural Elements

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

B. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of suspension system, including main runner,

C. Shop Drawings: Layout and details of acoustical ceilings show locations of items that are to be coordinated with or supported by the ceilings.

D. Acoustical Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

1.6 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

1. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
2. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 Classification.
3. Fire Resistance: As follows tested per ASTM E119 and listed in the appropriate floor or roof design in the Underwriters Laboratories Fire Resistance Directory

B. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.8 PROJECT CONDITIONS

A. Space Enclosure:

1. Standard Ceilings: Do not install interior ceilings until space is enclosed and weatherproof; wet work in place is completed and nominally dry; work above ceilings is complete; and ambient conditions of temperature and humidity are continuously maintained at values near those intended for final occupancy. Building areas to receive ceilings shall be free of construction dust and debris.
2. HumiGuard Plus Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Products with HumiGuard Plus performance and hot dipped galvanized steel, aluminum or stainless steel suspension systems can be installed up to 120°F (49°C) and in spaces before the building is enclosed, where HVAC systems are cycled or not operating. Cannot be used in exterior applications where standing water is present or where moisture will come in direct contact with the ceiling.
3. HumiGuard Max Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Ceilings with HumiGuard Max performance can be installed in conditions up to 120°F (49°C) and maximum humidity exposure including outdoor applications, and other standing water applications, so long as they are installed with either SS Prelude Plus, AL Prelude Plus, or Prelude Plus Fire Guard XL suspension systems. Products with Humiguard Max performance can be installed in exterior applications, where standing water is present, or where moisture will come in direct contact with the ceiling. Only Ceramaguard with AL Prelude Plus suspension system can be installed over swimming pools.

1.9 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:

1. Acoustical Panels: Sagging and warping
2. Grid System: Rusting and manufacturer's defects

B. Warranty Period:

1. Acoustical panels: One (1) year from date of Substantial Completion
2. Grid: One (1) year from date of Substantial Completion

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.10 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Acoustical Ceiling Units: Furnish quantity of five (5) full-size units.
2. Exposed Suspension System Components: Furnish quantity of five (5) each exposed suspension component.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Ceiling Panels:

1. Armstrong World Industries, Inc.

B. Suspension Systems:

1. Armstrong World Industries, Inc.

2.2 ACOUSTICAL CEILING UNITS

A. Acoustical Panels Type AP

1. Surface Texture: Fine
2. Composition: Fiberglass
3. Color: White

4. Size: 48 in x 96 in
5. Edge Profile: Square
6. Noise Reduction Coefficient(NRC):
7. Ceiling Attenuation Class (CAC):
8. Sabin: Up to 1.18
9. Articulation Class (AC):
10. Flame Spread: ASTM E 1264; Class A (UL)
11. Light Reflectance (LR) White Panel: ASTM E 1477; 0.90
12. Dimensional Stability: Standard
13. Recycle Content: Post-Consumer - 12% Pre-Consumer - 59%
14. Acceptable Product: SOUNDSCAPES Shapes, 5449 as manufactured by Armstrong World Industries

PART 3 – EXECUTION

3.1 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations. (Exception: HumiGuard Max Ceilings)

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

A. Follow manufacturer installation instructions.

B. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.

C. Suspend main beam from overhead construction with hanger wires spaced 4-0 on center along the length of the main runner. Install hanger wires plumb and straight.

D. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

E. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

F. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.4 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove any ceiling products that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.

C. Before disposing of ceilings, contact the Armstrong Recycling Center at 877-276-7876, select option #1 then #8 to review with a consultant the condition and location of building where the ceilings will be removed. The consultant will verify the condition of the material and that it meets the Armstrong requirements for recycling. The Armstrong consultant with provide assistance to facilitate the recycle of the ceiling.

END OF SECTION 095000

SECTION 09 51 23 – ACOUSTICAL TILE CEILINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Acoustical tiles for ceilings.
   b. Suspension systems.

1.3 REFERENCES

A. ASTM C423 – Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
B. ASTM C635 – Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
C. ASTM C636 – Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
D. ASTM C641-09 – Specification for Steel Sheet, Zinc-Coated (galvanized) Carbon Steel Wire.
E. ASTM D3273 – Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
F. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
G. ASTM E90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
H. ASTM E 119 – Standard Test Methods for Fire Tests of Building Construction and Materials.
I. ASTM E795 – Standard Practice for Mounting Test Specimens During Sound Absorption Tests.
J. ASTM E1264 – Standard Classification for Acoustical Ceiling Products.
K. ASTM E1414 – Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.
L. ASTM E1477 – Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating Sphere Reflectometer.
M. Ceilings and Interior Systems Contractors Association (CISCA) – Acoustical Ceilings: Use and Practice.
N. UL – Fire Resistance Directory.
O. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples:

1. Acoustical Tiles: Set of full-size Samples of each type, color, pattern, and texture.
2. Suspension-System Members: 6-inch long Sample of each type.
3. Moldings and Trim: Set of 6-inch long Samples of each type and color.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Method of attaching hangers to building structure.
   a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
3. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
4. Size and location of initial access modules for acoustical tile.
5. Ceiling-mounted items and items penetrating the ceiling including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
6. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

B. Product Test Reports: For each acoustical tile ceiling, for tests performed by a qualified testing agency.

C. Evaluation Reports: For each acoustical tile ceiling suspension system and anchor and fastener type, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

C. Manufacturer’s Qualifications: Employ only manufacturers making the specified products as a regular and current production item.

D. Single-Source Responsibility for Ceiling and suspension Units: Obtain each type of acoustical ceiling unit and suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.7 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.8 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. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed, minimum two full boxes.
2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 2 percent of quantity installed.
3. This stock shall be designated for use by Owner only, after completion of the Project and shall not be used for repair or replacement during the one-year warranty period.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

B. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components, and partition system.

1.11 WARRANTY

A. Manufacturer’s Warranty: Provide manufacturer’s warranty that the ceiling panels and suspension systems shall be free from sagging or warping for indicated warranty.

1. Warranty Period: Not less than ten (10) years from the Date of Substantial Completion.

1.12 PERFORMANCE

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. Flame-Spread Index: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Armstrong World Industries.
2. Manufacturers as indicated.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.

1. CertainTeed Corporation.
2. USG Interiors, Inc.
3. Gold Bond – National Gypsum
4. Rockfon

2.2 ACOUSTICAL TILES, GENERAL

A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

B. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

C. Mounting Method for Measuring NRC: Type E 400 (plenum mounting in which face of test specimen is 15-3/4" away from the test surface) per ASTM E 795-05(12).

2.3 ACOUSTICAL TILES

A. ACT-1:

1. Basis of Design: “Fine Fissured”
2. Edge: Angled Tegular
3. Size: 24" x 24" x 3/4"
4. NRC: 0.70
5. Color: White

2.4 METAL SUSPENSION SYSTEMS

A. Basis of Design: “Prelude XL 15/16" Steel Exposed Tee”.

B. Basis of Design: “Prelude XL 15/16" Steel with Aluminum Cap”.

C. Basis of Design: “Prelude Plus XL 15/16" Aluminum with Aluminum Cap”.

D. Basis of Design: “Suprafine XL 9/16" Steel Exposed Tee”.

E. Basis of Design: AL Prelude Plus XL 15/16" Aluminum Exposed Tee”.

F. Metal Suspension-System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

1. Electrogalvanized in all spaces unless indicated otherwise.
2. Hot-dipped galvanized shall be used in the food service related areas.

G. High-Humidity Finish: Provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M in food service, damp, and potentially wet spaces.

1. Provide aluminum cap in food preparations areas and associated spaces.
2. Provide aluminum cap in spaces that may experience damp or wet conditions.

H. Structural Classification: Intermediate Duty System.

I. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.

J. Color: White.

2.5 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings, and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.

B. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

C. Provide manufacturer's standard edge moldings that fit acoustical tile edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.

D. Ceiling Edge Trim: Provide “Straight Axiom Classic Trim” as manufactured by Armstrong World Industries.

1. Provide wherever a lay-in ceiling is located lower than an adjacent gypsum board ceiling.
2. Provide outside and inside corner trim, splice plates, clips, and miscellaneous items for a complete installation.
3. Size: 6” or as indicated on the drawings.
4. Size: As required for ceiling height change as indicated on the drawings.
5. Color: As selected by the Architect.

2.6 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
   a. Type: Postinstalled expansion anchors.
   b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B 633, Class SC 1 (mild) service condition.
2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106 inch diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch diameter bolts.

F. Retention Clips: Manufacturer’s standard retention clips.

2.7 ACOUSTICAL SEALANT

A. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90. Exposed and concealed joints nonsag, paintable, nonstaining latex sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required and no more than 20 degrees to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Do not place hanger wires thru cable trays or attach to cable trays and conduits or other similar items.
11. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
13. Secure wire hangers to the four corners of all light fixtures.

B. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

C. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
4. All seams to be tight and flush.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Arrange directionally patterned acoustical tiles as follows:

1. Install tiles in a basket-weave pattern – verify with Architect.

F. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.

1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.

G. If tegular panels are cut in the field, match factory reveal.

H. Install retention clips per manufacturer's installation instructions.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections of completed installations of acoustical tile ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion but no tiles have been installed. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.

1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and post-installed anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two post-installed anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

B. Acoustical tile ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 09 51 23

SECTION 09 65 13 – RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Resilient base.
   b. Accessories.

1.3 REFERENCES

A. ASTM D570 – Standard Test Method for Water Absorption of Plastics.
B. ASTM E 662 – Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
C. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
D. ASTM F 710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
E. ASTM F1515 – Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Changes.
F. ASTM F 1861 – Standard Specification for Resilient Wall Base.
G. NFPA 253 – Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
H. NFPA 258 – Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
I. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color selected, not less than 12 inches long.

1.5 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. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.6 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

1.9 WARRANTY

A. Furnish manufacturer's warranty covering manufacturing defects for a period of 2 years and 10 years for traffic wear resistance, excluding abusive treatment.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer shall be one of the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Johnsonite; A Tarkett Company
2. Roppe Corporation, USA
3. Burke Mercer Flooring Products

2.2 BASE TYPES: Refer to drawings for designations and selections.

A. Product Standard: Vinyl ASTM F1861, Type TV (Vinyl), Group I (solid, homogeneous)

B. Type: Cove

C. Thickness: 1/8 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Field formed.

G. Inside Corners: Field formed.

H. Colors: See drawings for selection or as selected by the Architect.

2.3 FLOOR TRANSISTIONS

A. Description: Transitions, reducer, edge strips, and adaptors strips as required to accommodate edge conditions and joints between different flooring materials.

B. Vinyl Transitions

1. Basis of Design: “Slim Line Reducer/Edge Strips”
2. Profile and Dimensions: Provide profiles to fit conditions and as recommended by flooring installer unless indicated otherwise. Profile and width of height required to protect exposed edge of carpet and provide transition to adjacent materials, and of maximum lengths to minimize running joints. Final selection shall be as approval by the Architect.
3. Locations: Provide at transition between floor types and at edges of floor covering that would otherwise be exposed unless indicated otherwise.
4. Colors and Patterns: As selected by Architect from full range of industry color.
5. Trim: Tile to carpet reducer shall be model #150, carpet reducer shall be model #800, tile reducer shall be #633 and feature strip shall be #643 as manufactured by Burke.
6. Manufacturer is as indicated however equal or better performing products of other manufacturers will be considered for acceptance by the Architect.

2.4 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

B. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

2.5 ENVIRONMENTAL

A. Adhesives: For adhesives, sealants, and chemical-bonding compounds, including printed statement of VOC content.

B. Compliance: Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
2. Rubber Floor Adhesives: Not more than 60 g/L.

C. Chemical-Bonding Compound: Use chemical-bonding compound that has a VOC content of 350 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

C. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Butt to adjacent materials and tightly adhere to substrates throughout length of each piece.

3.5 RESILIENT STAIR ACCESSORIES INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient stair accessories.

B. Apply resilient stair accessories to walls, treads, risers, and landings.

C. Install resilient stair accessories in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient stair accessories to substrate throughout length of each piece.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient stair accessories with manufacturer's recommended adhesive filler material.

3.6 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

3.7 INDOOR AIR QUALITY

A. Temporary ventilation: Provide temporary ventilation as specified – Indoor Air Quality (IAQ) Management, and as follows:

B. Ventilate products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 degrees F minimum to 90 degrees F maximum continuously for minimum 72 hours. Do not ventilate within limits of Work unless otherwise approved by Architect.

END OF SECTION 09 65 13

SECTION 09 65 19 – RESILIENT TILE FLOORING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:

1. Vinyl Composition Tile (VCT)
2. Luxury Vinyl Tile (LVT)
3. Luxury Vinyl Plank (LVP)

B. Refer to drawings for moisture mitigation and cementitious self-leveling floor slab preparation scope of work.

1.3 REFERENCES

A. ASTM D570 – Standard Test Method for Water Absorption of Plastics.
B. ASTM D2047 – Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
C. ASTM E84 – Standard Test Method for the Surface Burning Characteristics of Building Materials.
D. ASTM E 492 – for Impact Insulation.
E. ASTM E 648 – Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source.
F. ASTM E 662 – Test Method for Specific Density of Smoke Generated by Solid Materials.
G. ASTM E1428 – Standard Test Method for Evaluating the Performance of Antimicrobials in or on Polymeric Solids Against Staining by Streptomyce Species (A Pink Stain Organism).
H. ASTM F510/F510M – Standard Test Method for Resistance to Abrasion of Resilient Floor Covering Using an Abrader with a Grit Feed Method.
I. ASTM F 710 – Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.
J. ASTM F 970 – Test Method for Static Load Limit.
K. ASTM F1066 – Standard Specification for Vinyl Composition Floor Tile.
L. ASTM F1515 – Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Changes.
M. ASTM F1700 – Standard Specification for Solid Vinyl Floor Tile.
N. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride.

O. ASTM F2055 – Standard Test Method for Size and Squareness of Resilient Floor Tile by Dial Gage Method.
P. ASTM G21-15 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
Q. NFPA 253 – Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source.
R. NFPA 258 – Test Method for Specific Density of Smoke Generated by Solid Materials.
S. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: Submit technical data on each item specified including certification by manufacturer that products supplied for installation comply with local regulations controlling use of volatile organic compounds (VOC's).

B. Product Certificates: In lieu of laboratory test reports when permitted by Architect, signed by manufacturer certifying that each product complies with requirements.

C. Samples: Manufacturer's color charts consisting of actual tiles or sections of tiles showing full range of colors and patterns available for each type of resilient floor tile indicated.

1.5 INFORMATION SUBMITTALS

A. Test Results: Submit results from calcium chloride and bond and moisture tests as specified herein, before installation of resilient flooring.

B. Installer Statement of Compliance: Certify tile is installed in accordance with manufacturer’s installation manual in order to validate the manufacturer’s warranty on installation integrity.

C. Maintenance Data: Submit maintenance manuals for flooring materials provided to be included in Operation and Maintenance Manuals.

D. Warranty: Submit sample of warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

C. Single-Source Responsibility for Flooring: Obtain each type, color, and pattern of flooring from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

D. Installer's Qualifications: Employ only authorized representative of resilient flooring manufacturer for installation and maintenance of units required for this Project.

1. Employ only experienced Contractors (Installers) skilled in the successful installation of the specified materials and accessories on similar projects for a minimum of five (5) years.

E. Manufacturer's Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

F. Calcium Chloride Test: Contractor shall provide a calcium chloride test to measure moisture vapor emissions from the concrete slab on grade before the installation of the resilient flooring. Maximum moisture emissions levels shall be as recommended by the resilient flooring manufacturer.

G. Bond and Moisture Tests: Contractor shall provide bond and moisture tests before the installation of the resilient flooring. Bond and moisture tests shall be in strict accordance with the resilient flooring manufacturer's recommendations. Provide amount of tests as recommended by the resilient flooring manufacturer.

1.7 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver flooring and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store flooring materials in dry spaces protected from the weather with ambient temperatures maintained between 50 deg F and 90 deg F.

C. Store flooring on flat surfaces. Move flooring and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.9 FIELD CONDITIONS

A. Maintain a minimum temperature of 70 deg F in spaces to receive flooring for at least 48 hours before installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 deg F.

B. Do not install flooring until they are at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during installation.

D. Specified items shall not be delivered or installed until building is enclosed, wet work completed, and HVAC system is operating and maintaining temperature and humidity at occupancy level during remainder of construction period.

E. Do not install flooring over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive as determined by manufacturer's recommended bond and moisture test.

1.10 EXTRA MATERIALS

A. Furnish to Owner, not less than one box for each 50 boxes or fraction thereof, of each class, wearing surface, color, pattern, and size of resilient floor tile installed.

1.11 WARRANTY

A. Manufacturer’s Warranty covering manufacturing defects and installation integrity shall be indicated warranty period. Installation integrity is defined as products installed in accordance with the manufacturer’s installation manual.

1. Warranty Period: Not less than five (5) years from Date of Substantial Completion.

B. Installer’s Warranty: Fully guarantee installation of tile and wall base against defects in installation, workmanship, and loss of adhesion for indicated warranty period.

1. Warranty Period: Not less than one (1) year from Date of Substantial Completion.

1.12 PERFORMANCE

A. Fire Performance Characteristics: Provide resilient flooring with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45 watts per sq. cm or more per ASTM E648.
2. Smoke Density: Less than 450 per ASTM E662.
3. Flame Spread: Less than 75 per ASTM E84.

B. Slip Resistance: Flooring shall conform to static coefficient of friction (James test) ASTM D2047 plus/minus 0.5.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Manufacturer shall be as indicated however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

2.2 LUXURY VINYL TILE / PLANK– (Refer to drawings for designations and selections.)

A. Basis of Design Collection: Tarkett Contour Series Abstract + Techtonic
B. Style: TBD and as approved by Owner.
C. Composition: ASTM F1700, Class III, Type B.
D. Wear Layer Thickness: 32 mil
E. Overall Thickness: 0.120 inch (3.0mm)
F. Size: 18 inches by 18” inches, 6 inches by 39 inches and 9 inches by 36 inches.
G. Edge Treatment: Square (SE)
H. Emboss: Standard as shown on sample.
I. Color: One (1) field color and up to four (4) accent colors will be utilized. See drawings for selection or as selected by the Architect from manufacture full range of colors.

2.3 MISCELLANEOUS MATERIALS

A. Adhesive: Water-resistant type as recommended by product manufacturer. Water based adhesives are not allowed.

B. Trowelable Leveling and Patching Compounds. Latex-modified, Portland cement based or blended hydraulic-cement-based formulation or approved by manufacturer for applications indicated, as required to level uneven subfloor conditions.

C. VCT Floor Stripper: Flooring manufacturer’s standard floor stripper used to remove floor finishes, dirt, grime, oil, stains, tar, gum adhesives and scuffmarks.

D. VCT Floor Finish: Low odor, ultra-high solids acrylic, white opaque liquid coating. Drying time shall be no more than 30 minutes in standard conditions. Non-Volatile Solids (%) 25.5 +/- 0.5. Coverage rate – approximately 2,500 sq. ft. per gallon. Product shall have a 3-year strip and re- coat cycle; be scuff, scratch, and abrasion resistant; respond to ultra -high speed burnishing; and has a refractive index not less than 1.3861 and a maximum of 1.3898. UL classified for slip resistance.

1. National Chemical Laboratories (NCL), Inc.: “24/7 Extended Performance Floor Finish”

E. VCT Floor Finish for static dissipation tile: Manufacturer’s static dissipative tile polish.

F. Grounding Strips: Copper grounding strips as recommended by the manufacturer.

2.4 FLOOR TRANSISTIONS

A. Vinyl Transitions

1. Description: Transitions, reducer, edge strips and adaptors strips as required to accommodate edge conditions and joints between different flooring materials.
2. Basis of Design: “Slim Line Reducer/Edge Strips”
   a. Manufacturers: The basis of design products are manufactured by Tarkett/Johnsonite. Equal or better performing products of other manufacturers will be considered for acceptance by the Architect.

3. Profile and Dimensions: Provide profiles to fit conditions and as recommended by flooring installer unless indicated otherwise. Profile and width of height required to protect exposed edge of carpet and provide transition to adjacent materials, and of maximum lengths to minimize running joints. Final Selection shall be as approved by the Architect.
4. Locations: Provide at transition between floor types and at edges of floor covering that would otherwise be exposed unless indicated otherwise.
5. Colors and Patterns: As selected by Architect from full range of industry colors.
6. Trim: Tile to carpet reducer shall be model #150, carpet reducer shall be model #800, tile reducer shall be #633 and feature strip shall be #643 as manufactured by Burke.
7. Manufacturer is as indicated however equal or better performing products of other manufacturers will be considered for acceptance by the Architect.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas where installation of flooring will occur, with Installer present. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by tile manufacturer.
2. Finishes of subfloors comply with tolerances and other requirements specified in Division 03 Section "Cast-In-Place Concrete" for slabs receiving resilient flooring.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.

3.2 PREPARATION

A. Comply with manufacturer's installation specifications to prepare substrates to receive flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient stile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to resilient tile manufacturer's written recommendations, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Use trowelable leveling and patching compounds per manufacturer's directions to fill cracks, holes, and depressions in substrates.

D. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

E. Broom or vacuum clean substrates to be covered by flooring immediately before installation. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

F. Apply concrete slab primer, if recommended by flooring manufacturer, before applying adhesive. Apply according to manufacturer's directions.

G. When installing resilient flooring over fiber reinforced concrete, the fibers will either have to be ground off or level the slab with cementitious underlayment. Exposed reinforcing fibers are considered matter that will adversely affect the appearance of the installed resilient flooring.

3.3 INSTALLATION

A. Comply with manufacturer's installation directions and other requirements indicated that are applicable to each type of installation included in Project.

B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width, unless noted otherwise Adjust to avoid using cut widths at perimeter that equal less than one-half of a tile, unless noted otherwise Install tiles square with room axis, unless otherwise indicated.

C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in pattern with respect to location of colors, patterns, and sizes as indicated on drawings.

D. Scribe, cut, and fit tiles to butt tightly to vertical surfaces, permanent fixtures, built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

E. Extend flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.

G. Install flooring on covers for telephone and electrical ducts, and similar items occurring within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly adhere edges to perimeter of floor around covers and to covers.

H. Adhere flooring substrates without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed tile installation.

I. Use full spread of adhesive applied to substrate in compliance with manufacturer's directions including those for trowel notching, adhesive mixing, and adhesive open and working times. Spray applied adhesives are not allowed.

J. Hand roll flooring where required by manufacturer.

K. Apply resilient base to walls, columns, pilasters, casework, and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

1. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
2. Install preformed corners before installing straight pieces.

L. Apply transition accessories at edges of carpeting materials and resilient flooring that would otherwise be exposed.

M. Install grounding strips per manufacturer’s recommendations.

3.4 CLEANING AND PROTECTION

A. Perform the following operations after completing installation and in coordination with Owners approved maintenance regiment:

1. Allow adhesive to dry for 48 hours after installation.
2. Remove visible adhesive and other surface blemishes using cleaner recommended by manufacturers.
3. Sweep or vacuum floor thoroughly.
4. Do not wash floor until after time period recommended by resilient floor manufacturer.
5. Damp-mop surfaces with neutral detergent solution while machine scrubbing to remove soil marks.
6. Pick up spent solution with mop or wet vacuum as soon as each floor section has been stripped. Do not allow solution to dry. Rinse thoroughly with clear water. Allow floor to dry thoroughly before applying floor finish.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended by manufacturer or if not recommended, use 1/4-inch thick corrugated cardboard, securing to floor surfaces with “3M” tape. Maintain integrity of covered areas until resilient flooring is ready to receive final floor coating/sealer finishes before Substantial Completion.

3.5 INDOOR AIR QUALITY

A. Temporary ventilation: Provide temporary ventilation as specified – Indoor Air Quality (IAQ) Management, and as follows:

B. Ventilate products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 degrees F minimum to 90 degrees F maximum continuously for minimum 72 hours. Do not ventilate within limits of Work unless otherwise approved by Architect.

3.6 WASTE MANAGEMENT

A. Collect cutoffs and scrap and place in designated areas for recycling.

B. Coordinate with manufacturer and local recycler for take-back program or recycling. Set aside scrap to be returned to manufacturer for recycling into new product.

END OF SECTION 09 65 19

SECTION 09 84 33
ACOUSTICAL WALL PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Acoustical wall panels.

1.3 QUALITY ASSURANCE

A. All packages shall be clearly marked and labeled at plant with manufacturer's name and indicate the specific materials specified.

1.4 REFERENCES

A. ASTM C423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
B. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
C. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
D. UL 723 Tests for Surface Burning Characteristics of Building Materials

1.5 SUBMITTALS

A. Submit complete specifications and installation instructions for all materials furnished.
B. Submit full range of color samples for Architect's selection.
C. Submit shop drawings showing materials, installation details, sizes, and layout.
D. Product Data: Unless otherwise indicated, submit the following for each type of product provided under work of this Section:
   1. Recycled Content:
      a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
      b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
      c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
      d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
   2. Local/Regional Materials:
      a. Sourcing Location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

b. Manufacturing Location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

3. Toxicity/IEQ: Mold and mildew resistant:
   a. Perlite Acoustical Panels: Provide volcanic perlite, clay, and inorganic binders.
4. Toxicity/IEQ: Products shall contain no added formaldehyde.

1.6 DELIVERY, STORAGE & HANDLING

A. Handle material per manufacturer's requirements.
B. Store the materials in the original packaging material in a clean dry area until ready for installation.
C. Do not install until cleanliness and temperature is controllable.

1.7 WARRANTY

A. Provide written warranty, executed by the manufacturer, agreeing to replace defected products for one year after final acceptance.

1.8 MAINTENANCE

A. Provide owner with manufacturer's recommendations for cleaning and repairing panels.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer shall be one of the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product
   1. AVL System, Inc of FL.
   2. Armstrong

2.2 INTERIOR ACOUSTICAL WALL PANELS:

A. Provide 2" thick panels in a size per drawings with fiberglass core material (6 PCF) and minimum NRC of 0.80 per inch.
B. Panels shall have beveled edges and be furnished with continuous chemically hardened internal edge protection.
C. Provide woven polyester fabric covering the face, all edges, and a return on the back of a minimum of 1½".
D. All components utilized in the construction of these wall panels shall meet Class A (0-25) rating per ASTM E84, fuel contribution of 20, and smoke density value of 65.
E. Architect will select colors from manufacturer's full range.

F. Mounting Accessories: Manufacturer's standard Z-clips and trim for interior and exterior corners, leveling and base support, and as required. Provide panel manufacturer's standard factory applied finish on exposed items in the following color:
   1. Color: Match color of facing material.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Complete installation and workmanship for each type of acoustical system specified under this section in strict accordance with the manufacturers' standard printed specification, recommendations and as detailed on the drawings.
B. The wall panels shall be mounted utilizing Z-clips.

3.2 PROTECTION OF FINISHED WORK

A. Protect finished work.

3.3 SITE ENVIRONMENTAL PROCEDURES

A. Waste Management: As specified – Construction Waste Management Plan.

END OF SECTION

SECTION 09 91 13 – EXTERIOR PAINTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Exterior paint and coating systems.

1.3 REFERENCES

A. ASTM D16 – Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
B. ASTM D3359 – Standard Test Methods for Measuring Adhesion by Tape Test.
C. ASTM D4442-92 – Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood Base Materials.
D. EPA – Method 24.
E. GS-11, GC-03.
F. NACE International (National Association of Corrosion Engineers) – Industrial Maintenance Painting.
G. NPCA (National Paint and Coatings Association) – Guide to U.S. Government Paint Specifications.
H. Paint – Certified Product List - Florida Department of Agriculture and Consumer Services.
I. PDCA (Painting and Decorating Contractors of America) – Architectural Painting Specifications Manual.
J. PDCA Standard P1-04 Touchup Painting and Damage Repair; Financial Responsibility.
K. PDCA Standard P5-04 Benchmark Sample Procedures for Paint and other Decorative Coating System.
L. SSPC (Steel Structures Painting Council) – Steel Structures Painting Manual.
M. SSPC-SP 1 – Solvent Cleaning.
N. Modern Guide to Paint Specifications (current edition) – Standard Type 1.

1.4 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product:

1. Product characteristics
2. Surface preparation instructions and recommendations
3. Primer requirements and finish specifications
4. Storage and handling requirements
5. Application methods
6. Cautions and VOC levels, certification from manufacturer that products comply with local regulations controlling volatile organic compounds (VOC's).
7. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
8. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

B. Samples:

1. Submit a complete set of color chips representing the full range of manufacturer's color samples available.
2. Submit two 9" x 9" samples illustrating selected colors and textures for each type.

1.6 INFORMATION SUBMITTALS

A. Closeout Documents:

1. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as "Custodian Project Color and Product Information" by Sherwin-Williams or equal. Manual shall include an Area Summary with finish schedule designating where each product/color/finish was used. It shall also include care and cleaning instructions, touch up procedures, and a Product Data Sheet for each product used.

1.7 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5-years documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum 5-years documented experience.

C. The painting manufacturer's representative shall visit the site and review the paint application during the priming and the finish painting application and report to the Construction Manager, Contractor and Architect as to the acceptability of the application.

D. Existing Coatings: The manufacturer's representation shall visit the site to confirm acceptability of existing surfaces to receive paint and make recommendations to specified paint systems to obtain proper compatibility.

1.8 MOCKUPS

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

B. Architect will select one surface to represent surfaces and conditions for application of each paint system.

1. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. and at exterior inside and outside corner.
2. Other Items: Architect will designate items or areas required.

C. Final approval of color selections will be based on mockups.

1. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

D. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

E. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRE-INSTALLATION MEETING

A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

B. The paint manufacturer’s representative shall review the painting systems with the Construction manager, Contractor, Architect, and painting Contractor.

1.10 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke rating requirements for finishes.

B. Painting manufacturer and Contractor shall conform to Federal Rules and Regulations, Vol. 63, No. 176, September 11, 1998, State and local VOC (Volatile Organic Compound) Regulations in area where Project is located. Notify Architect in writing if variations to Specifications herein are required.

1. VOC content shall be a maximum 350 gm/liter, unless noted otherwise.

C. VOC Content: Determine VOC (Volatile Organic Compound) content of solvent borne and waterborne paints and related coatings in accordance with EPA Method 24 or ASTM D3960.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

B. Storage:

1. Store paint materials in a properly ventilated area at the temperature range required by the manufacturer.
2. Store and dispose of solvent-based materials and materials used with solvent-based materials in accordance with manufacturers and other regulating authorities having jurisdiction.

1.12 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.13 MAINTENANCE MATERIAL

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.14 WARRANTY

A. Contractor shall provide five (5) year warranty against defects in labor and installation of paint materials in the form indicated at the end of this section.

B. Manufacturer shall provide five (5) year warranty against defects in all paint products and materials incorporated into the work.

C. Manufacturer shall provide fifteen (15) year warranty against defects in textured paint products and materials incorporated into the work.

D. The manufacturer shall assume all responsibility for substrate acceptance and adhesion and to uphold the required warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers

1. The painting schedule is based on products manufactured by the Sherwin-Williams Company and Textured Coatings of America.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Sherwin Williams
2. Textured Coatings of America.
3. Benjamin Moore & Co.
4. Florida Paint

2.2 COMPATIBILITY

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists.

B. Paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with the surface to be coated; tools and equipment shall be compatible with the coating to be applied.

1. Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristic of finish materials to ensure use of compatible primers.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Adhesion Test: Provide adhesion X-cut and tape test for primer adhesion per ASTM D3359 for every 200 s.f. of primed area.

D. Thinners, when used, shall be only those thinners recommended for that purpose by the manufacturer of the material to be thinned.

E. The term "paint," as used herein, includes enamels, paints, sealers, stains, fillers, emulsions, and other coatings, whether used as prime, intermediate, or finish coats.

2.3 ACCEPTANCE OF SPECIFICATION

A. By submitting a proposal, the Contractor has reviewed the bidding documents with the painting subcontractor and accepts the Specifications as sufficient to produce approved painting results. If the painting subcontractor contends that the materials or number of coats specified will not produce satisfactory results, he shall so notify the Architect directly or indirectly through a Bidding Contractor 14 days prior to receipt of bids for proper action.

B. The type of material to be used and the number of coats to be applied are listed in the "Painting Schedule" of this section of these specifications. Also refer to Room Finish Schedule.

1. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
2. The Architect shall not be limited in the number of colors selected for single space or for the complete Project.
3. The architect shall make the final selection of the finish sheen.

2.4 PAINTING SCHEDULE

A. Concrete (Cast-In Place, Precast Concrete)

1. Latex Systems
   a. Gloss Finish
      1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2-dry) – MPI#3
      2nd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series – MPI#11
      3rd Coat: S-W A-100 Exterior Latex Gloss, A8W150Series (1.3-mil dry per coat)
   b. Semi-Gloss Finish
      1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2-dry) – MPI#3
      2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 – MPI#153
      3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 (2.5-4.0-mil dry per coat)
   c. Satin Finish
      1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2-dry) – MPI#3
      2nd Coat: S-W SuperPaint Acrylic Satin, A89 Series – MPI#15
      3rd Coat: S-W SuperPaint Acrylic Satin, A89 Series (1.4-mil dry per coat)
2. Elastomeric Systems
   a. Flat Finish
      1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2-dry) – MPI#3
      2nd Coat: S-W ConFlex SherLastic Elastomeric Masonry Coating, CF16W50 Series – MPI#113
      3rd Coat: S-W ConFlex SherLastic Elastomeric Masonry Coating, CF16W50 Series (4.0-6.0-mil dry per coat)
3. Clear Water Repellant
   a. Clear Finish
      1st Coat: S-W ConFlex Water Repellent 7% Siloxane, CF31T7 – MPI#117
      2nd Coat: S-W ConFlex Water Repellent 7% Siloxane, CF31T7 (50-200 sq ft/gal per coat)

B. Tilt Up

1. Textured Coating
   a. 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2 dry) – MPI#3
      2nd Coat: S-W ConFlex UltraCrete Textured Masonry Topcoat, CF17W800 Series (9.4 mils) – MPI#41, Texture and color as selected by Architect.
2. Textured Coating
   a. 1st Coat: Tex-Cote XL- 70 "W" Primer (250 – 350 square feet per gallon)
      2nd Coat: Tex-Cote XL-70 "W" Textured Coating (15 mils dry), Texture and color as selected by Architect.
3. Textured Coating (15 year warranty)
   a. 1st Coat: S-W UltraCrete Textured Masonry Topcoat, A44W800 Series, (9.4 mils) – MPI#41, Texture and color as selected by the Architect.
      2nd Coat: S-W Emerald Exterior Satin, K48 Series, (5.3-6.4 mils) – MPI#11, Texture and color as selected by the Architect.
      3rd Coat: S-W Emerald Exterior Satin, K48 Series, (5.3-6.4 mils) – MPI#11, Texture and color as selected by the Architect.

C. Cement Plaster and Cementitious Siding

1. Latex Systems
   a. Gloss Finish
      1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2-dry) – MPI#3
      2nd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series – MPI#11
      3rd Coat: S-W A-100 Exterior Latex Gloss, A8W150Series (1.3-mil dry per coat)
   b. Semi-Gloss Finish
      1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2-dry) – MPI#3
      2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 – MPI#153
      3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 (2.5-4.0-mil dry per coat)
   c. Satin Finish
      1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2-dry) – MPI#3
      2nd Coat: S-W SuperPaint Acrylic Satin, A89 Series – MPI#15
      3rd Coat: S-W SuperPaint Acrylic Satin, A89 Series (1.4-mil dry per coat)

D. Synthetic Stucco

1. Latex Systems
   a. Gloss Finish
      1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 – MPI#3
      2nd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series – MPI#11
      3rd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series (1.3-mil dry per coat)
   b. Semi-Gloss Finish
      1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 – MPI#3
      2nd Coat: S-W - Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series (2.5-4.0-mil dry per coat) - MPI #153
      3rd Coat: S-W - Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series (2.5-4.0-mil dry per coat)

c. Flat Finish
1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 – MPI#3
2nd Coat: S-W A-100 Exterior Latex Flat, A6 Series - MPI #10
3rd Coat: S-W A-100 Exterior Latex Flat, A6 Series (1.4-mil dry per coat)

E. Masonry (CMU, Split-Face, Scored, Smooth, High-Density, Low- Density, Fluted)

1. Latex Systems
a. Gloss Finish
1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 (8-10.5mil dry) – MPI#4 X-Green
2nd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series – MPI#11
3rd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series (1.3-mil dry per coat)
b. Semi-Gloss Finish
1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 (8-10.5mil dry) - MPI#4 X-Green
2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series – MPI#153
3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series (2.5-4.0-mil dry per coat)
c. Satin Finish
1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 (8-10.5mil dry) - MPI#4 X-Green
2nd Coat: S-W SuperPaint Acrylic Satin, A89 Series – MPI#15
3rd Coat: S-W SuperPaint Acrylic Satin, A89 Series (1.4-mil dry per coat)
2. Elastomeric Systems
a. Flat Finish
1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (3.2-dry) – MPI#3
2nd Coat: S-W ConFlex Sherlastic Elastomeric Masonry Coating, CF16W50 Series – MPI#113
3rd Coat: S-W ConFlex SherLastic Elastomeric Masonry Coating, CF16W50 Series (4.0-6.0-mil dry per coat)
3. Clear Water Repellant
a. Clear Finish
1st Coat: S-W ConFlex Water Repellent 7% Siloxane, CF31T7 – MPI#117
2nd Coat: ConFlex Water Repellent 7% Siloxane, CF31T7 (50-200 sq ft/gal per coat)

F. Metal – (Aluminum, Galvanized)

1. Latex Systems
a. Gloss Finish
1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (5.0 - 10.0-mil dry) – MPI#107
2nd Coat: S-W Pro Industrial DTM Acrylic Gloss Coating, B66W1050 Series – MPI#114
3rd Coat: S-W Pro Industrial DTM Acrylic Gloss Coating, B66W1050 Series (2.5 - 4.0-mil dry per coat)
b. Semi-Gloss Finish

1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (5.0 - 10.0-mil dry) – MPI#107
2nd Coat: S-W Pro Industrial DTM Acrylic Semi-Gloss Coating, B66W1150 Series - MPI#114
3rd Coat: S-W Pro Industrial DTM Acrylic Semi-Gloss Coating, B66W1150 Series (2.5 - 4.0-mil dry per coat)

G. Metal – (Misc. Iron, Ornamental Iron, Structural Iron, Ferrous Metal)

1. Latex Systems
   a. Gloss Finish
      1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 - 4.0-mil dry) – MPI#107
      2nd Coat: S-W Pro Industrial DTM Acrylic Gloss Coating, B66W1050 Series - MPI#114
      3rd Coat: S-W Pro Industrial DTM Acrylic Gloss Coating, B66W1050 Series – (2.5 - 4.0-mil dry per coat)
   b. Semi-Gloss Finish
      1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 - 4.0-mil dry) – MPI#107
      2nd Coat: S-W Pro Industrial DTM Acrylic Semi-Gloss Coating, B66W1150 Series – MPI#114
      3rd Coat: S-W Pro Industrial DTM Acrylic Semi-Gloss Coating, B66W1150 Series (2.5 - 4.0-mil dry per coat)

H. Wood (Siding, Trim, Shutters, Hardboard-Bare/Primed)

1. Latex Systems
   a. Gloss Finish
      1st Coat: S-W Exterior Latex Primer, B42Series (1.4-mil dry) – MPI#4
      2nd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series – MPI#11
      3rd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series (1.3-mil dry per coat)
   b. Semi-Gloss Finish
      1st Coat: S-W Exterior Latex Primer, B42Series (1.4-mil dry) – MPI#4
      2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series – MPI#153
      3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series (2.5-4.0-mil dry per coat)

I. Architectural PVC, Plastic, Fiberglass

1. Latex Systems
   a. Gloss Finish
      1st Coat: S-W Multi-Purpose Latex Primer/Sealer, B51-450 Series (1.4-mil dry) – MPI#17
      2nd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series – MPI#11
      3rd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series (1.3-mil dry per coat)
   b. Semi-Gloss Finish
      1st Coat: S-W Multipurpose Latex Primer/Sealer, B51-450 Series (1.4-mil dry) – MPI#17

2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series – MPI#153
3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series (2.5-4.0-mil dry per coat)

J. Drywall (Gypsum Board, Exterior Drywall)

1. Latex Systems
   a. Gloss Finish
      1st Coat: S-W Multipurpose Latex Primer/Sealer, B51-450 Series (1.4-mil dry) – MPI#17
      2nd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series – MPI#11
      3rd Coat: S-W A-100 Exterior Latex Gloss, A8W150 Series (1.3-mil dry per coat)
   b. Semi-Gloss Finish
      1st Coat: S-W Multipurpose Latex Primer/Sealer, B51-450 Series (1.4-mil dry) – MPI#17
      2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series – MPI#153
      3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66W1150 Series (2.5-4.0-mil dry per coat)

K. Concrete, Masonry and Cement Plaster – Deck and Underside Coating

1. Tex Cote – Cool Tec Solid Deck Coating as manufactured by Textured Coatings of America.
   a. 1st Coat: Cool Tec, (13 – 18 mils).
      2nd Coat: Cool Tec, (13 – 18 mils) with slip resistant aggregate texture. Color as selected by Architect; two colors will be selected.
      Location all surfaces unless indicated otherwise.
2. Tex Cote – Bridge Coat Coating as manufactured by Textured Coatings of America.
   a. 1 Coat System: XL 70 “W” Bridge Coat (15 – 17 mils).
      Location: Underside and sides of structure as indicated by the Architect.
      Texture and color as selected by Architect.

2.5 MATERIALS – GENERAL REQUIREMENTS

A. Paints and Coatings – General

1. Unless otherwise indicated, provide factory-mixed coatings.
2. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application.
3. Do not reduce, thin, or dilute coatings or add materials to coatings unless approved in manufacturer's product instructions.
4. Confirm VOC’s need by using the products MSDS sheets.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as “best” by the manufacturer.

2.6 ACCESSORIES

A. Coating application accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows (Do not apply finishes unless moisture content of surfaces is below the following maximums):

1. Concrete: 12 percent
2. Fiber-Cement Board: 12 percent
3. Masonry (Clay and CMUs): 12 percent
4. Wood: 15 percent
5. Gypsum Board: 12 percent
6. Plaster: 12 percent

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

E. Do not begin application of coatings until substrates have been properly prepared; notify Owner's Representative of unsatisfactory conditions before proceeding.

F. If substrate preparation is the responsibility of another installer, notify Owner's Representative of unsatisfactory preparation before proceeding.

G. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

H. Test shop applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

C. The surface shall be dry and in sound condition. Remove all oil, dust, dirt, loose rust, peeling paint, or other contamination to ensure good adhesion.

D. Provide barrier coats over incompatible primers or remove and re-prime. Notify Architect in writing about anticipated problems using the specified finish coat material with substrates primed by others.

E. Impervious Surfaces:

1. Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach.
2. Rinse with clean water and allow surface to dry.

F. Aluminum Surfaces:

1. Remove all oil, grease, dirt, oxide, and other foreign material by cleaning per SSPC-SP1 Solvent Cleaning.

G. Block/Unit Masonry (Cinder and Concrete)

1. Remove all loose mortar and foreign material.
2. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners.
3. Let concrete and mortar cure at least 30 days at 75°F unless the manufactures products are designed for application prior to the 30-day period.
4. The pH of the surface and moisture content must be in accordance with the paint manufacturer’s recommendations prior to painting.

H. Concrete:

1. Remove contamination by washing with an appropriate cleaner, rinse thoroughly.
2. The pH of the surface and moisture content shall be in accordance with the paint manufacturer’s recommendations prior to painting.
3. Allow the surface to thoroughly dry.
4. Clean concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid or other etching cleaner. Flush floor with clean water to neutralize acid and allow to dry before painting.
5. Fill bug holes, air pockets, and other voids under another section with a cement-patching compound of sufficient cohesive strength to support the specified coating system.

I. Drywall:

1. Shall be clean, dry and all dust removed prior to painting.
2. All nail heads must be set and spackled.
3. Tape all joints and cover with a joint compound.
4. Spackled nail heads and tape joints shall be sanded smooth.

J. Galvanized Surfaces:

1. Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils.
2. Apply a test area, priming as required.
3. Allow the coating to cure in accordance with the manufacturer's recommendation before testing.
4. Perform adhesion tests in accordance with ASTM 3359 Adhesion by Tape Test.
5. If adhesion is poor, then notify Owner's representative that additional surface preparation under another section is necessary to remove pre-treatments or contaminants that interfere with adhesion of the coating.

K. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

L. Plaster Cement Surfaces:

1. Shall allow to thoroughly dry for at least 30 days before painting unless the manufacturer's products are designed for application prior to the 30-day period.
2. Bare plaster must be cured and hard prior to painting.
3. Correct any soft, porous, or powdery plaster per requirements under another section of the specifications.

M. Steel: Structural, Plate, etc.:

1. Check other sections for additional surface preparation and shop priming of bare steel surfaces.
2. Surface preparation shall include appropriate SSPC recommended methods.
   a. Shop primer shall be compatible with the field-applied coatings.
   b. Surfaces shall be dry and clean prior to the application of field-applied coatings.
   c. Remove all contaminants in accordance with SSPC-SP1 Solvent Cleaning or SSPC Method recommended for condition of substrate.

N. Wood:

1. Shall be clean and dry, then prime and paint as soon as possible.
2. Scrape, sand, and spot prime knots and pitch streaks before a full priming coat is applied.
3. Patch all nail holes and imperfections with a wood filler or putty and sand smooth after application of primer.
4. Seal with shellac any marks, which may bleed through surface finishes.
5. Wood Doors: Finish doors on tops, bottoms, and side edges same as hinge side face, unless otherwise indicated.

3.3 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

D. Use only thinners approved by the paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat of lighter shade to facilitate identification of each coat where multiple coats of the same materials are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

F. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming surface treatment specified under other sections.

G. Preparation and testing of existing painted surfaces, indicated to be repainted to accommodate new work, shall be performed as work of this section.

3.4 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

B. Use applicators and techniques suited for paint and substrate indicated.

1. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
3. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
4. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.
5. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
6. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
7. Apply paint in a cross-hatch application to achieve an even coverage.

3.5 FIELD QUALITY CONTROL

A. The right is reserved by Owner/Architect to invoke the following material testing procedure in addition to other tests indicated when and as often as he deems necessary during the period of field painting.

B. Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified, and sealed, and certified in presence of Contractor.

C. Testing laboratory will perform appropriate tests for one or each of the following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance, and quantitative materials analysis.

D. A test patch for applied paint adhesion may be required.

1. Adhesion text shall provide the adhesion X-cut and tape test for adhesion per ASTM D3359 for areas selected by the Architect.
2. Areas found to be defective shall have paint removed and repainting shall be provided.
3. Owner/Architect may require retesting.

E. A test patch for adhesion may also be required. The procedure for the test patch is as follows:

1. An area that represents the worst condition of the existing paint is selected.
2. The surface is prepared as appropriate for the repaint work.
3. The new coating or coating system is applied.
4. The coating is allowed to cure for at least 7 days at 75 degrees F. or according to the coating manufacturer's instructions.
5. After proper curing the adhesion is tested using an acceptable method such as the Adhesion by Tape Test (ASTM D 3359).

F. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove noncomplying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the 2 coatings are noncompatible.

3.6 EQUIPMENT

A. Paint the following work where exposed.

1. Uninsulated metal and plastic piping.
2. Pipe hangers and supports.
3. Metal and plastic conduit.

3.7 CLEAN-UP AND PROTECTION

A. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Provide "Wet Paint" signs as required to protect newly painted finishes.

C. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

D. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.8 TOUCH-UP AND DAMAGE REPAIR

A. Contractor shall repair all deficiencies in coating application in accordance with PDCA Standard P1-04.

B. Inform Owner's representative of all damage to properly painted surfaces and receive authorization prior to performing damage repair.

3.9 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality: Provide temporary ventilation as specified in section "Temporary Controls."

B. Waste Management: As specified in section "Temporary Construction Facilities" and as follows:

1. Coordinate with manufacturer for take-back program. Set aside scrap to be returned to manufacturer for recycling into new product. Close and seal all partially used containers of pain to maintain quality as necessary for reuse.

END OF SECTION 09 91 13

SECTION 09 91 23 – INTERIOR PAINTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:

1. Interior paint and coating systems.

1.3 REFERENCES

A. ASTM D16 – Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
B. ASTM D3359 – Standard Test Methods for Measuring Adhesion by Tape Test.
C. ASTM D4442-92 – Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood Base Materials.
D. EPA – Method 24.
E. GS-11, GC-03.
F. NACE International (National Association of Corrosion Engineers) – Industrial Maintenance Painting.
G. NPCA (National Paint and Coatings Association) – Guide to U.S. Government Paint Specifications.
H. Paint – Certified Product List - Florida Department of Agriculture and Consumer Services.
I. PDCA (Painting and Decorating Contractors of America) – Architectural Painting Specifications Manual.
J. PDCA Standard P1-04 Touchup Painting and Damage Repair; Financial Responsibility.
K. PDCA Standard P5-04 Benchmark Sample Procedures for Paint and other Decorative Coating System.
L. SSPC (Steel Structures Painting Council) – Steel Structures Painting Manual.
M. SSPC-SP 1 – Solvent Cleaning.
N. Modern Guide to Paint Specifications (current edition) – Standard Type 1.

1.4 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product:

1. Product characteristics
2. Surface preparation instructions and recommendations
3. Primer requirements and finish specifications
4. Storage and handling requirements
5. Application methods
6. Cautions and VOC levels, certification from manufacturer that products comply with local regulations controlling volatile organic compounds (VOC's).
7. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
8. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

B. Samples:

1. Submit a complete set of color chips representing the full range of manufacturer's color samples available.
2. Submit two 9" x 9" samples illustrating selected colors and textures for each type.

1.6 INFORMATION SUBMITTALS

A. Closeout Documents:

1. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as "Custodian Project Color and Product Information" by Sherwin-Williams or equal. Manual shall include an Area Summary with finish schedule designating where each product/color/finish was used. It shall also include care and Cleaning instructions, touch up procedures, and a Product Data Sheet for each product used.

1.7 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5-years documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum 5-years documented experience.

C. The painting manufacturer's representative shall visit the site and review the paint application during the priming and the finish painting application and report to the Construction Manager, Contractor and Architect as to the acceptability of the application.

D. Existing Coatings: The manufacturer's representation shall visit the site to confirm acceptability of existing surfaces to receive paint and make recommendations to specified paint systems to obtain proper compatibility.

1.8 MOCKUPS

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

B. Architect will select one surface to represent surfaces and conditions for application of each paint system.

1. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. and at exterior inside and outside corner.
2. Other Items: Architect will designate items or areas required.

C. Final approval of color selections will be based on mockups.

1. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

D. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

E. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRE-INSTALLATION MEETING

A. The contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

B. The paint manufacturer's representative shall review the painting systems with the Construction Manager, Contractor, Architect, Interior Design and painting Contractor.

1.10 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke rating requirements for finishes.

B. Painting manufacturer and Contractor shall conform to Federal Rules and Regulations, Vol. 63, No. 176, September 11, 1998, State and local VOC (Volatile Organic Compound) Regulations in area where Project is located. Notify Architect in writing if variations to specifications herein are required.

1. VOC content shall be a maximum 350 gm/liter, unless noted otherwise.

C. VOC Content: Determine VOC (Volatile Organic Compound) content of solvent borne and waterborne paints and related coatings in accordance with EPA Method 24 or ASTM D3960.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

B. Storage:

1. Store paint materials in a properly ventilated area at the temperature range required by the manufacturer.
2. Store and dispose of solvent-based materials and materials used with solvent-based materials in accordance with manufacturers and other regulating authorities having jurisdiction.

1.12 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Provide lighting level of 80 foot-candles measured mid-height at substrate surface.

1.13 MAINTENANCE MATERIAL

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.14 WARRANTY

A. Contractor shall provide five (5) year warranty against defects in labor and installation of paint materials in the form indicated at the end of this section.

B. Manufacturer shall provide five (5) year warranty against defects in all paint products and materials incorporated into the work.

C. The manufacturer shall assume all responsibility for substrate acceptance and adhesion and to uphold the required warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers

1. The painting schedule is based on products manufactured by the Sherwin-Williams Company.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Sherwin-Williams Company
2. Benjamin Moore & Co.
3. Florida Paint

2.2 COMPATIBILITY

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists.

B. Paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with the surface to be coated; tools and equipment shall be compatible with the coating to be applied.

1. Review other sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristic of finish materials to ensure use of compatible primers.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Adhesion Test: Provide adhesion X-cut and tape test for primer adhesion per ASTM D3359 for every 200 s.f. of primed area.

D. Thinners, when used, shall be only those thinners recommended for that purpose by the manufacturer of the material to be thinned.

E. The term "paint," as used herein, includes enamels, paints, sealers, stains, fillers, emulsions, and other coatings, whether used as prime, intermediate, or finish coats.

2.3 ACCEPTANCE OF SPECIFICATION

A. By submitting a proposal, the Contractor has reviewed the bidding documents with the painting subcontractor and accepts the Specifications as sufficient to produce approved painting results. If the painting subcontractor contends that the materials or number of coats specified will not produce satisfactory results, he shall so notify the Architect directly or indirectly through a Bidding Contractor 14 days prior to receipt of bids for proper action.

B. The type of material to be used and the number of coats to be applied are listed in the "Painting Schedule" of this section of these specifications. Also refer to Room Finish Schedule.

1. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
2. The Architect shall not be limited in the number of colors selected for single space or for the complete Project.
3. The Architect shall make the final selection of the finish sheen.

2.4 PAINTING SCHEDULE

A. Concrete (Walls, Ceilings, Poured, Precast, Cement Plaster, Cement Board, and Cast-In Place)

1. Latex Systems
   a. Gloss Finish
      1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (8-mil wet, 3.2-dry) – MPI #3
      2nd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series – MPI #114
      3rd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series, (2.5 - 4-mil dry per coat)
   b. Semi-Gloss Finish
      1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (8-mil wet, 3.2-dry) – MPI #3
      2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series – MPI #153
      3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series (2.5 - 4-mil dry per coat)
   c. Eggshell/Satin Finish
      1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (8-mil wet, 3.2-dry) – MPI #3S-W Pro Industrial Heavy-Duty Block Filler, B42W150 at 75-100 sq/gallon
      2nd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series – MPI #144 X-Green
      3rd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series (1.6-mil dry per coat)
   d. Flat Finish – Ceilings Only
      1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, LX02W50 (8-mil wet, 3.2-dry)
      2nd Coat: S-W Harmony Low Odor Interior Latex Flat, B5 Series
      3rd Coat: S-W Harmony Low Odor Interior Latex Flat, B5 Series (4-mil wet, 1.6-mil dry per coat)

2. Epoxy System (Water Base)
   a. Gloss Finish

1st Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-300/ B73V300 – MPI #254X-Green
2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-300/ B73V300 - (2.0 – 4.0-mil dry per coat)

b. Semi-Gloss Finish
1st Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B70/B60V25 – MPI #254X-Green
2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B70/B60V25 - (2.0 – 4.0-mil dry per coat)

c. Eggshell/Satin Finish
1st Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 / B73V300 – MPI #254X-Green
2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 / B73V300 - (2.0 – 4.0-mil dry per coat)

B. Masonry (CMU, Split-Face, Scored, Smooth, High-Density, Low- Density, Fluted)

1. Latex Systems
a. Gloss Finish
1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 at 75-100 sq/gallon – MPI #4
2nd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series – MPI #114
3rd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series, (2.5 - 4-mil dry per coat)

b. Semi-Gloss Finish
1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 at 75-100 sq/gallon – MPI#4
2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series – MPI #114
3rd Coat: S-W Pro Industrial Acrylic Semi-GlossGloss Coating, B66-650 Series (2.5 - 4-mil dry per coat)

c. Eggshell/Satin Finish
1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 at 75-100 sq/gallon – MPI#4
2nd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series – MPI #144 X-Green
3rd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series (1.6-mil dry per coat)

2. Water Epoxy System (Water Base)
a. Gloss Finish
1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 at 75-100 sq/gallon – MPI#4
2nd Coat: Pro Industrial Water Based Catalyzed Epoxy, B73-300/ B73V300 – MPI #254X-Green
3rd Coat: Pro Industrial Water Based Catalyzed Epoxy, B73-300/ B73V300 (2.0 – 4.0-mil dry per coat)

b. Semi-Gloss Finish
1st Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B70/B60V25 – MPI #254X-Green

2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B70/B60V25 - (2.0 – 4.0-mil dry per coat)

c. Eg-Shel Finish
1st Coat: S-W Pro Industrial Heavy-Duty Block Filler, B42W150 at 75-100 sq/gallon – MPI#4
2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 / B73V300 – MPI #254X-Green
3rd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 / B73V300 (2.0 – 4.0-mil dry per coat)

C. Metal – (Aluminum, Galvanized)

1. Latex Systems
a. Gloss Finish
1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 – 4.0-mil dry per coat) – MPI #107
2nd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series – MPI #114
3rd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series Series (2.5 - 4.0-mil dry per coat)
b. Semi-Gloss Finish
1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 – 4.0-mil dry per coat) – MPI #107
2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series – MPI #153
3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series (2.5 - 4.0-mil dry per coat)
c. Eg-Shel/Satin Finish
1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 – 4.0-mil dry) – MPI#107
2nd Coat: S-W Pro Industrial DTM Acrylic Eg-Shel Coating, B66W1250 Series – MPI #151X-Green
3rd Coat: S-W Pro Industrial DTM Acrylic Eg-Shel Coating, B66W1250 Serie (2.5 - 4.0-mil dry per coat)

D. Metal – (Galvanized; Ceiling, Ductwork)

1. Dryfall Waterborne Systems
a. Eggshell Finish
1st Coat: S-W Pro Industrial Waterborne Acrylic Dry-Fall Eg-Shel, B42W82
2nd Coat: S-W Pro Industrial Waterborne Acrylic Dry-Fall Eg-Shel, B42W82 (1.9 – 2.9-mil dry per coat)

E. Metal – (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous & Ornamental Iron, Structural Iron, Ferrous Metal)

1. Latex Systems
a. Gloss Finish
1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 – 4.0-mil dry) – MPI #107
2nd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series – MPI #114

3rd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series (2.5 - 4.0-mil dry per coat)

b. Semi-Gloss Finish
1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 – 4.0-mil dry) – MPI #107
2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series – MPI #153
3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series (2.5 - 4.0 mils dry per coat)

c. Eg-Shel/Satin Finish
1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (2.0 – 4.0-mil dry) – MPI#107
2nd Coat: S-W Pro Industrial DTM Acrylic Eg-Shel Coating, B66W1250 Series – MPI #151X-Green
3rd Coat: S-W Pro Industrial DTM Acrylic Eg-Shel Coating, B66W1250 Serie (2.5 - 4.0-mil dry per coat)

2. Epoxy Systems (Water Base)
a. Gloss Finish
1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (5.0 – 10.0-mil dry) – MPI #107
2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-300/ B73V300 – MPI #254X-Green
3rd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-300/ B73V300 (2.0 - 4.0-mil dry per coat)

3. Dryfall Waterborne System on non-pre-primed material
a. Eggshell Finish
1st Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66W1300 Series (5.0 – 10.0-mil dry) – MPI #107
2nd Coat: S-W Pro Industrial Waterborne Acrylic Dry-Fall Eg-Shel, B42W82 – MPI #155
3rd Coat: S-W Pro Industrial Waterborne Acrylic Dry-Fall Eg-Shel, B42W82 (3.0 – 4.5-mil dry per coat)

4. Dryfall Waterborne System on pre-primed material
a. Eggshell Finish
1st Coat: S-W Pro Industrial Waterborne Acrylic Dry-Fall Eg-Shel, B42W82 – MPI #155
2nd Coat: S-W Pro Industrial Waterborne Acrylic Dry-Fall Eg-Shel, B42W82 (3.0 – 4.5-mil dry per coat)

F. Wood (Walls, Ceilings, Doors, Trim)

1. Latex Systems
a. Gloss Finish
1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (4-mil wet, 1.8-mil dry) – MPI # N/A
2nd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series – MPI #114

3rd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series (2.5 – 4.0-mil dry per coat)

b. Semi-Gloss Finish
1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (4-mil wet, 1.8-mil dry) – MPI# N/A
2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series – MPI #153
3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series (2.5 – 4.0-mil dry per coat)

c. Eg-Shel/Satin Finish
1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (4-mil wet, 1.8-mil dry) – MPI# N/A
2nd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series – MPI #N/A
3rd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series (1.6-mil dry per coat)

G. Stain Systems

1. Satin Finish
1st Coat: S-W 61807000 Minwax Water Based Wood Stain
2nd Coat: S-W 61807000 Minwax Water Based Wood Stain
3rd Coat: S-W Minwax Water Based Oil Modified Polyurethane Varnish, Satin Clear

H. Drywall (Walls, Ceiling, etc.)

1. Latex Systems
a. Semi-Gloss Finish
1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (4-mil wet, 1.8-mil dry) – MPI #N/A
2nd Coat: S-W Harmony Low Odor Interior Latex Semi-Gloss, B10 Series – MPI #147
3rd Coat: S-W Harmony Low Odor Interior Latex Semi-Gloss, B10 Series (1.6-mil dry per coat)

b. Eg-Shel/Satin Finish
1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (4-mil wet, 1.8-mil dry) – MPI #N/A
2nd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series – MPI #144 X-Green
3rd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series (1.6-mil dry per coat)

c. Flat Finish Ceiling Only
1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (1.8-mil dry) – MPI #N/A
2nd Coat: S-W Harmony Low Odor Interior Latex Flat, B5 Series – MPI #53X-Green
3rd Coat: S-W Harmony Low Odor Interior Latex Flat, B5 Series (1.6-mil dry per coat)

2. Epoxy System (Water Base)

a. Gloss Finish
   1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (1.8-mil dry) – MPI #N/A
   2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-300/ B73V300 – MPI #115
   3rd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-300/ B73V300 B60V15 (2.0 – 4.0-mil dry per coat)
b. Eg-Shel Finish
   1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (1.8-mil dry) – MPI #N/A
   2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 / B73V300 – MPI #254X-Green
   3rd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 / B73V300 (2.0- 4.0-mil dry per coat)

I. Fiberglass (Bullet resistant panel)

1. Latex Systems
   a. Gloss Finish
      1st Coat: S-W PrepRite ProBlock Latex Primer, B51W00623 (4-mil wet, 1.4-mil dry) – MPI # N/A
      2nd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series – MPI #114
      3rd Coat: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series (2.5 – 4.0-mil dry per coat)
   b. Semi-Gloss Finish
      1st Coat: S-W PrepRite ProBlock Latex Primer, B51W00623 (4-mil wet, 1.4-mil dry) – MPI # N/A
      2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series – MPI #153
      3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series (2.5 – 4.0-mil dry per coat)
   c. Eg-Shel/Satin Finish
      1st Coat: S-W PrepRite ProBlock Latex Primer, B51W00623 (4-mil wet, 1.4-mil dry) – MPI # N/A
      2nd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series – MPI #N/A
      3rd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series (1.6-mil dry per coat)

2.5 MATERIALS – GENERAL REQUIREMENTS

A. Paints and Coatings – General

1. Unless otherwise indicated, provide factory-mixed coatings.
2. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application.
3. Do not reduce, thin, or dilute coatings or add materials to coatings unless approved in manufacturer's product instructions.
4. Confirm VOC’s need by using the products MSDS sheets.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as “best” by the manufacturer.

2.6 ACCESSORIES

A. Coating application accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer’s specifications.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows (Do not apply finishes unless moisture content of surfaces is below the following maximums):

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

E. Do not begin application of coatings until substrates have been properly prepared; notify Owner’s Representative of unsatisfactory conditions before proceeding.

F. If substrate preparation is the responsibility of another installer, notify Owner’s Representative of unsatisfactory preparation before proceeding.

G. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

H. Test shop applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. The surface shall be dry and in sound condition. Remove all oil, dust, dirt, loose rust, peeling paint, or other contamination to ensure good adhesion.

E. Provide barrier coats over incompatible primers or remove and re-prime. Notify Architect in writing about anticipated problems using the specified finish coat material with substrates primed by others.

F. Impervious Surfaces:

1. Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach.
2. Rinse with clean water and allow surface to dry.

G. Aluminum Surfaces:

1. Remove all oil, grease, dirt, oxide, and other foreign material by cleaning per SSPC-SP1 Solvent Cleaning.

H. Block/Unit Masonry (Cinder and Concrete)

1. Remove all loose mortar and foreign material.
2. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners.
3. Let concrete and mortar cure at least 30 days at 75°F unless the manufactures products are designed for application prior to the 30-day period.
4. The pH of the surface and moisture content must be in accordance with the paint manufacturer’s recommendations prior to painting.

I. Concrete:

1. Remove contamination by washing with an appropriate cleaner, rinse thoroughly.
2. The pH of the surface and moisture content shall be in accordance with the paint manufacturer’s recommendations prior to painting.
3. Allow the surface to thoroughly dry.

4. Clean concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid or other etching cleaner. Flush floor with clean water to neutralize acid and allow to dry before painting.
5. Fill bug holes, air pockets, and other voids under another section with a cement-patching compound of sufficient cohesive strength to support the specified coating system.

J. Drywall:

1. Shall be clean, dry and all dust removed prior to painting.
2. All nail heads must be set and spackled.
3. Tape all joints and cover with a joint compound.
4. Spackled nail heads and tape joints shall be sanded smooth.

K. Galvanized Surfaces:

1. Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils.
2. Apply a test area, priming as required.
3. Allow the coating to cure in accordance with the manufacturer's recommendation before testing.
4. Perform adhesion tests in accordance with ASTM 3359 Adhesion by Tape Test.
5. If adhesion is poor, then notify Owner's representative that additional surface preparation under another section is necessary to remove pre-treatments or contaminants that interfere with adhesion of the coating.

L. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

M. Plaster Surfaces:

1. Shall allow to thoroughly dry for at least 30 days before painting unless the manufacturer's products are designed for application prior to the 30-day period.
   a. Bare plaster must be cured and hard prior to painting.
   b. Correct any soft, porous, or powdery plaster per requirements under another section of the specifications.

N. Steel:

1. Check other sections for additional surface preparation and shop priming of bare steel surfaces.
2. Surface preparation shall include appropriate SSPC recommended methods.
3. Shop primer shall be compatible with the field-applied coatings.
4. Surfaces shall be dry and clean prior to the application of field-applied coatings.
5. Remove all contaminants in accordance with SSPC-SP1 Solvent Cleaning or SSPC Method recommended for condition of substrate.

O. Wood:

1. Shall be clean and dry, then prime and paint as soon as possible.
2. Scrape, sand, and spot prime knots and pitch streaks before a full priming coat is applied.

3. Patch all nail holes and imperfections with a wood filler or putty and sand smooth after application of primer.
4. Wood doors scheduled for Painting: Finish doors on tops, bottoms, and side edges same as hinge side face, unless otherwise indicated.
5. Seal with shellac any marks, which may bleed through surface finishes.

3.3 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

D. Use only thinners approved by the paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat of lighter shade to facilitate identification of each coat where multiple coats of the same materials are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

F. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming surface treatment specified under other sections.

G. Preparation and testing of existing painted surfaces, indicated to be repainted to accommodate new work, shall be performed as work of this section.

3.4 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

B. Use applicators and techniques suited for paint and substrate indicated.

C. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

D. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

E. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

F. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

G. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

H. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

I. Apply paint in a cross-hatch application to achieve an even coverage.

3.5 FIELD QUALITY CONTROL

A. The right is reserved by Owner/Architect to invoke the following material testing procedure in addition to other tests indicated when and as often as he deems necessary during the period of field painting.

B. Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.

C. Testing laboratory will perform appropriate tests for one or each of the following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance, and quantitative materials analysis.

D. A test patch for applied paint adhesion may be required.

1. Adhesion text shall provide the adhesion X-cut and tape test for adhesion per ASTM D3359 for areas selected by the Architect.
2. Areas found to be defective shall have paint removed and repainting shall be provided.
3. Owner/Architect may require retesting.

E. A test patch for remedial painting adhesion may also be required. The procedure for the test patch is as follows:

1. An area that represents the worst condition of the existing paint is selected.
2. The surface is prepared as appropriate for the repaint work.
3. The new coating or coating system is applied.
4. The coating is allowed to cure for at least 7 days at 75 degrees F. or according to the coating manufacturer's instructions.
5. After proper curing the adhesion is tested using an acceptable method such as the Adhesion by Tape Test (ASTM D 3359).

F. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove noncomplying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the 2 coatings are noncompatible.

3.6 EQUIPMENT

A. Refer to Divisions 21, 22, 23, 26, 27, & 28 for schedule of color-coding and identification banding of equipment, ductwork, piping, and conduit.

B. Color code equipment, piping, conduit, and exposed ductwork in accordance with requirements indicated.

1. Color band and identify with flow arrows, names, and numbering.

C. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:
   a. Equipment, including both sides of panelboards.
   b. Uninsulated metal and plastic piping.
   c. Pipe hangers and supports.
   d. Metal and plastic conduit.
   e. Tanks that do not have factory-applied final finishes.
2. Paint the following work where exposed in occupied spaces:
   a. Equipment, including both side of panelboards.
   b. Uninsulated metal and plastic piping.
   c. Pipe hangers and supports.
   d. Metal and plastic conduit.
   e. Duct, insulation having cotton or canvas insulation covering or other paintable jacket material.
   f. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
   g. Interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint.
   h. Paint dampers exposed behind louvers and grilles to match face panels.
   i. Other items as directed by Architect.

3.7 CLEAN-UP AND PROTECTION

A. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

C. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

D. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.8 TOUCH-UP AND DAMAGE REPAIR

A. Contractor shall repair all deficiencies in coating application in accordance with PDCA Standard P1-04.

B. Inform Owner's representative of all damage to properly painted surfaces and receive authorization prior to performing damage repair.

3.9 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality: Provide temporary ventilation as specified in section "Temporary Controls."

B. Waste Management: As specified in section "Temporary Construction Facilities" and as follows:

1. Coordinate with manufacturer for take-back program. Set aside scrap to be returned to manufacturer for recycling into new product. Close and seal all partially used containers of pain to maintain quality as necessary for reuse.

END OF SECTION 09 91 23

SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Tactile/raised letter plastic signs
   2. Individual plastic characters signs
   3. Signs of silk-screened characters on plastic
   4. Required sign type:
      a. Interior room, space, and area ID signs
      b. International symbols of accessibility for accessible spaces and exits
      c. Accessible routes
      d. Tactile “exit” signs
      e. Hazard and safety signs
      f. Evacuation plans

1.3 REFERENCES

A. ANSI A117.1 – Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People
B. FBC – Florida Building Code
C. NFPA 101: 7.10.1.3

1.4 SUBMITTALS

A. Submit shop drawings as specified.
B. Indicate sign styles, lettering font, foreground and background colors, locations, overall dimensions of each sign and anchorage.
C. Provide complete interior and exterior sign schedule showing sign type, location, and verbiage.
D. Samples: Submit two sample signs in size illustrating type, style, letter font, and colors specified, and method of attachment.
E. Provide manufacturer’s installation instructions, templates, and attached devices.
F. Colors shall be as selected by the Architect.

1.5 QUALIFICATIONS

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

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable codes for requirements for the physically handicapped, safety and egress.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site.
B. Package signs, labeled in name groups
C. Store adhesive attachment tape at ambient room temperatures

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install signs when ambient temperature is lower than recommended by manufacturer.
B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer shall be one of the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.
   1. ASI Sign Systems, Indianapolis, Indiana; Cincinnati, Ohio; Cleveland, Ohio
   2. Andco Industries Corp., Greensboro, North Carolina
   3. Baron Signs, Lake Park, Florida
   4. Multi-Graphics, Inc. Pelham, Georgia

2.2 FLORIDA AMERICANS WITH DISABILITIES ACT REQUIREMENTS

A. Manufacturer shall conform to tactile, Braille, letter size, and other requirements as required by Florida Accessibility Code for Building Construction and ANSI A117.1.
B. ADA requirements supersede technical specifications in this Section.

2.3 BUILDING SIGNAGE – GENERAL

A. General; applies to all signs except as noted:
   1. Material shall be minimum 1/8" clear matte acrylic stock with 3/8" radius corners.
      a. Exterior signs – Shall be UV stable material of non-petroleum base phenolic resin using sand carving process to create the raised lettering, which is an integral part of the sign.
      b. Interior signs – Shall be material of non-petroleum base phenolic resin using sand carving process to create the raised lettering, which is an integral part of the sign.
      c. Interior signs exposed to direct sun, shall be of same material as exterior signs.
      d. Paint shall be Matthews Acrylic Polyurethane system or equal.
         i) Shall be low VOC
         ii) Shall be UV Stable
         iii) Shall be lead and chromate free
         iv) Minimum life expectancy of 10-years
   2. Applied lettering not allowed.

3. Letters and background colors selected by Architect from manufacturer's standard colors.
4. Mounting:
   a. Shall be with adhesives and non-removable oval head screws.
   b. Mount at locations as directed by Architect.
   c. Mount at 60" above finished floor to the center of the sign.
5. Graphic Process with Braille in one of the following, but no applied lettering method allowed:
   a. Provide raised (photopolymer process)
   b. Engraved letters
   c. Sand craved process
6. Letters:
   a. Letters and numbers shall have width to height ratio between 3:5 and 1:1 and stroke width to height ratio between 1:5 and 1:10.
   b. Letters and numbers to be raised $^{1}/_{32}$" upper case sans serif font with Grade 2 Braille.
   c. Raised characters shall be 5/8" high minimum and 2" high maximum.
   d. Pictograms shall have the equivalent verbal description directly below the pictogram.
7. Characters and backgrounds must be matte or other non-glaze surface and of contrasting colors.
8. All signs shall comply with chapter 11 FBC.

B. Room Name and Number Signs
1. Provide a sign for each room or space to include name and room number.
   a. Minimum size of 3" high by 6" wide for signs, longer where nomenclature demands
2. Mount number as directed by Architect.
3. All spaces listed in Finish Schedule plus if more than one door is to a space, additional signs will be required one by number of doors to space.

C. Storage Signs
1. Provide and install at mechanical and electrical rooms a sign mounted on the door to read as follows: "STORAGE NOT ALLOWED".
2. Signs shall be matte acrylic plastic, red background with white letters 1 " high by width needed for copy and Braille, with 3/8" radius corners.
3. Mount on doors with non-removable oval head screws verify number signs required.

D. Toilet Room Handicapped Signs
1. Furnish and install one sign depicting National Handicapped Symbol (wheelchair) at each toilet room, equipped with facilities for the handicapped.
   a. Size shall be 6" by 10.5".

E. Fire Extinguisher, No Exit and Pull Station Sign
1. Copy to read: “No Exit”, "Fire Pull Station Inside", and "Fire Extinguisher Inside".
2. Red letters, same material, size and mounting as in A. General.
3. NO EXIT sign shall have letter size as per NFPA 101 section 7.10.8.3.
4. Braille sign not required for fire extinguisher.
5. See plans for locations.

F. Stair Signs
1. Provide tactile signs at each doorway leading to exit stairway.
2. Wording on sign: "EXIT"

G. Fire Rated/Smoke Partition Labeling
1. Field label all fire rated walls above ceiling level, with fire rating shown on the construction plans.
   a. Provide minimum 1½" high block lettering stenciled on wall above finished ceiling, if in a storage, mechanical, electrical, or similar unfinished room, install at approximately 84 inches above floor.

b. *(Contractor to use rating from permit plans)* HOUR FIRE RATED WALL, PROTECT ALL OPENING AND THROUGH WALL PENETRATION PER CODE REQUIREMENTS.

2. Field label all smoke partitions above ceiling level.
   a. Provide minimum 1½" high block lettering stenciled on wall above finished ceiling, if storage, mechanical, electrical, or unfinished room, install at 84" above floor.
   b. SMOKE PARTITION, PROTECT ALL OPENING AND THROUGH WALL PENETRATION PER CODE REQUIREMENTS.

H. Mechanical, Electrical, Data, and Similar Rooms
   1. Provide a sign saying "NO STORAGE" meeting the General requirements.
   2. If these rooms have pair of doors, provide sign saying "THIS DOOR TO REMAIN CLOSED AND LATCHED TOP AND BOTTOM, EXCEPT DURING THE TRANSFER OF EQUIPMENT".
      a. Sign shall have 1" high block letters and be permanently attached (Attached in way as to maintain the rating of the door) to the inactive door near the latch side 60 inches from finished floor to center of sign.
      b. Braille not required for this sign.

I. Evacuation Plan
   1. Provide frame for a graphic floor plan in each student occupied room.
      a. Size to be nominal 9" high by 12" width
      b. Provide a clear removable plastic cover over each sign.
      c. Sign cover will only be removable using a tool.
   2. Mounting:
      a. Non-removable oval head screws, using rawl plugs where mounted on masonry.
      b. Architect shall supply the plans to the Contractor.
   3. Frame Material: Matte acrylic plastic with all edges eased and tempered glass or clear plastic cover.

2.4 BUILDING SPECIALITY SIGNAGE

A. "No Smoking" - “Smoke Free Campus” Signs.
   1. Copy to read: “No Smoking” or “Smoke Free Campus” with universal graphic.
   2. Mounting: Non-removable oval head screws, using rawl plugs where mounted on masonry.
   3. Signs shall be non-corrosive, 1/8” three ply laminate, UV inhibitors, non-glare surface, green background with white letters 3” high by width needed for copy.
   4. Graphic Process: Raised letters, and graphic, Braille shall be formed as an integral part of the sign face or surface applied to the sign face.
   5. Colors: Letters and background colors as selected by Architect from manufacturer’s standard colors.
   6. Letters: Letters and numbers shall have width to height ratio between 3:5 and 1:1 and a stoke width to height ratio between 1:5 and 1:10. Letters and numbers shall be raised 1/32” upper case sans serif font type with Grade 2 Braille. Verify exact location with Architect. Schedule is provided for verbiage and quantity for pricing purposes. Locations and final graphics/verbiage to be determined by Architect.
   7. Raised characters shall be 2” high. Pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram.

B. School Name and Address Letters/Numbers – Provide letters meeting the following requirements:

1. Type: “Helvetica Medium” Letter Style. Provide minimum sufficient letters for School's name and building name as indicated on the drawings, subject to District approval.
2. Color: Aluminum with Dark Bronze anodized finish.
3. Size and Number:
   a. Primary Text
      i) 18 inches high x length as required for proper optical letter spacing.
      ii) 10 ½ inches average width
      iii) 2-1/8” inches strike width
      iv) 1/4 inches depth
   b. Secondary Text
      i) 12 inches high x length as required for proper optical letter spacing.
      ii) 8½ inches average width
      iii) 2-1/8” inches strike width
      iv) 1/8 inches depth
4. Anchors: Stainless steel drilled in place concealed anchors minimum 2 anchors per letter.
5. Material: Welded aluminum back-channel fabricated non-illuminate letters.
6. Manufacturer: Andco Industries Corporation or equivalent.
7. Caulk: Seal perimeter of each letter to wall or frame with thin neat bead of clear silicone sealant.
8. Install using manufacturers approved anchoring method to meet ASTM 7 wind load requirements.
9. School name and street address shall be visible from the main road fronting the campus.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install all signs in strict accordance with manufacturer's instructions and FADA requirements.
B. Room signs to be mounted 60" to center above finish floor on walls adjacent to the latch side of any door opening.

3.2 CLEANING

A. After installation, thoroughly clean all exposed surfaces and restore all damaged material to its original condition or replaced with new material.

3.3 WARRANTY

A. This Contractor shall fully guarantee all materials and labor under this section for a period of 5-years from date of final acceptance of the building against all defects in both workmanship and materials and he shall promptly correct and/or replace such faulty work if so notified.

END OF SECTION

SECTION 10 21 13 – HDPE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Toilet enclosures.
   b. Urinal screens.

1.3 REFERENCES

A. Florida Building Code, Chapter 11 – Florida Accessibility Code for Building Construction.
B. ANSI A117.1 – Accessible and Usable Buildings and Facilities
C. ADAAG – American with Disabilities Act, Accessibility Guidelines.
D. ASTM A167 – Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
E. ASTM B86 – Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings.
F. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
G. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
H. NFPA – 101 Life Safety Code.
I. NFPA 286 – Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
J. FBC – Florida Building Code.
K. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" for toilet compartments designated as accessible.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of reinforcements for compartment-mounted grab bars.
2. Show locations of centerlines of toilet fixtures.

C. Samples: Include Samples of hardware and accessories involving material and color selection.

1.5 INFORMATION SUBMITTALS

A. Product Certificates: For each type of toilet compartment, from manufacturer.

1.6 CLOSEOUT SUBMITTAL

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.7 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 and source.

1. Door Hinges: Two hinges with associated fasteners.
2. Latch and Keeper: One latch and keeper with associated fasteners.
3. Door Bumper: Two bumpers with associated fasteners.
4. Door Pull: One door pull with associated fasteners.
5. Fasteners: Ten fasteners of each size and type.

1.8 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver items in manufacturer’s original unopened protective packaging.

B. Store the materials in original protective packaging to prevent physical damage.

C. Handle material in a way to prevent damage to finished surfaces.

1.10 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, and other construction contiguous with toilet compartments by field measurements before fabrication.

1.11 WARRANTY

A. Warranty: Manufacturer's standard twenty-five (25) year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship.

B. Manufacturer's standard one (1) year guarantee against defects in material and workmanship for door hardware and mounting brackets.

1.12 PERFORMANCE

A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire hazard classification: Class A flame spread/smoke developed rating, tested to ASTM E84.

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities for toilet compartments designated as accessible.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Scranton Products.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.

1. Accurate Partitions Corporation.
2. Bradley Corporation; Mills Partitions.

2.2 GENERAL

A. Basis of Design: "Hiny Hiders"

B. Door, Panel, and Pilaster Materials: Fabricated from solid 1' thick high-density polyethylene (HDPE) polymer resins under high pressure forming a single component section which is waterproof, corrosion-proof, impact resistant nonabsorbent, and has a self-lubricating surface that resists marking with pens, pencils, lipstick, and other writing or marking utensils.

C. Waterproof and nonabsorbent, with self-lubricating surface, resistant to marks by pens, pencils, markers, and other writing instruments.

2.3 PARTITIONS

A. Design Type: Standard height with door and panel height of 55 inches with floor clearance of 14 inches.

B. Mounting Type: Floor-mounted, overhead-braced with pilaster height of 82 inches.

2.4 URINAL SCREENS

A. Type: Wall mounted screen 48 inches high by 18 inches deep with floor clearance of 14 inches.

2.5 COMPONENTS

A. Pilaster Shoes: 3 inches high, 20-gauge stainless steel, secured to pilaster with stainless steel tamper resistant Torx head sex bolt.

B. Wall Brackets: 54 inches long, stainless steel double flange continuous full panel height U-bracket, fastened to pilasters and panels with stainless steel tamper resistant Torx head sex bolts.

C. Urinal Wall Bracket: 48 inches long, stainless steel double flange continuous full panel height U-bracket, fastened with stainless steel tamper resistant Torx head sex bolts.

D. Overhead Brace: Heavy-duty extruded aluminum, anti-grip design, clear anodized finish, fastened to headrail bracket with stainless steel tamper resistant Torx head sex bolt and at top of pilaster with stainless steel tamper resistant Torx head screws.

E. Headrail Brackets: 20-gauge stainless steel, satin finish, secured to wall with stainless steel tamper resistant Torx head screws.

F. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip fastened to exposed bottom edges of door and panel solid-polymer components to prevent burning.

2.6 HARDWARE

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware, and accessories.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel.

1. Hinges: Continuous hinge fabricated from stainless steel, wrap-around flanges, through bolted to doors and pilasters with stainless steel, Torx head sex bolts. Hinges operate on field-adjustable nylon cams, field adjustable in 30-degree increments.
2. Latch and Keeper: Stainless steel surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
3. Coat Hook: Stainless steel combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
4. Door Bumper: Stainless steel rubber-tipped bumper at out-swinging doors and entrance-screen doors.
5. Door Pull: Stainless steel pull unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
6. Equip outswing handicapped doors with second door pull and door stop.

or

1. Hinges: 8 inches long, fabricated from heavy-duty extruded aluminum with bright dip anodized finish, wrap-around flanges, adjustable on 30-degree increments, through bolted to doors and pilasters with stainless steel, Torx head sex bolts.
2. Latch and Keeper: 6 inches long, fabricate from heavy-duty extruded aluminum with bright dip anodized finish, with wrap-around flanges secured to pilasters with stainless steel tamper resistant Torx head sex bolts. Bumper: Extruded black vinyl.
3. Latch Housing: Heavy-duty extruded aluminum with an anodized finish and a slide bolt and button to be black anodized finish.
4. Coat Hook/Bumper: Combination type, chrome plated Zamak. Equip outswing handicapped doors with second door pull and door stop.
5. Door Pulls: Chrome plated Zamak.
6. Equip outswing handicapped doors with second door pull and door stop. Aluminum

2.7 MATERIALS

A. Stainless-Steel Castings: ASTM A 743/A 743M.

2.8 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Urinal-Screen Pilasters: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.

D. Door Size and Swings: Unless otherwise indicated, provide 24-inch wide, in-swinging doors for standard toilet compartments and wide, out-swinging doors with a minimum 32-inch wide, clear opening for compartments designated as accessible.

2.9 FINISH

A. Color and Pattern: Color and pattern as selected by Architect from manufacturer’s full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking, overhead above ceiling supporting structure and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:
   a. Pilasters and Panels: 1/2 inch.
   b. Panels and Walls: 1/2 inch.
2. Stirrup Brackets: Secure panels to pilasters with brackets thru bolted to panel and pilaster.
   a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
   b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13

SECTION 10 22 26 – OPERABLE PARTITIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:

1. Operable partitions

1.3 REFERENCES

A. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
B. ASTM E90 – Standard Test Method for Laboratory of Airborne Sound Transmission Loss of Building Partitions and Easements
C. ASTM E413 – Classification for Rating Sound Insulation
D. ASTM E557 – Standard Guide for the Installation of Operable Partitions
E. ASTM E596 – Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures
F. NEMA LD-3 – High Pressure Decorative Laminates.
G. UL – Underwriters Laboratories Inc, Fire Resistance Directory
H. FBC – Florida Building Code
I. FFPC – Florida Fire Prevention Code

1.4 ACTION SUBMITTALS

A. Product Data: Provide data on partition operation, hardware and accessories, track-switching components, colors and finishes available.

B. Shop Drawings:

1. Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, location, and details of pass door and frame, adjacent construction and finish trim and stacking sizes.
2. Provide structural calculations for support structure by Florida structural engineer.

C. Samples: Submit samples of full manufacturer's color range for selection of colors. Submit samples of surface finish, 12 x 12 inches, size, illustrating quality, colors selected, texture, and weight.

D. Manufacturer's Installation Instructions: Include specific procedures, perimeter conditions requiring special attention and installation sequence.

E. Manufacturer's Certificate: Certify that partition system meets or exceeds specified acoustic requirements and flame/smoke rating.

F. Environmental:

1. Recycle: Submit manufacturer's documentation substantiating the following requirements for materials for each type provided under work of this section for recycled content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
   b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
   c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
   d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

1.5 MAINTENANCE DATA

A. Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5-years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum 5-years documented experience and approved by manufacturer.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated panel construction, surface burning characteristics, and combustibility requirements for materials.

1.8 FIELD CONDITIONS

A. Verify that field measurements are as indicated on approved shop drawings.

B. Coordinate work with other sections providing panel finish materials to this section.

1.9 WARRANTY

A. Warranty: Manufacturer shall warrant the product against defects in materials or workmanship and agrees to repair or replace components that fail within specified warranty period. The warranty period shall commence at the time of substantial completion and extend for a period of two (2) years.

1.10 PERFORMANCE REQUIREMENTS

A. Fire Rated Partition Assembly, UL assembly for any required hourly rating.

B. Sound Transmission Coefficient (STC): Measured in accordance with ASTM E413, tested on panel size of 100 sq ft.

C. Acoustical Performance: Provide operable panel partitions tested by a qualified independent testing agency for the following acoustic properties according to following test method:

1. Sound Transmission Requirements: Operable panel partition assembly tested in a full scale opening (14 feet by 9 feet) for laboratory sound transmission loss performance according to ASTM E 90, determined by ASTM E 413 and rated for an STC plus or minus 1 as follows:
   a. Sound Transmission Class (STC): As indicated (with or without steel face).

D. Install partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

E. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Modernfold

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.

1. Panelfold
2. Hufcor

2.2 TYPES

A. Basis of Design: “Acousti-Seal Series 900, Model 931 Panel”

B. Panel: Series of single flat panels, manually operated, top supported with operable floor seals and automatic top seals.

C. Final closure shall occur at the stacking end of track with a jamb hinged panel closure at one location and an expandable jamb closure at another location. Closure to incorporate locking mechanism from inside of room.

2.3 MATERIALS AND FABRICATION

A. Panel Construction: Shall be nominal 3.00 inches thick in standard widths not exceeding 48 inches.

1. Panel frame shall be all-steel with horizontal and vertical framing members fabricated from minimum 18 Acousti-Seal gauge formed steel, overlapped, and welded at all corners to form a unitized frame. Loose panel face construction is not acceptable.
2. Panel skins shall be:
   a. 1/2 inch gypsum board with steel face sheet minimum 22 gauge steel roll-formed and welded to the steel frame.
3. Hinges for Pass Doors, and Pocket Doors shall be full leaf butt hinges, attached directly to panel frame with welded hinge anchor plates within panel to support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.
4. Panels shall have a Class "A" flame spread rating when tested in accordance with ASTM E84 test procedure.
5. Acoustical rating: STC rating of 50 STC Acousti-Seal
   Noise Reduction Coefficient (NRC) to ASTM E596 standards, with a minimum NRC rating of 0.60.
6. Trim design shall provide a minimum "joint" appearance at vertical joints, with no exposed vertical trim. Acousti-Seal

B. Panel Finish: Shall be factory applied: Class A

1. Provide heavy duty vinyl fabric with a total weight of not less than 30 oz. per lineal yard, 54 inches wide, conforming to Federal Specification CCC-W-408A, Type 2, and having a flame spread rating of 25 or less when tested in accordance with ASTM E84.

C. Seals shall be provided at the perimeter of each panel as follows: Acousti-Seal

1. Vertical Seals: Shall consist of tongue and groove astragals interlocking a nominal .50 inch and providing stability and a light and sound seal.
2. Bottom Seals: Shall consist of an automatic bottom seal providing two inch minimum operating clearance and shall automatically drop as panels are positioned.
3. Top Seals: Shall be a continuous contact multi-finger vinyl sweep.

2.4 SUSPENSION SYSTEMS

A. Carriers: Steel trolley system as required for type, size, and weight of partition for ease of operation. Carriers shall utilize steel-tired ball bearing wheels. Aluminum is not acceptable.

B. Suspension Tracks: #17 minimum 11-gauge roll-formed steel track with overhead supports of adjustable 3/8" minimum diameter threaded steel hanger rods designed for size and type of operable panel partition assembly indicated. Track deflection shall be no more than 0.10 inch between bracket supports or no more than 1/360th of the overall opening width. Tracks for single panel partition shall be of switch and curve design with automatic indexing of panels to the stack area. 90-degree right angle turn or aluminum track is not acceptable.

1. Exposed track soffit: Steel, integral to track, and pre-painted off-white.

2.5 ACCESSORIES

A. Single Pass Doors:

1. Matching pass door same thickness and appearance as panels. ADA compliant pass door to be trimless and equipped with friction latch and flush pulls for panic operation. No threshold will be permitted.
2. Hardware:
   a. Panic hardware lever handle.
   b. Automatic door closer.

2.6 HARDWARE

A. Latch: Latching door handles of cast steel, stain chrome finish; lock cylinder master keyed to building keying system.

B. Closure: White enamel ceiling closure, aluminum jamb and head molding, fittings, and attachments.

C. Acoustic Sealant: Provide the manufacturer's standard.

D. Meeting stile latch

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verifying supporting structure is sufficient for the partition weight and dynamic loads

C. Verify lateral bracing on track supports will permit track to be level within 1/4" of required position and parallel to the floor surface.

D. Verify floor flatness and wall plumbness of 1/8" in 10', non-cumulative.

3.2 PREPARATION

A. Verify that required utilities are available, of the correct characteristics, in proper location, and ready for use.

B. Provide minimum two 20 ga. galvanized sheet steel backing at each wall contact point of operable partitions.

3.3 INSTALLATION

A. General: Comply with ASTM E557, operable partition manufacturer's written installation instructions, Drawings, and approved Shop Drawings.

B. Install operable partitions and accessories after other finishing operations, including painting have been completed.

C. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed or unmatched panels are not acceptable.

E. Lubricate moving components.

F. Apply acoustic sealant to achieve required acoustic performance.

3.4 ADJUSTING

A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

B. Adjust partition assembly to provide smooth operation from stacked to full open position.

1. Do not over-compress acoustic seals.

C. Visually inspect partition in full-extended position for light leaks to identify a potential acoustic leak.

D. Adjust to achieve light, tight seal.

E. Adjust doors in panels for smooth operation.

3.5 CLEANING

A. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and installer that ensure operable partitions are without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Demonstrate operation of partitions identify potential operational problems.

END OF SECTION 10 22 26

SECTION 10 22 30
OPERABLE GLASS PARTITIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:

1. Operable glass partitions

1.3 REFERENCES

A. ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.
B. ASTM E90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
C. ASTM C1036 – Standard Specification for Flat Glass.
D. ASTM C1048 – Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
E. ASTM E84 – Surface Burning Characteristics of Building Materials.
F. ASTM E413 – Classification for Rating Sound Insulation
G. Health Product Declaration Open Standard v2.1
H. ISO 14021 – Environmental Labels and Declarations - Self-Declared Environmental Claims (Type II Environmental Labeling).
I. ISO 14025:2011-10, Environmental Labels and Declarations – Type III Environmental Declarations - Principles and Procedures.
J. ISO 14040:2009-11, Environmental Management – Life Cycle Assessment - Principles and Framework.
K. ISO 14044:2006-10, Environmental Management – Life Cycle Assessment - Requirements and Guidelines.
L. ISO 21930 – Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services.
M. ADA – Americans with Disabilities Act.
N. ANSI Z97.1 – Safety Glazing Materials Used in Buildings.
O. CPSC 16 CFR 1201 – Safety Standard for Architectural Glazing Materials.
P. NEMA LD3 – High Pressure Decorative Laminates.

1.4 ACTION SUBMITTALS

A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.

B. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

C. Coordination Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.

D. Samples: Submit samples of full manufacturer's color range for selection of colors. Submit samples of surface finish, 12 x 12 inches, size, illustrating quality, colors selected, texture, and weight.

E. Manufacturer's Installation Instructions: Include specific procedures, perimeter conditions requiring special attention and installation sequence.

F. Manufacturer's Certificate: Certify that partition system meets or exceeds specified acoustic requirements and flame/smoke rating.

1.5 INFORMATION SUBMITTALS

A. Include recommended cleaning methods, cleaning materials, and stain removal methods.

B. Reports: Provide a complete and unedited written sound test report indicating glass thickness and spacing in test specimen matches product as submitted.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5-years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum 5-years documented experience and approved by manufacturer.

C. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer’s partition systems for work similar in material, design, and extent to that indicated for this Project.

D. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure and classified in accordance with ASTM E413 to attain no less than the STC rating specified. Provide a complete and unedited written test report upon request.

E. Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.

F. Do not begin installation until permanent HVAC systems are properly operating and building and temperature and humidity have stabilized.

G. The operable wall must be manufactured by a certified ISO-9001-2015 company or an equivalent quality control system.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated panel construction, surface burning characteristics, and combustibility requirements for materials.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.

B. Protect panels during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

1.9 FIELD CONDITIONS

A. Verify that field measurements are as indicated on approved shop drawings.

B. Coordinate work with other sections providing panel finish materials to this section.

1.10 WARRANTY

A. Warranty: Manufacturer shall warrant the product against defects in materials or workmanship and agrees to repair or replace components that fail within specified warranty period. The warranty period shall commence at the time of substantial completion and extend for a period of two (2) years.

1.10 PERFORMANCE REQUIREMENTS

A. Sound Transmission Coefficient (STC): Measured in accordance with ASTM E413, tested on panel size of 100 sq ft.

B. Acoustical Performance: Provide operable panel partitions tested by a qualified independent testing agency for the following acoustic properties according to following test method:

1. Sound Transmission Requirements: Operable panel partition assembly tested in a full scale opening (14 feet by 9 feet) for laboratory sound transmission loss performance according to ASTM E 90, determined by ASTM E 413 and rated for an STC plus or minus 1 as follows:
   a. Sound Transmission Class (STC): As indicated (with or without steel face).

C. Install partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

D. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Modernfold

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.

1. Panelfold

2.2 PANEL SYSTEM

A. Basis of Design:

1. Acousti-Clear Automatic – Single Panel - Manually operated and manually activated individual panel operable partition. Series of individual flat panels, manually operated, and manually activated, top supported with automatic top and bottom seals.

B. Final Closure: Horizontally expanding panel edge with removable crank.

2.3 PANEL CONSTRUCTION

A. Glass Panels

1. Type: Acousti-Clear Automatic Seal – Glass Panel.

2. Nominal 4-inch thick panels in manufacturer's standard 48-inch widths. All panel horizontal and vertical framing members shall be fabricated from aluminum extrusions and mechanically fastened. Frame shall be designed to minimize exposure on face of panels.
3. Panel Faces:
   a. 5/16-inch clear glass on one face, mechanically fastened and sealed in frame.
   b. 3/8-inch clear glass on one face, mechanically fastened and sealed in frame.
   c. Glass Type: Tempered, complying with ASTM C1036, ASTM C1048, CPSC 16 CFR 1201 Categories 1 & 2, and ANSI Z97.1.
4. Glass Finish: Clear tempered
5. Panel Trim: Pre-finished aluminum to protect edge of glass in the following finish: Clear Anodized
6. Acoustical ratings of panels with this construction achieve Sound Transmission Class of 51 minimum STC when tested in accordance with ASTM E90 and classified in accordance with ASTM E413.

2.4 SOUND SEALS

A. Vertical Interlocking Sound Seals between panels: Extruded aluminum astragals with interlocking convex/concave resilient quad-lip gaskets. Rigid plastic astragals or astragals with gaskets on only one panel edge are not acceptable.

B. Horizontal Top and Bottom Seals shall be automatic operable seals providing 7/8-inch operating clearance with an operating range of +9/16-inch to -3/8-inch. Seals shall operate automatically without tools or cranks and shall extend as panels are positioned. Fixed (non-operating) seals at top or bottom of panels are not acceptable.

2.5 SUSPENSION SYSTEM

A. Suspension System #17. Suspension Tracks: Minimum 11 gauge, 0.12inch roll-formed steel track suitable for either direct mounting to a wood header or supported by adjustable steel hanger brackets supporting the load-bearing surface of the track, connected to structural support by pairs of 3/8-inch diameter threaded steel rods. a. Exposed track soffit: Steel, integral to track, and pre-painted off-white.

1. Carriers: One all-steel trolley with steel ballbearing wheels and vinyl tires per panel (except Pivot Panel).
2. Right Angle Turn - Two stainless steel trolleys with steel ballbearing wheels and vinyl tires. Trolley design incorporates eight (8) wheels of varying dimensions that permit panels to traverse L, T, and X intersections without mechanical switching, on all panels (except Pivot Panel).

2.6 ACCESSORIES

A. Pass Doors (Glass Panel):

1. Single Pass Doors:

a. Matching pass door same thickness and appearance as the panels. ADA-compliant pass door equipped with non-locking lever latch. No threshold will be permitted.

2. Hardware: Panic Hardware w/ locking lever handle.
3. Self-Illuminated exit signs.

B. Pocket Door: Manufacturer's standard Pocket Door from the specified system.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verifying supporting structure is sufficient for the partition weight and dynamic loads

C. Verify lateral bracing on track supports will permit track to be level within 1/4" of required position and parallel to the floor surface.

D. Verify floor flatness and wall plumbness of 1/8" in 10', non-cumulative.

3.2 PREPARATION

A. Verify that required utilities are available, of the correct characteristics, in proper location, and ready for use.

B. Provide minimum two 2" x 8" full height wood blocking at each wall contact point of operable partitions.

3.3 INSTALLATION

A. General: Comply with ASTM E557, operable partition manufacturer's written installation instructions, Drawings, and approved Shop Drawings.

B. Install operable partitions and accessories after other finishing operations, including painting have been completed.

C. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

E. Lubricate moving components.

F. Apply acoustic sealant to achieve required acoustic performance.

3.4 ADJUSTING

A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

B. Adjust partition assembly to provide smooth operation from stacked to full open position.

1. Do not over-compress acoustic seals.

C. Visually inspect partition in full-extended position for light leaks to identify a potential acoustic leak.

D. Adjust to achieve light, tight seal.

E. Adjust doors in panels for smooth operation.

3.5 CLEANING

A. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and installer that ensure operable partitions are without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Demonstrate operation of partitions identify potential operational problems.

END OF SECTION 10 22 30

SECTION 10 28 00 – TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Toilet accessories.
   b. Underlavatory guards.

1.3 REFERENCES

A. Florida Building Code, Chapter 11 – Florida Accessibility Code for Building Construction.
B. ANSI A117.1 – Safety Standards for the Handicapped.
C. ADA Accessibility Guidelines for Buildings and Facilities July 23, 2004 – Provisions for Children.
D. ASTM A123 /A123M – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
E. ASTM A167 – Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
F. ASTM A269 – Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
G. ASTM A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
H. ASTM A794 – Standard Specifications for Commercial Steel, Carbon, Cold-Rolled.
I. ASTM B456 – Electro-deposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
J. ASTM C1036 – Standard Specification for Flat Glass.
K. ASTM C1048 – Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
L. ASTM C1503 – Standard Specification for Silvered Flat Glass Mirror.
M. OSHA Department of Labor CFR 29, section 1910.141: Sanitation.
N. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions gauges, dimensions of individual components and profiles, and finishes.

2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Samples: Submit two samples of each accessory illustrating color and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

B. Include maintenance instructions and manufacturer’s list of replaceable parts and service recommendations.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

C. Inserts and Anchorages: Provide accessory Manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other Work to avoid delay.

D. Field Verification: Before start of installation of wall finishes, installer shall verify that required blocking has been installed in proper locations. Verify that installation of finishes and required anchoring devices are complete.

E. Industry Standards: Work shall comply with applicable provisions of the following:

1. OSHA Department of Labor CFR 29, section 1910.141: Sanitation.
2. Florida Building Code, Chapter 11 – Florida Accessibility Code for Building Construction
3. ANSI A117.1 – Safety Standards for the Handicapped
4. ADA Accessibility Guidelines for Buildings and Facilities July 23, 2004 – Provisions for Children

1.8 FIELD CONDITIONS

A. Coordinate accessory locations, installation, and sequencing with other Work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

B. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

C. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.9 WARRANTY

A. Toilet Accessory Warranty: Provide manufacturer's one (1) year warranty from the Date of Substantial Completion, against defects in material and workmanship, unless otherwise indicated.

B. Mirror Warranty: Submit a written warranty executed by mirror manufacturer, agreeing to replace any mirrors that develop visible silver spoilage defects within 15 years from the Date of Substantial Completion.

1.10 PERFORMANCE REQUIREMENTS

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Bobrick
2. Manufacturers listed in the schedule for a specific item.
3. Manufacturers listed in the schedule on the drawings.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.

1. Bradley Corporation
2. American Specialties, Inc.

3. AJW Architectural Products

2.2 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings. To be provided at all exposed piping. Provide Truebro Lav Guard 2 as manufacturer by IPS Corp.
2. Material and Finish: Antimicrobial, molded plastic, white.

2.3 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Stainless Steel Tubing: ASTM A269/A269M, Type 304 or 316

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirror Glass: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

I. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

J. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

K. Galvanized Steel Mounting Devices: ASTM A153, hot-dip galvanized after fabrication.

L. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.4 FABRICATION

A. No names or labels are permitted on exposed faces of toilet and bath accessory units. On either interior surface not exposed to view or on back surface, provide identification of each accessory item either by a printed, waterproof label or a stamped nameplate indicating Manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

C. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.

D. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to Owner's representative.

2.5 KEYING

A. Supply four keys for each accessory to Owner.

B. Provide a master-key system for all accessories.

2.6 FINISHES

A. Galvanizing ASTM A123 to 1.25-oz/sq yd Galvanize ferrous metal and fastening devices.

B. Shop Primed Ferrous Metals: Pre-treat and clean, spray apply one coat primer and bake.

C. Enamel: Pre-treat to clean condition, apply one-coat primer and minimum two-coat epoxy baked enamel.

D. Chrome/Nickel Plating: ASTM B456, Type SC 2 satin finish.

E. Stainless Steel: No. 4 satin luster finish.

F. Back paint components where in contact with building finishes helping resist electrolysis.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to Manufacturer's instructions for type of substrate involved.

C. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F446.

D. Provide all items and accessories as required for a complete and total installation in every respect, whether or not specified or indicated on the drawings.

3.2 ADJUSTING AND CLEANING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

SCHEDULE SEE ATTACHMENT 10 28 00.01

SCHEDULE SEE DRAWINGS

A. General Schedule Notes

1. Soap Unit to be secured to wall above lavatory with two screws. Exact location shall be indicated by Architect at the time of installation. Coordinate the location of this dispenser so that no conflict occurs at either the wall mounted mirror above the lavatory or the faucet assembly mounted on the deck of the lavatory.
2. Coordinate bottom opening towel dispenser with wall cabinets above so conflict occurs when dispenser is opened to load towels.
3. One (1) mop holder shall be provided at each custodial sink and mounted at 60" AFF.

END OF SECTION 10 28 00

SECTION 10 44 00 – FIRE PROTECTION SPECIALTIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
    a. Fire protection cabinets for portable fire extinguishers.
    b. Portable fire extinguishers
    c. Fire extinguisher brackets

1.3 REFERENCES

A. ASTM A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
B. 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.
C. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
D. ASTM B221 – Standard Specification for Aluminum-and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
E. Carbon Dioxide Types UL 154.
F. Dry Chemical Types UL 299.
G. Water Types UL 626.
H. Halon Types UL 1093.
I. UL 92 – Fire Extinguisher & Booster Hose.
J. UL 711 – Rating and Fire Testing of Fire Extinguishers.
K. NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems.
L. Portable fire extinguishers used to comply with this standard shall be listed and labeled and meet or exceed all the requirements of Fire Test Standards UL 711.
M. FFPC – Florida Fire Prevention Code.
N. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated door hardware, cabinet type, trim style, and panel style. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required, prepared on samples of size 6 by 6 inches square.

D. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function. Use same designations indicated on drawings.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.

C. Installer Qualifications: Shall be State of Florida certified.

D. Conform to NFPA 10 requirements for all portable fire extinguishers and fire blankets.

E. Provide fire extinguishers, cabinets, fire blankets, and accessories by single manufacturer.

F. The identification of the listing and labeling organization, the fire test, and the performance standard that the fire extinguisher meets or exceeds shall be clearly marked on each fire extinguisher.

1.6 FIELD CONDITIONS

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguisher cabinets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure of hydrostatic test according to NFPA 10.
   b. Faulty operation of valves or release levers.
2. Warranty Period: Five (5) years from date of Substantial Completion.

1.8 PERFORMANCE

A. Performance: Fire extinguishers shall be UL-rated, fully charged and ready for emergency use when applicable per the Florida Building Code, the Florida Fire Prevention Codes, NFPA 10 as adopted by the Florida State Fire Marshall Office and NFPA standards as adopted by the Florida State Fire Marshall Office.

B. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. J. L. Industries, Inc., a division of Activar Construction Products Group.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.

1. Amerex Corporation
2. Ansul Incorporated
3. Larsen's Manufacturing Company
4. Potter Roemer LLC

2.2 LEGEND

A. FEC – Fire Extinguisher Cabinet

B. FE – Fire Extinguisher Bracket

2.3 EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

1. Valves: Manufacturer's standard.
2. Handles and Levers: Manufacturer's standard.
3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5 lb. nominal capacity in enameled steel tank with pressure gauge size and classification as scheduled. To be used at all locations unless noted otherwise.

C. Purple-K Dry-Chemical Type in Aluminum Container: UL-rated 2.5-lb nominal capacity, with potassium bicarbonate-based dry chemical in enameled-aluminum container. To be used in food preparation areas.

D. Stored-Pressure Water-Mist Type: WM-Series UL-rated 2-A:C, 2.5-gal. nominal capacity, with water in enameled-steel container; with pressure-indicating gauge. To be used in computer labs.

E. Wet-Chemical Type – (FK): UL-rated 2-A:1-B:C:K, 1.6-gal. nominal capacity, with potassium acetate-based chemical in stainless-steel container; with pressure-indicating gauge.

F. Carbon Dioxide Type: UL 154, Stainless steel tank with pressure gauge size and classification as scheduled, or if not scheduled, provide 10-B:C, 5 lb. nominal capacity. To be used in electrical rooms.

G. Halogenated Type: UL 1093, Halotron 1, Stainless steel tank with pressure gauge; size and classification as scheduled, or if not scheduled, provide 10-B:C 5 lb. nominal capacity.

H. Provide additional types to comply with conditions

I. Extinguisher Finish:

1. Multi-purpose units: Provide heavy-duty, DOT steel cylinders with corrosion and impact resistant polyester/epoxy paint finish.
2. Gaseous and wet chemical units: Provide stainless steel, satin chrome finish.

2.4 SEMI-RECESSED FIRE PROTECTION CABINET

A. Basis of Design: “Academy Series, Model 1027”

B. Cabinet Metal: Use a formed sheet steel, galvanized 18-gauge thick base metal.

C. Configuration: Semi-recessed type, per drawing details and locations, sized to accommodate required extinguishers, combination fire extinguisher cabinet and accessories.

D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   a. Rolled Edge Trim: 2-1/2 inch backbend depth (semi-recessed) surface.

E. Cabinet Trim Material: Manufacturer's standard, as follows:

1. Extruded aluminum shapes.

F. Door Style: Manufacturer's standard design, as follows:

1. Fully glazed panel with frame and aluminum backing.
2. Vertical duo glazed panel with pull.

G. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.

1. Provide minimum 1/2 inch thick door frames, fabricated with tubular stiles and rails, and hollow metal design.

H. Door: Extruded aluminum shapes, reinforced for flatness and rigidity.

I. Door Operation: Emergency open handle.

J. Door Glazing: Clear tempered glass.

K. Door Glazing: Clear transparent acrylic sheet.

L. Door Glazing: Breakable glass system. Provide "In Case of Fire Break Glass" signage.

M. Cabinet Mounting Hardware: Appropriate to cabinet and extinguisher size and weight.

N. Form cabinet enclosure with right angle inside corners and seams.

1. Form perimeter-trim and door stiles.

O. Pre-drill the unit for anchors and accessories.

P. Hinge doors for 180° opening with continuous piano hinge.

1. Provide nylon self-adjusting roller catch.
2. Provide recessed door pull.

Q. Glaze doors with resilient channel gasket glazing.

R. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.

1. Identify fire extinguisher in cabinet with the words “FIRE EXTINGUISHER” applied to door.
   a. Location: Applied to cabinet door.
   b. Application Process: Pressure-sensitive vinyl letters.
   c. Lettering Color: Red.
   d. Orientation: Vertical Horizontal

S. Fire Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428 inch thick, cold-rolled steel sheet lined with minimum 5/8” thick fire-barrier material. Provide UL Certification.

2.5 SURFACE MOUNT FIRE PROTECTION CABINET

A. Basis of Design: “Aluminum Series, Model 2023”

B. Metal: Aluminum.

C. Configuration: Surface mount type, per drawing details and locations, sized to accommodate required extinguishers, combination fire extinguisher cabinet and accessories.

D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

E. Cabinet Trim Material: Extruded aluminum shapes.

F. Door Style: Manufacturer’s standard design, as follows:

1. Vertical duo panel with frame.

G. Door Construction: Fabricate doors according to manufacturer’s standards, of materials indicated, and coordinated with cabinet types and trim styles selected.

H. Door: Extruded aluminum shapes, reinforced for flatness and rigidity.

I. Door Operation: Emergency open handle.

J. Door Glazing: Clear tempered glass.

K. Door Glazing: Clear transparent acrylic sheet.

L. Door Glazing: Breakable glass system. Provide “In Case of Fire Break Glass” signage.

M. Cabinet Mounting Hardware: Appropriate to cabinet and extinguisher size and weight.

N. Pre-drill the unit for anchors and accessories.

O. Hinge doors for 180° opening with continuous piano hinge.

1. Provide nylon self-adjusting roller catch.
2. Provide recessed door pull.

P. Glaze doors with resilient channel gasket glazing.

Q. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.

1. Identify fire extinguisher in cabinet with the words “FIRE EXTINGUISHER” applied to door.
   a. Location: Applied to cabinet door.
   b. Application Process: Pressure-sensitive vinyl letters.
   c. Lettering Color: Red.
   d. Orientation: Vertical

R. Fire Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428 inch thick, cold-rolled steel sheet lined with minimum 5/8” thick fire-barrier material. Provide UL Certification.

2.6 MOUNTING BRACKETS

A. Wall and Cabinet Brackets: Shall be designed to fit extinguishers and shall hold extinguishers firmly and securely in place but shall provide for easy removal. Brackets shall be J. L. Industries "MARK" type.

B. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

C. Identification: Provide 8” x 8” minimum plastic sign on the wall above the mounting bracket. Lettering shall comply with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Provide at hand held extinguishing units not in fire protection cabinets.
2. Sign shall be fabricated with the words "FIRE EXTINGUISHER" in red letter letters applied to the white plastic sign surface.
   a. Orientation: Horizontal.

2.7 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Extruded Aluminum: ASTM B221.

C. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

D. Acrylic Glazing: Clear acrylic

2.8 ACCESSORIES

A. Fire Blanket: Fire retardant treated wool red color 62 x 84 inch size, with wall mounted case.

2.9 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive handle.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

D. Brackets and cabinets shall be designed to prevent accidentally dislodging extinguisher and shall be size required for type and capacity of extinguisher indicated.

2.10 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

E. Steel Finishes

1. Surface Preparation: 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". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
2. Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

3. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
   a. Cabinet Tub Color: White
   b. Fire Extinguishers: Red

F. Aluminum Finishes

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.
3. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
   a. Cabinet Color: White

2.11 ENVIRONMENTAL

A. Recycled Content: Provide products with an average recycled content of metal products so 100% of postconsumer recycled content plus 50% of preconsumer recycled content is not less than 20 percent.

PART 3 – EXECUTION

3.1 INSPECTION:

A. Verify all rough openings, dimensions and clearances are the correct size and in the correct location prior to installation.

B. Examine the areas and conditions of the work in this Section.

1. Correct conditions detrimental to timely and proper completion of the Work.
2. Do not proceed until unsatisfactory conditions are correct.

C. Verify servicing, charging, and tagging of all fire extinguishers.

D. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:

1. Fire Protection Cabinets: 48 inches above finished floor to top of cabinet.

B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Provide inside latch.
2. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

C. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

D. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

E. Recharge existing fire extinguisher for units that are indicated to remain, replace if recharging is not possible.

F. Provide occupancy hazard protection with fire extinguishers suitable for such Class A, B, C, D, or K fire potentials as might be present. Class K shall be provided in all food preparation areas.

G. Install fire extinguishers in accordance with NFPA 10.

H. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

I. Install cabinets plumb and level in wall openings in strict accordance with NFPA 10, the original design, the approved Shop Drawings and the manufacturer's recommended installation procedures as approved by the Architect and authorizing agencies, anchoring all components firmly into position for long life under hard use.

1. Secure rigidly in place.

J. Do not install extinguishers until Substantial Completion inspection date.

1. Place extinguishers and accessories in cabinets or on wall brackets.

K. Inspection tags shall be current as of the date of Substantial Completion and good for 1-year.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturers written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 00

SECTION 11 31 00 – RESIDENTIAL APPLIANCES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:

1. Appliances
2. Provide accessories and necessary mechanical and electrical connections as shown on the plans, specified, and as required for complete operating systems.

1.3 REFERENCES

A. FBC – Florida Building Code

1.4 ACTION SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Submit shop drawings and manufacturer literature including the model number, material, finishes, and details of construction and installation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of appliance.

C. Field quality-control reports.

D. Sample Warranties: For manufacturers' special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Certification Labels: Provide residential appliances which complies with standards and bears certification labels as follows:

1. Energy Ratings: Provide energy guide labels with energy cost analysis (annual operating costs) and efficiency information as required by Federal Trade Commission.
2. UL Standards: Provide residential appliances with UL labels.
3. Uniformity: Provide residential appliances by single manufacturer to the greatest extent possible for the entire project.

B. An installer who has a minimum of five (5) years experience in the field and can demonstrate successful completion of similar projects must perform installation of specified work.

C. Electrical Appliances: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

D. UL and NEMA Compliance: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.

E. AGA and ANSI Standards: Provide gas-burning appliances that carry the design certification seal of AGA and that comply with ANSI Z21-Series standards.

F. AHAM Standards: Provide appliances that comply with the following AHAM standards.

1.8 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranties: Written warranties, executed by manufacturer of each appliance specified agreeing to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Electrical Range: Five (5) year limited warranty for in-home service on surface-burner elements.
2. Refrigerator/Freezer: Five (5) year limited warranty on the sealed refrigeration system.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Manufacturer shall be one of the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding:

1. General Electric
2. Hotpoint
3. LG Electronics
4. Speed Queen
5. Whirlpool
6. Accurex

B. All products shall be ADA compliant and installed to meet code requirement.

2.2 MATERIALS

A. The use of Energy Star products is required over non-energy star product when available.

B. Provide appliance in the number, location, and type shown on the plans and from the Residential Equipment Schedule acceptable standards.

2.3 ACCESSORIES

A. Provide all ductwork, termination caps, and accessories as required by each manufacturer to complete the install of each unit as shown on the drawings.

B. Coordinate electrical accessories required for complete installation.

2.4 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Examine walls, ceilings, and roofs for suitable conditions where overhead exhaust and microwave ovens with vented exhaust fans will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install appliances according to manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 11 31 00

Martin County School District
District Administrative Offices
New Boardroom Tenant Improvement

RESIDENTIAL EQUIPMENT SCHEDULE

ITEM NO.	SOURCE	CAT. NO.	DESCRIPTION	DIVISION 23 – MECHANICAL FIELD CONNECTION	DIVISION 26 – ELECTRICAL FIELD CONNECTION	NOTE REF.
REF	GE	GNE29GSKSS	STAINLESS STEEL 28.5 CU FT. FRENCH DOOR REFRIGERATOR	WATER	120V, 60 HZ; 15 AMP	
RANGE	GE	J5645SLSS	STAINLESS STEEL SLIDE-IN ELECTRIC RANGE	-	208V, 40 AMP	
RANGE HOOD	ACCUREX	XRRS-36	RESIDENTIAL RANGE HOOD	-	120V, 60HZ; 1 5 AMP BREAKER	

Verify and coordinate electrical requirements

SECTION 12 24 13 – ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   a. Manual operated roller shade with single rollers.

1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

1. Shadeband Material: Not less than 10 inches square. Mark interior face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 10 inches long.

D. Product Data: Submit manufacturer's product data, installation instructions and general recommendations for each specified material and fabricated product. Unless otherwise indicated, submit the following for each type of product provided under work of this section for recycled content:

1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
2. Indicate relative dollar value of recycled content product to total dollar value of product included in project.

3. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
4. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

E. Paints, primers, coatings, and adhesives for or site installation or factory fabrication:

1. Submit manufacturer's product data for paints, primers, coatings, and adhesives as indicated.
2. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.
3. Submit manufacturer's certification that products comply with VOC limits when calculated according to 40CFR 59, Subpart D (EPA Method 24).

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material.

C. Product Test Reports:

1. Fire-Test-Response Characteristics: Passes NFPA 701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
2. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 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. Roller Shades:
   a. Fabric equal to 5 percent of quantity installed for each color, and shadeband material indicated.
   b. Brackets equal to 5 percent of quantity installed for each type on project.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.10 WARRANTY

A. Roller Shade Hardware and Shadecloth: Manufacturer's standard non-depreciating twenty-five (25) year limited warranty.

B. Roller Shade Installation: One year from date of substantial completion, not including scaffolding, lifts, and other means of access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. MechoShade Systems, Inc.

B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.

1. Insoltroll Window Shading Systems
2. SWF Contract
3. Draper, Inc.

2.2 MANUALLY OPERATED SHADES WITH SINGLE-ROLLERS

A. Basis of Design: “Mecho 5” Light Filtering

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Stainless steel
   a. Loop Length: Full length of roller shade except at clerestory windows where chain will stop 48” inches above finished floor, to be verified with the Architect.
   b. Limit Stops: Provide upper and lower ball stops.
   c. Chain-Retainer Type: Standard Clip
2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
   a. Provide for shadebands that weigh more than 12 lb. or for shades as recommended by manufacturer, whichever criteria are more stringent.

C. Rollers: Corrosion-resistant extruded-aluminum tubes of diameters and wall thicknesses required for accommodating operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: As indicated on Drawings.
2. Direction of Shadeband Roll: Regular, from back of roller.
3. Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

1. Brackets: Constructed of minimum 1/8-inch thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
2. Plastics: Provide self–lubricating plastic for all plastic components of shade hardware.

E. Shadebands:

1. Shadeband Material: Light filtering fabric or light blocking as indicated.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
3. Type: Enclosed in sealed pocket of shadeband material.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
   a. Shape: L-shaped.
   b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open.
   c. Endcap Covers: To cover exposed endcaps.
   d. Installation Accessories Color and Finish: As selected from manufacturer's full range.
2. Side Channels: To be installed at light blocking shades only.

a. Extruded aluminum with polybond edge seals and SnapLoc-mounting brackets and with concealed fastening. Exposed fastening is not acceptable.
b. Color: Selected from manufacturer's standard colors.

G. Location: See drawings for blind locations.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Identify products with appropriate markings of applicable testing agency.

B. Final light filtering and light blocking fabric shall be as selected by the Architect.

C. Light-Filtering Fabric: Woven fabric, stain and fade resistant

1. Basis of Design: "ThermoVeil Dense Basket Weave"
2. Style: MechoShade 1300 Series
3. Type: Light filtering
4. Content: Extruded vinyl yarn comprising of 25 percent polyester and 75 percent reinforced vinyl.
5. Weave: Basketweave.
6. Thickness: Single thickness non-raveling 0.030-inch thick vinyl fabric, woven from 0.018-inch diameter extruded vinyl yarn.
7. Roll Width: 96 inches
8. Orientation on Shadeband: As indicated on Drawings.
9. Openness Factor: 5 percent.
10. Color: Final selection shall be as selected by Architect from manufacturer's full range.

Or

1. Basis of Design: "ThermoVeil Dense Basket Weave"
2. Style: MechoShade 1500 Series
3. Type: Light filtering
4. Content: Extruded vinyl yarn comprising of 25 percent polyester and 75 percent reinforced vinyl.
5. Weave: Basketweave
6. Thickness: Single fabric thickness 0.025 inches thick vinyl fabric, woven from 0.010-inch diameter vinyl/polyester yarn.
7. Roll Width: 96 inches
8. Orientation on Shadeband: As indicated on Drawings.
9. Openness Factor: 3 percent.
10. Color: Final selection shall be as selected by Architect from manufacturer's full range.

2.4 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

C. Provide multi-band shades to provide the maximum allowable width to accommodate operation by a single unit.

D. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. One batten seam will be required for stability on shades taller than fifteen feet to be placed as indicated by Architect.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions on inside face of mullion unless indicated otherwise.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13

SECTION 12 48 12
ENTRANCE FLOOR MATS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
   1. Surface-type foot grille mats.

1.3 SUBMITTALS

A. Submit manufacturer's specifications and installation instructions for each type of entrance mat.
B. Include methods of installation for each type of substrate.
C. Submit samples for each type and color of exposed entrance mat, frames, and accessories required.
D. Provide 12" square samples of mat materials and 12" lengths of frame members.

1.4 MAINTENANCE DATA

A. Maintenance Data: Submit manufacturer's printed instructions for cleaning, drying, maintaining, and re-handling of removable entrance mat units.

1.5 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product.
   1. Forbo Entrance Systems

2.2 MATERIALS AND FABRICATION

A. General: Provide colors/patterns/profiles of materials, including metals and metal finishes, as indicated on drawings or by this specification or, where not indicated, as selected by Architect from manufacturer's standard colors/patterns/profiles.

1. Shop-fabricate the entrance mat work to greatest extent possible, in sizes as indicated on plans.
2. Where not otherwise indicated, provide single unit for each mat installation, but do not exceed manufacturer's maximum size recommendation for units intended for removal and cleaning.
3. Where joints in mats are necessary, space them symmetrically and away from normal traffic lanes.
4. Miter corner joints in framing elements, with hairline joints, or provide prefabricated corner units without joints.
5. Where possible, verify sizes by field measurement prior to shop fabrication.

B. Entrance Mat Systems:
1. Provide model Forbo coral mats entrance system or approved equal.
2. Vinyl edge accessories to accommodate mat application as indicated per manufacturer.
3. All building doors opening to the exterior shall have mats provided except for mechanical/electrical room doors.
4. All entrance mats are to provide 6’-0” minimum travel length.
5. Color: As selected by the Architect from the manufacturer’s standard color palette. Provide samples for approval.
6. Mat size shall be 6’-0” wide x 6’-0” deep.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install surface-type units to comply with manufacturer's instructions, at locations indicated and coordinated with entrance locations and traffic patterns.
1. Anchor the fixed surface type frame members to floor with devices spaced as recommended by manufacturer.

END OF SECTION

SECTION 21 00 02
FIRE SUPPRESSION SYSTEMS – PERFORMANCE BASED

PART 1 – GENERAL

1.1 SYSTEM DESCRIPTION

A. Layout and provide automatic wet pipe fire sprinkler system in accordance with but not limited to NFPA 101, NFPA 13, local and county codes and all applicable codes set forth by the Authority Having Jurisdiction. Discharge from individual heads in the hydraulically most remote/demanding areas shall be hydraulically calculated to an acceptable margin of safety not less than 10 psi for growth and fluctuation in the available water supply of the area. Each system shall include materials, accessories, and equipment inside and outside the building to provide each system complete and ready for use. Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, HVAC equipment, access space needed for maintenance of equipment and other construction and equipment in accordance with detailed working drawings to be submitted for approval. Locate sprinkler heads in a consistent pattern with ceiling grid, lights, diffuser, registers, and grilles. Provide sprinkler heads and piping system layout. Devices and equipment for fire protection services shall be U.L. listed or F.M. approved for use in wet pipe system.

1.2 QUALITY ASSURANCE

A. Qualification of installers.
   1. The entire fire protection system shall be fabricated, installed, and tested by a company approved by owner. Contractor shall qualify himself as to experience, insurability, and capability by submitting an “AIA” and a 306 contractor’s qualification statement. Satisfactory completion of similar projects is required.

B. All fire protection systems and equipment shall conform to the applicable standards and requirements of the following:
   1. Sprinkler systems: NFPA 13, 2016
   2. Florida Administrative code 61G15-32.003 and 61G15-32.004.
   3. Florida Building Code, 2020 (7th Edition)
   4. Life Safety Code - NFPA 101, 2018
   5. Florida Fire Prevention Code, 2020
   6. Local codes or standards incorporated by the authority having jurisdiction.
   7. All components shall be U.L. listed and FM (Factory Mutual) approved and labeled where applicable.
   8. Installation of sprinkler system components shall be per the more stringent or either U.L. listed or FM (Factory Mutual) approved installation requirements.
   9. The entire fire protection system shall be approved by the authority having jurisdiction. Any adjustments or additions to this system required to secure the approvals, shall be part of the work of this Section.

1.3 SUBMITTALS

A. Working plans shall be submitted by a State of Florida license fire protection contractor.

B. Working plans shall be drawn on sheets of uniform size at a scale of not less than 1/8" - ft., with plan of each floor on reproducible material, and shall show the following data:
   1. Name of Owner and Occupant.
   2. Location, including street address.
   3. Point of compass.
   4. Ceiling construction.
   5. Full height cross section.
   6. Location of fire walls.
   7. Location of partitions.
   8. Occupancy of each area or room.
   9. Location and size of concealed spaces and closets.
   10. Any questionable small enclosures in which no sprinklers are to be installed.
   11. Size of city main in street, pressure and whether dead-end or circulating and, if dead-end, direction and distance to nearest circulating main, city main test results.
   12. Other sources of water supply, with pressure or elevation.
   13. Make, type and nominal orifice size of sprinkler.
   14. Temperature rating and location of high temperature sprinklers.
   15. Total area protected by each system on each floor.
   16. Number of sprinklers on each riser per floor.
   17. Make, type, model, and size of each valve.
   18. Make, type, and location of each interior and exterior alarm as required by local Code.
   19. Total number of sprinklers on each system.
   20. Approximate capacity in gallons of each system.
   21. Pipe type and schedule of wall thickness.
   22. Nominal pipe size and cutting lengths of pipe.
   23. Location and size of riser nipples.
   24. Type of fittings and joints and location of all welds and bends.
   25. Type and locations of hangers and sleeves.
   26. All control valves, check valves, drainpipes, and test pipes.
   27. Size and location of hand hose, hose outlets and related equipment.
   28. Make, type, model, and size of all fire department connections.
   29. Underground pipe size, length, location, weight, material, points of connection to city main; type of valves, meters, and valve pits; and the depth that the top of pipe is laid below finished grade.
   30. Provisions for flushing.
   31. Hydraulic data nameplate with name and address of contractor.
   32. Cross connection protection devices as required by the local authority.
   33. Drawings, cuts, and catalog information showing manufacturer name, product numbers, or other means of identification, of all pipes, fittings, valves, and other materials, dimensions, weight, performance, etc., of all equipment. All information shall be submitted on reproducible copies.
   34. Schedules of all material showing manufacturer.

35. Drawings and details showing pumps, jockey pumps, controls, mains, risers, drains, runs, branches, valves, alarms, fire hose racks, etc., for complete fire protection system.
36. In addition to submittals to the authority having jurisdiction furnish to the Architect copies of working plans in quantities as designated in Section 15010 for review and comment. Any adjustments to the installation or materials of the system required by the Architect as noted on the plans shall be part of the work of this section.

C. Approval of the complete system shall be obtained from the authorities having jurisdiction, and a copy of the same shall be delivered to the Owner's representative for delivery to owner.

1.4 APPROVAL

A. The installer shall perform all required acceptance tests, complete the contractor's material, and test certificate and forward the certificates to the authority having jurisdiction prior to asking for approval of the installation.
B. The general contractor & the Owner's authorized representative shall schedule all inspections with the AHJ and the AHJ shall be given a 24 hour prior to any requested inspection.
C. When the authority having jurisdiction desires to be present during the conduct of acceptance tests, the installer shall give advance notification of the time and date the testing will be performed.
D. All acceptance tests shall be in strict compliance with NFPA #13. 'Acceptance Tests" including, but not limited to the following:
    1. All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi (13.8 bar) and shall maintain that pressure without loss for 2 hours.
    2. Contractor must fill out the "Contractor's Material and Test Certification for Aboveground Piping" and submit to the Building Department and Engineer.
    3. Portions of systems normally subject to system working pressures in excess of 150 psi (10.4 bar) shall be tested as described in NFPA 13 - at a pressure of 50 psi (3.5 bar) in excess of system working pressure.
    4. Loss shall be determined by a drop in gauge pressure or visual leakage.
    5. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.
    6. Additives, corrosive chemicals such as sodium silicate, or derivates of sodium silicate, brine, or other chemicals shall not be used while hydrostatically testing systems or stopping leaks.
    7. Provisions shall be made for the proper disposal of water used for flushing or testing.

PART 2 – PRODUCTS

2.1 EQUIPMENT

A. Provide sprinkler heads of type indicated and to suit each location. Types noted on drawings.

B. Sprinkler heads in areas with ceilings shall be the pendent type, white finish with two-piece escutcheon plates. All other heads to be brass finish. Sprinkler head guards are to be installed in areas where heads are exposed to damage.
C. Sprinkler heads in areas with no ceiling (no tiles or gypsum board) shall be a brass upright sprinkler type. Sprinkler head guards shall be installed in areas where heads are exposed to damages.
D. Side wall heads mounted on a wall or soffit shall be provided with white finish.
E. Teflon pendent sprinklers shall be installed in areas prone to high moisture (showers, locker Rooms, etc.).
F. Corrosion resistant sprinklers shall be installed in areas prone to corrosion.
G. Pendent sprinklers shall be installed in all areas with lay-in ceilings. Sprinkler shall be located in the center of the tile.
H. Orifice size for all sprinkler heads shall be 1/2 inch unless conditions occur which will require another size. Sprinkler pipe hangers and supports shall be subject to applicable requirements of NFPA 13.
I. Provide a surface mounted cabinet at system riser location with spare heads of each type used and wrenches to fit heads in accordance with NFPA 13.
J. Provide a Siamese connection branded “AUTO. SPKR." with caps and chains, check valve and ball drip as directed by the local official for connection by the fire department.
K. Provide water motor gong.
L. Provide all appropriate signage to properly identify all fire protection system components.
M. All manufacturers’ instruction on installation, operation and maintenance shall be provided to owner upon completion of installation.

2.2 MATERIALS

A. Product Handling:
   1. Protection: Use all means necessary to protect fire sprinkler system materials before, during and after installation and to protect the installed work of all other trades.
   2. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.
B. Steel Piping:
   1. Pipe shall be new, designed for 175 psi working pressure, conforming to ASTM specifications and have the manufacturers name and brand, along with the applicable ASTM standard, marked on each length of pipe.
      a. Overhead – Steel piping shall be black or galvanized steel.
         1) Standard Wall: Overhead piping to be black steel, electric resistance welded and shall comply to the specifications of ASTM-135. Piping 2-1/2” and larger to be schedule 10 and 2” and smaller to be Schedule 40. All pipe and fittings to be in accordance with NFPA.
         2) Thin Wall: Overhead pipe sizes of 2-1/2” and larger for welded and seamless type specified in ASTM A 53-80 used in welded systems shall have a minimum pipe wall thickness for pressures up to 300 psi as follows: Schedule 10 in sizes up to 5-inch; 0.134 inches for 6-inch; and 0.188 inches for 8-inch pipe. Pipe ends shall be roll grooved or welded in accordance with NFPA 13.

b. Underground: Ductile iron pipe to be utilized under the building to a point 5'-0" outside the building line. All underground fittings to be mechanical joint per NFPA A24. Refer to civil specifications for site underground piping materials.

C. Fittings:
1. Changes in direction shall be accomplished by the use of fittings suitable for use in sprinkler systems and defined in NFPA 13. Bushings shall not be used unless written approval is obtained from the Engineer.
a. Steel Pipe Fittings:
1) Fittings shall withstand a cold-water working pressure of not less than 175 psi and shall be cast or malleable iron in compliance with the NFPA Standards. Victaulic fittings are equally acceptable.
2) Fittings for pipe size 2" and under shall be screwed and for pipe sizes 2-1/2" and over may be grooved coupling or flanged to suit the NFPA requirements.
3) Flanged fittings shall be cast iron, short body, Class 125, black and in accordance with ANSI B 16.1. Gaskets shall be full face on 1/8-inch minimum thickness red sheet rubber. Flange bolts shall be hexagon head nuts, cadmium plated, having dimensions in accordance with NSI B 18.2.
4) Weld fittings shall be steel, standard weights, black and in accordance with ANSI B 16.9, ANSI B 16.25, ANSI B16.11 and ASTM A 234.
5) Grooved couplings and mechanical fittings shall be malleable iron, 500 psi working pressure, in accordance with ASTM A 47. The couplings gasket material shall be butyl rubber. Grooved couplings and mechanical fittings shall be tested and listed by UL and/or FM and products of the same manufacturer.
6) Push-on fittings shall not be used.

D. Shut-Off Valves:
1. Except as hereinafter specified, valves used on the system shall be 175 lbs. UL listed and approved by FM Insurance Group.
2. All control valves shall be butterfly type with grooved or wafer body. Valve shall be of the indicator type and UL/FM approved. Central Mode BFV or equal.
3. Check valves shall be UL and FM approved swing check type for 175 psi pressure, as manufactured by Crane, Jenkins, or Victaulic.
4. Valves, where noted, shall be supervised type. Supervisory switches at the valve shall be as manufactured by Potter Electric Signal & Mfg., Co. Ltd. Model OSTS-B or PTS to suit valve size with two (2) sets of form 'C' contacts for remote monitoring switches shall be UL and FM approved.
5. Wiring from the supervised valve up to and including the supervisory annunciator will be done under the Electrical Division 26.

E. Riser Check Valves and Flow Indicators:
1. Riser check valve assemblies shall be provided complete with gate valves, test connections, pressure gauges and flow switches.
2. Provide flow indicators where shown and as manufactured by Grinnell Co., or Potter Electric.
3. Flow switches shall be provided with two (2) sets of form 'C' (SPDT) contacts.
4. Alarm check valves and flow indicators will be connected to the fire alarm system under Electrical Division 26.
5. Riser check valves for wet system shall be as manufactured by Automatic Sprinkler Company, Viking Sprinkler Company, Grinnell Company, Star Sprinkler Corporation and/or Reliable Automatic Sprinkler Company.

F. Drains for Test Connections: Provisions shall be made to run drain line from sprinkler test connection to the outside of the building.
G. Alarm Systems:
   1. Provide one normally open and one normally closed 120-volt A.C., rated alarm contacts on the alarm valves.
   2. Alarm contacts to the fire alarm annunciator will be connected under Electrical Division 26, including wiring, conduit, and annunciator.
H. Painting includes field painting of exposed pipes and fire system items (interior and exterior of the project), FD connections, fire hydrant, and hangars. Color to be: Red Tomato SW6607.

PART 3 – EXECUTION

3.1 SYSTEM DESIGN CONDITIONS

A. The sprinkler piping shall be hydraulically designed and shall be governed by NFPA 13, Chapter 7, Hydraulically Designed Sprinkler Systems.
B. Coordinate setting of equipment with the requirements of other trades so as to avoid conflicts and to insure compatibility. Equipment shall not block access for installation of other equipment.
C. Set base mounted equipment on permanent and finished supports. Temporary support, if any, shall be removed prior to making final pipe connections to equipment.
D. Adjust suspended equipment to final elevation prior to making pipe connections.
E. Exercise caution during equipment placing operations to ensure that structure is not overloaded.
F. Installation of the fire protection systems shall be entrusted to none but fully experienced workers. The fire protection system shall be installed by responsible parties equipped to do the work under the approved detailed plans and specifications.
G. Provide sleeves and escutcheon plates at all pipe/wall penetrations.
H. All surfaces shall be protected during installation and testing of system.
I. During progress of work, maintain an accurate record of all changes made in the fire system installation from layout materials shown on the approved shop drawings.

PART 4 – TRAINING

4.1 TRAINING OF FACILITIES STAFF

A. The sprinkler contractor shall provide training in the time required for staff to fully understand the basic information of the sprinkler system and requirement to keep the sprinkler system certified.
B. The training shall be held on site for the familiarity of the system to the staff.
C. Contractor is responsible for providing handout to all staff to be trained and provide one electronic copy reproducible by the St. John’s County School District.
D. Contactor shall provide a schedule for testing and maintenance to maintain a certified sprinkler system.
E. Contractor shall advise staff on recommended procedures in occurrence of an accidental sprinkler head discharge.
F. Testing schedule requirements per the Table below:

Training Schedule							
Div.	**Training Description**	**Subcontractor**	**Demo Date**	**Time**	**Hours**	**Comments**	**Personnel to attend training**
	Automatic Sprinkler System – Wet Pipe				2 hours	Demonstrate to owner selected personnel the operation of entire system, required maintenance and emergency procedures .	

END OF SECTION

SECTION 22 00 01
PLUMBING SYSTEMS

PART 1 – GENERAL

1.1 GENERAL CONDITIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Refer to Division 1 for all requirements pertaining to General Provisions.
C. Provide all the plumbing work in accordance with the Contract Documents.
D. Contractor shall provide adequate training to school personal on the use, operation, and maintenance of plumbing systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Outside utilities 5'-0" beyond the building wall.
B. Final connections to heating, ventilating and air conditioning equipment.
C. Cutting and patching.
D. All concrete foundations or bases.
E. Mounting of all starters, except those specified to be factory-mounted and wired as part of the equipment. All wiring necessary to supply power to electric motors and remote operating valves, including connections from the disconnect switches and starters to the motors.
F. Providing the wiring of all plumbing alarm devices excluding house pump controls from the alarm devices to an alarm panel.
G. Motor disconnects switches and circuit breakers, except in combination starters and where otherwise noted.
H. All finished painting of exposed pipes and apparatus.
I. Domestic water meters and detector fire meters.
J. Concrete pits for sump pumping units.
K. Installation of access doors in finished construction furnished as the work of this Section.
L. Flashing of roof drains and pipes penetrating the roof.
M. Flashing of floor drains in membrane waterproofed floors.
N. Excavation and backfilling.
O. Extension of fire protection from valved outlets.
P. Bracing and supports for hot water heaters.
Q. Toilet accessories.
R. Contractor shall provide adequate training to school personal on the use and maintained of plumbing systems.

1.3 WORK INCLUDED

A. Plumbing Fixtures and Trim.
B. Sanitary Waste and Vent Systems.
C. Water Supply System.
D. Storm Drainage System.

1.4 DESCRIPTION OF SYSTEMS

A. Provide all plumbing fixtures and trim as indicated on the drawings and as specified elsewhere herein. All fixtures shall be connected to the plumbing systems as indicated and required for proper operation. Piping materials, accessories, and equipment shall be as specified elsewhere in Division 22.
B. Sanitary Waste and Vent Systems:
   1. Provide a complete sanitary, waste and vent system for all fixtures and equipment in the building requiring connections.
   2. All waste from the building shall discharge by gravity from the building to 5 ft. outside of building as shown on the drawings.
C. Water Supply System:
   1. Provide a complete water supply system for all fixtures and equipment in the building including domestic water heaters.
   2. The domestic water system shall connect to 5’-0” outside of building as shown on the plans.
   3. Local connections to fixtures and equipment shall be not less than full size of the fittings on the fixtures and equipment, and runouts and risers serving same shall be as shown and not less than one pipe size larger than the fittings on the fixtures and equipment.
   4. Provide stop-and-waste valves or ball valves at every branch off water mains where accessible and provide approved gate or compression stops at every connection to fixtures and equipment.
   5. Provide shock arresters in accordance with the Plumbing and Drainage Institute Standard PDI-WH201. Provide access door at each location of shock arrester. All shock arresters shall comply with ANSI A112.26.1-1969 (R1975). Coordinate access door locations with the architect.
   6. Pressure gauges shall be provided, on the inlet and outlet of all pumps, at the connection to each piece of equipment connected to by the plumbing contractor and at the main service valve in the building. Gauges shall be as specified herein.
   7. Thermometers shall be provided, on the inlet and outlet of each water heater, HWR pipe at the discharge of the circulator pump. Thermometers shall be as specified herein.
D. Storm Drainage System:
   1. All drain connections to the building storm water system at the lower levels subject to backflow shall be equipped with back water valves.
   2. Insulate floor drains receiving cold condensate for a minimum distance of 20'-0" to the vertical stack.

PART 2 – PRODUCTS

2.1 SHOCK ARRESTERS

A. Shock arresters shall be stainless steel, welded nesting type expansion bellows as manufactured by Sioux Chief, Zurn, or Josam. Provide access panels.

PART 3 – EXECUTION

3.1 PIPING WORK - INSTALLATION

A. The drawings shall be followed where they are definite and provided such procedure causes no objectionable conditions or does not conflict with other trades, laws, regulations, or recommendations of equipment manufacturers. The drawings are intended to indicate the sizes of piping connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.

3.2 STERILIZATION OF PIPING AND EQUIPMENT

A. After all domestic cold water and hot water supply and return piping has been flushed free of foreign matter, and within 30 days prior to turning the building over to the Owner, this piping shall be sterilized in accordance with Section 22 11 17 – Disinfection of Domestic Water Lines.

END OF SECTION

SECTION 22 02 00
BASIC MATERIALS AND METHODS FOR PLUMBING SYSTEMS

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Piping and equipment identification.
B. Electrical requirements.
C. Painting.
D. Concrete work.
E. Fabricated steel supports.
F. Excavation, trenching and backfilling.
G. Placing of equipment.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced.
   1. American Institute of Steel Construction (AISC) Publications
   2. American National Standards Institute (ANSI) Standards
   3. American Society for Testing and Materials (ASTM) Publications
   4. American Welding Society (AWS) Publications
   5. Underwriters Laboratories, Inc. (UL) Standards

1.4 SUBMITTALS

A. Where submittals are required, comply with Division 1.
B. Shop Drawings: Submit drawings of fabricated steel supports where proposed supports are not in accordance with details on drawings, or where drawings do not detail supports. Submittal for acceptance is required.
C. Product Data: Submittal for other than fabricated steel supports are not required. Product data for the following shall be included in the operation and maintenance manuals. Submittal for acceptance is not required.
   1. Piping and equipment identification.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Piping and Equipment Identification:
   1. Communications Technology Corp.
   2. Craftmark Identification Systems, Inc.

3. EMED Co., Inc.
4. Florida Marking Products, Inc.
5. Marking Services, Inc.
6. Seton Name Plate Corp.
7. W.H. Brady Co., Signmark Division

2.2 FABRICATION

A. Piping and Equipment Identification:
1. Pipe markers: Sub-surface printed plastic, with protective undercoating. Markers shall be permanently curled for snap-on installation for pipe sizes (including insulation) up to 6" diameter. For external diameters above 8". Marker shall be secured using cable ties for indoor use and stainless-steel banding or ultraviolet resistant plastic for exterior use. Markers for outdoor installation shall be over-laminated with Tedlar□ on polyester ultraviolet to avoid damage and fading. Markers shall identify the pipe contents and direction of flow through 360-degree visibility range. Marker size, letter size, letter color, wording and background color shall be in accord with ANSI A13.1 – Scheme for the Identification of Piping Systems. Based on Marking Services Inc. Model MS-970 Coiled Plastic Markers for indoor use and Model MS-995 Maxilar Marker for exterior use.
2. Valve tags: Contractors Option:
   a. Indoor:
      1. 19-gauge brass, 1-1/2-inch round, with 1/4-inch-high black pipe service letter abbreviation above 1/2-inch-high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.
      2. 1/16-inch-thick plastic, 1-1/2" round, with ¼ inch high black pipe service abbreviation above 1/2-inch-high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.
   b. Outdoor Service:
      1. 19-gauge brass, 1-1/2-inch round, with 1/4-inch-high black pipe service letter abbreviation above 1/2-inch-high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.
      2. 19-gauge Type 304 stainless steel, 1-1/2" round, with ¼ inch high pipe service abbreviation above 1/2-inch-high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 stainless wire meter seal or #6 Type 304 stainless steel bead chain with locking link. Based on Marking Services, Inc.

3. Valve chart frame: Self-closing, satin-finished, extruded aluminum with glass window, 8-1/2 inch by 11-inch chart size.
4. Equipment nameplates:

c. Indoor: Shall be 1/16-inch-thick plastic with black satin surface and white core. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4-inch-high lettering for equipment and 3/4 inch by 2-1/2 inch, with 3/16-inch-high lettering for ceiling grid labeling. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre- drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.

d. Outdoor: Shall be 125 Mil rigid plastic constructed of printed legend sealed between two layers of chemically resistant plastic to resist ultraviolet damage. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4-inch-high lettering for equipment. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre- drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.

e. Based on Marking Services Inc. Model MS-215 Max-Tex.
   i. Electrical Requirements: Refer to Division 26 for requirements
   ii. Painting: Product specified in Division 9 - FINISHES.
   iii. Concrete Work:
      1. Concrete is provided under DIVISION 3 - CONCRETE.
      2. This contractor to provide detailed dimension drawings, including anchor bolt locations where required for all bases and pads required for equipment furnished under this Division.
      3. Concrete for equipment bases and pads shall be 3000 p.s.i. design mix prepared in accord with ASTM C94. Cement shall be in accord with ASTM C150. Aggregate shall be fine sand in accord with ASTM C33. Water shall be clean, fresh, and drinkable.
   iv. Fabricated Steel Supports:
      1. Steel angles, channels, and plate shall be in accordance with ASTM A36.
      2. Steel members, including fasteners, exposed to weather shall be galvanized.
   v. Excavation, Trenching, and Backfilling: Product description not applicable.
   vi. Placing of Equipment: Product description not applicable.

PART 3 – EXECUTION

3.1 GENERAL

A. Installation of materials and equipment shall be in accord with the manufacturer's written instructions, except as specified.

3.2 INSTALLATION

A. Piping and Equipment Identification:
   1. Install pipe markers adjacent to each valve and fitting, at each branch connection, on each side of wall, floor, and ceiling penetrations, where entering and leaving underground areas, and at minimum 40 foot spacing on horizontal and vertical pipe runs. Markers shall be arranged for easy reading at eye level.
   2. Provide valve tags on all valves exposed or concealed unless otherwise noted.
   3. Attach valve tag to stem of each valve to be tagged. Valve numbers shall follow in sequence the Owner's existing valve numbers, where applicable.
   4. Provide a marker for each valve and equipment to be tagged, located above lift-out tile ceilings. The marker shall be 1/16-inch-thick plastic with a satin surface and white core. Color of the marker shall match color of piping identification system. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be ¾ inch by 2-1/2 inch, with 3/16-inch-high lettering for ceiling grid labeling. Plate manufacturer shall furnish suitable adhesive for permanently attaching plate to ceiling grid.
   5. Provide a minimum of 4 valve charts. Chart information shall indicate job name, Contractor name, date of installation, valve number, valve location, valve type, valve purpose, and system in which installed. Mount framed chart in equipment room and insert copy of chart in each operating and maintenance manual under separate tabbed section labeled "Valve Chart". Where project drawings include a piping flow schematic, request AutoCAD file from Engineer and label all of the valves according to the valve chart and frame in an 18” x 24” frame in main mechanical or pump room.
   6. Permanently affix nameplate to each item of equipment using stainless steel pop rivets. Where irregular surface impedes direct attachment of plates, affix plate to sheet metal bracket and attach bracket to equipment with screws, bolts, or suitable adhesive from nameplate manufacturer.

B. Electrical Requirements: All work as provided under Division 26.

C. Painting:
   1. All equipment shall be furnished with a factory- applied galvanized, prime paint, or finish paint finish. Touch-up damaged surfaces of equipment immediately.
   2. Paint for galvanized surfaces shall be in accordance with ASTM A780 using zinc rich compound.
   3. Paint wooden mounting backboards with two coats of gray enamel prior to making attachments to the board.
   4. For quality control refer to DIVISION 9 - FINISHES.
   5. Remove all dirt, rust, scale, grease, pipe dope, solder flux, and welding slag from all surfaces to be painted.
   6. Paint immediately, under this Division, all damaged galvanized surfaces. Paint galvanized metal surfaces behind grilles with two coats of flat black paint.
   7. Apply rust inhibitive primer to ferrous surfaces of shop fabricated steel supports.
   8. Paint immediately under this division all field and shop welded joints in piping or equipment supports with 2 coats of grey metal primer.

D. Concrete Work: All work as provided by Division 3.

E. Fabricated Steel Supports:
   1. Because of the small scale of the drawings, details of equipment support are not always shown. It shall be the responsibility of the contractor to provide supports as required for safe and adequate support.
   2. Fabricated steel supports and ladders may be shop or field-fabricated and shall be in accord with details on drawings.
   3. When details are not indicated, the contractor shall submit proposed support detail for review. The contractor shall bear all cost in producing this detail in the bid. This includes but is not limited to structural engineering support.
   4. Steel members shall be saw cut, with corners ground smooth, and shall be assembled with welded or bolted connections at Contractor's option. Connections shall be in accord with specified AISC Publications.

F. Excavation, Trenching, and Backfilling: Excavation, trenching, and backfilling for site utility piping systems specified in DIVISION 31.

G. Placing of Equipment:
   1. Coordinate setting of equipment with the requirements of other trades so as to avoid conflicts and to insure compatibility. Equipment shall not block access for installation of other equipment.
   2. Set base mounted equipment on permanent and finished supports. Temporary support, if any, shall be removed prior to making final pipe, duct, or electrical connections to equipment.
   3. Adjust suspended equipment to final elevation prior to making pipe, duct or electrical connections.
   4. Exercise caution during equipment placing operations to ensure that structure is not overloaded.
   5. Do not move heavy equipment across floor or roof of insufficient load bearing capacity to support such equipment. Provide bracing or shoring as required or use crane to place equipment directly on permanent and finished support.
   6. Secure all roof mounted equipment to the structure adequately to resist overturning, uplift and sliding forces for basic wind speeds indicated for this location in Figure 1609 of the Florida Building Code, Latest Edition.

END OF SECTION

SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING SYSTEMS

PART 1 – GENERAL

1.1 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. Comply with Sections 01 33 00 – Submittal Procedures and 01 60 00 – Material Equipment and Approved Equals.

1.2 ARTICLES INCLUDED

A. Definitions.
B. Permits, Fees and Notices.
C. Applicable Publications.
D. Code Compliance.
E. Scope of Work.
F. Record Drawings.
G. Intent of Drawings and Specifications.
H. Quality Assurance
I. Submittals.
J. Product Requirements - Equals and Substitutions.
K. Manufacturer’s Instructions.
L. Transportation and Handling.
M. Storage and Protection.
N. Cutting, Patching and Demolition.
O. Cleaning Up/Removal of Debris.
P. Operating and Maintenance Manuals.
Q. Training of Owners Operators.
R. Guarantee of Work.
S. System Testing.

1.3 ARTICLES

A. Definitions:
   1. The term "As indicated" means as shown on drawings by notes, graphics, or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "scheduled" and "specified" have same meaning as "indicated" and are used to assist the reader in locating information.
   2. The term "Provide", means furnish and install as part of the work covered in Division 22.
   3. The term "Furnish" means furnish only, for installation, as part of this contract, by other Divisions.
   4. The term "Install only" means to install under the work of Division 22 equipment furnished by other Divisions, or by the Owner.

5. The term "Owner's Representative" when referenced herein shall be the Architect or the Engineer acting as his designated representative unless otherwise noted.
6. The term "design" as it pertains to the work of this division shall describe the basic intent, component sizing, component relationships and overall architecture of the Plumbing system. The design is generally schematic in nature and will require specific detailing after the accepted products are determined.
7. The term "detail" as it pertains to the work of this division shall describe the work required by the contractor to assure a fully coordinated installation of the material and equipment supplied. When requested, the contractor shall produce detailed shop drawings or sketches indicating the actual placement of the equipment or material supplied; also including how the equipment or material interfaces with work of other sections or divisions within the contract documents.
8. The term "workman-like manner" as it pertains to the work of this division shall describe a neat well-organized high-quality installation system (piping, etc.). Routing shall be well thought out providing adequate service clearance and maximum use of space. Equipment placement shall exhibit proper clearances for service. All lines (piping, etc.) shall be run straight and true, parallel, or perpendicular to building structure neatly supported.
9. For additional definitions refer to the General Conditions.

B. Permits, Fees and Notices: Comply with the General Conditions.
C. Applicable Publications:
   1. Publications listed in each Section form a part of that Section to the extent referenced.
   2. When a standard is specified by reference, comply with requirements of that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.
   3. The Publication or Standard is the publication in effect as of the bid date, except when a specific date is listed.
D. Code Compliance:
   1. Life Safety Code - NFPA 101
   2. Florida Building Code, 7th Edition (2020)
   3. Florida Accessibility Code, 2020
   4. National Electrical Code 2017
   5. Florida Plumbing Code, 7th Edition (2020)
   6. State Requirements for Educational Facilities (SREF), 2014
   7. NFPA Standards, Latest Edition.
E. Scope of Work: The work to be performed under this Division consists of the satisfactory completion of all PLUMBING as indicated in the Contract Documents.
F. Record Drawings: Comply with the General Conditions.
G. Intent of Drawings and Specifications:
   1. The intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment, and workmanship, and to provide operable plumbing systems complete in every respect.

2. Existing conditions, dimensions, etcetera, depicted on the drawings are taken from the "as-built" drawings of the original construction supplemented by field observation. The contractor is cautioned to field verify all existing conditions, dimensions, etcetera, notifying the Owner's Representative of any discrepancies other than those minor in nature, for direction, prior to ordering or fabricating equipment or materials. Anything mentioned in the specifications and not shown on the drawings or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawing and specifications, the more stringent shall govern, unless the discrepancy conflicts with applicable codes, wherein the code shall govern. The drawings are diagrammatic, intending to show general arrangement, capacity, and location of system components, and are not intended to be rigid in detail. Final placement of equipment, other system components, and coordination of all related trades shall be the contractor's responsibility.
3. Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets and fittings may not be shown but shall be provided at no additional change in contract cost.
4. In the event of a conflict, the Owner's Representative will render an interpretation in accordance with the General Conditions.

H. Quality Assurance:
1. All equipment furnished under this Division shall be listed and labeled by U.L., ETL or a nationally recognized testing laboratory (NRTL).
2. Material furnished under this Division shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such material and shall be the latest design.
3. Materials shall be the best of their respective kinds. Materials shall be new except where the specifications permit reuse of certain existing materials.
4. Work provided for in these specifications shall be constructed and finished in every part in a workmanlike manner.
5. All items necessary for the completion of the work and the successful operation of a product shall be provided even though not fully specified or indicated on the drawings.
6. All work to be performed by qualified and experienced personnel specifically trained in their respective field.
7. All work of this division shall be carefully interfaced with the work of other divisions to assure a complete, functioning system or systems.

I. Submittals:
1. In addition to all other submittal requirements elsewhere in the contract documents, the contractor shall comply with the following.
2. Submittal for acceptance is required only on those items specifically requested in the specification section that applies.
3. For products and equipment that do not require a submittal for acceptance, submit a separate letter for each specification section certifying that all products and equipment will be provided in compliance with the contract documents.
4. Provide submittal data in accordance with the General Conditions and/or as listed below.

5. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that the submittals will be needed in order to meet construction schedule. This schedule shall be submitted prior to or in conjunction with the first submittal. Processing of submittals may be delayed pending the receipt of this schedule at the reviewer's discretion.
6. Submittal data shall be presented in a clear and thorough manner and referenced to the specification section.
    a. Where applicable, data shall be identified by reference to sheet and detail, schedule or room numbers, equipment or unit number as shown on Contract Drawings.
7. Prepare performance and product data as follows:
    a. Clearly mark each copy to identify pertinent products or models, delete non-pertinent data.
    b. Show performance characteristic and capacities.
    c. Show dimensions and clearances required.
    d. Show wiring or piping diagrams and controls.
    e. Clearly list any deviation in the submittals from the requirements of the contract documents.
    f. Include installation requirements.
8. Manufacturer's standard schematic drawings and diagrams:
    a. Modify drawings and diagrams to delete information not applicable to the work of this project.
    b. Supplement standard information to provide information specifically applicable to the work of this project.
9. Prohibition of Asbestos and PCB:
    a. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound of material containing or incorporating asbestos or PCB, is prohibited. The requirements of this specification for complete and operating mechanical systems shall be met without the use of asbestos or PCB.
    b. Prior to the Final Review field visit the Contractor shall certify in writing that the equipment and materials installed in this Project under this Division 22 contain no asbestos or PCB. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB. This statement shall be signed by a duly authorized agent of the manufacturer.
10. Letter of Certification: Where a submittal is not required, provide letter certifying that the work will be completed in strict accordance with the specified requirements. In the event the contractor wishes to alter the requirements of the specification for whatever reason, this should be clearly explained in this letter noting that this alteration may require additional submittal requirements.
11. Schedules: Where schedules are called for, submit schedule indicating which products will be used and to what extent by system, location, size, etc.
12. Where samples are requested, samples shall be of sufficient size and quantity to clearly illustrate:
    a. Functional characteristics of the product, with integral related parts and attachment devices.
    b. Full range of color, texture, and pattern.

c. Where a mock-up is specified, erect at the Project site, in a location acceptable to the Owner's Representative. Size or area shall be that specified or as agreed upon during pre-construction or other job site meetings.
d. Where mock-up is not a permanent part of the installation, remove mock-ups at conclusion of work or when acceptable to the Owner's Representative.

13. The Contractor shall:
    a. Review Shop Drawings, Product Data and Samples prior to submission.
    b. Determine and verify:
        1) Field measurements.
        2) Field construction criteria.
        3) Catalog numbers and similar data.
        4) Conformance with specifications.
        5) All submittals have been properly interfaced with the requirements of this and other divisions of work so as to assure a complete, functioning system in accordance with the contract documents.
    c. Coordinate each submittal with requirements of the work and of the Contract Documents.
    d. Clearly identify any deviations in the submittals from requirements of the Contract Documents. Any deviations not specifically disclosed in the submittal shall be solely at the risk of the Contractor and shall be subject to discovery at any time. Any undisclosed deviations shall be corrected by the Contractor to comply with the requirements of the Contract Documents at no cost to the Owner regardless of the action code accorded the submittal by the Owner's Representative.
    e. Do not release equipment for shipment, begin fabrication or work on any items requiring submittals for acceptance until all submittals are returned with the Owner's Representative acceptance.
    f. Make submittals promptly, and in such sequence as to cause no delay in the work or in the work of any other contractor.
14. Number of Submittals: Comply with the Division 1, Specification Section 01 33 00 – Submittal Procedures.
15. Submittals shall contain:
    a. The date of submission and the dates of any previous submissions.
    b. The Project title and number.
    c. Contract identification.
    d. The names and phone numbers including personal contact of:
        1) Contractor.
        2) Supplier.
        3) Manufacturer.
    e. Identification of the product, with the specification section number and contract document description clearly indicated.
    f. Field dimensions clearly identified as such.
    g. Relation to adjacent or critical features of the work or materials.
    h. Applicable standards.
    i. Identification of deviations from Contract Documents.
    j. Identification of revisions on re-submittals.

k. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
l. Each submittal shall be limited to a single specification section. Submittals shall not be grouped with other sections in common binders or under common control sheets except as defined in paragraph m. below. Each submittal shall have a cover/control sheet containing the information listed above (a thru k) and have a minimum of 8" x 3" clear space for the general contractors, engineers, and architects review stamp.
m. The first group of submittals shall be sent in a minimum of one (or if required) two hard cover view type 3-ring binder(s) White, sized to hold 8-1/2” x 11” sheets:
    1) Binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1”, maximum spline size to be 3” (provide additional binders if 3” size is not sufficient to properly hold submittals).
    2) Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket. Description sheets are to be white with black letters, minimum of 11” high and full width of pocket. Description is to describe project and match project drawing/project manual description.
    3) Submittals not complying with these requirements may be returned with no action taken at the reviewer’s discretion.

16. Re-submittals shall contain:
    a. The date of re-submission and the dates of all previous submissions.
    b. A copy of the Engineer's comments from the previous submittal.
    c. An itemized response to each of the Engineer's comments specifically outlining the changes or corrections being made. As an example, this could be either noting the page(s) of the previous submission that are affected and what changes have been made or noting specific additional information being provided.
    d. Submittals not complying with these requirements may be returned with no action taken at the reviewer’s discretion.
    e. Turnaround time and copies as indicated in Section 01 33 00 – Submittal Procedures.
17. The Owner's Representative will (if they so desire):
    a. Review submittals promptly and where special attention is requested, review in accordance with the schedule required.
    b. Review the submittal for general compliance with the contract documents. The contractor is responsible for quantities, dimensions, placement of the product, coordination with all other trades occupying the space, maintain service clearance, function, and compliance with the written installation instructions.
    c. Determine the appropriate action for the submittal. Action codes will be as follows:
        - "NO EXCEPTIONS TAKEN" - Copies will be distributed as indicated under above schedule.

- "NOTE MARKINGS/CONFIRM" - Final but Restricted Release; General Contractor may proceed with fabrication, taking into account the necessary corrections on submittal and with Contract Documents. General Contractor must submit a confirmation letter to remove restriction and allow shop drawings on the project site. A sample of a confirmation letter is enclosed herein.
- "NOTE MARKINGS/RESUBMIT" - General Contractor may proceed with fabrication, taking into account the necessary corrections. Corrected shop drawings shall be resubmitted before fabrication of this work is complete to obtain a different action marking. Do not allow drawings marked, "Resubmit" to be used in connection with installation of the Work.
- "REJECTED/RESUBMIT" - General Contractor will be required to resubmit shop drawings in their entirety. No fabrication or installation shall be started until shop drawings so marked have been completely revised, resubmitted, and marked by Architect according to preceding Paragraphs a. or b.

d. Turnaround time will be per Division 1.
e. Review comments will be per Division 1.

18. Resubmission requirements for "as specified" products.
    a. Make any corrections or changes in the submittals required by the Owner's Representative and resubmit until accepted.
    b. A submittal shall only be reviewed a maximum of 3 times. If upon the second resubmission an accepted action cannot be rendered (No Exceptions Noted or Make Corrections as Noted), the contractor shall supply the basis of design product and bear all costs incurred by the Engineer during the review process until an accepted submittal is achieved.
19. The Contractor shall maintain one copy of all accepted submittal data including letters of compliance in a job site file.

J. Product Requirements, Equals and Substitutions:
    1. In addition to all other requirements for submittals, equals and substitutions elsewhere in the contract documents, the contractor shall comply with the following.
    2. Product Requirements:
        a. The specifications sections under Article 2.1 "ACCEPTABLE MANUFACTURER", lists suppliers found acceptable for this project. The names listed are manufacturers who meet the minimum acceptable standards that this project dictates. The list is furnished as a guide. Even though a manufacturer is named, he must still provide the type and quality of equipment specified as well as equipment that will fit within the allotted space and within the design weight allowance, etc. Being named does not imply permission for that manufacturer to provide an alternative product or design. Other manufacturers not named will be considered to be equal providing they furnish a product of the type and quality specified.
        b. In certain cases, foundations and/or structural supports or electrical requirements for equipment specified in this Division are provided under other divisions of the specifications. Where an alternate acceptable manufacturer's product is provided, this contractor shall coordinate the revised requirements and include an allowance for any cost differential.

c. If the list, under Article 2.1 "ACCEPTABLE MANUFACTURERS" names only one manufacturer followed by "No Substitutions" that product shall be supplied.

3. Substitutions: *Comply with the General Conditions, but the following are in addition to:*
   a. A substitution is defined as any product not meeting the requirements as outlined in PART 2 - PRODUCTS. A different design accomplishing the same result will be considered a substitution. The same design requiring a larger motor, or more space or a structural change to accommodate larger weight, etc., will be considered a substitution. If a manufacturer who is not listed as an "ACCEPTABLE MANUFACTURER" wants to have his product considered as an equal or as a substitution, he shall submit details to the Engineer 10 days in advance of bid date and a decision will be rendered. If necessary, a clarification will be issued in the form of an Addendum. No substitution requests shall be considered after the Bid.
   b. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including.
      1) Comparison of the qualities of the proposed substitution with that specified in tabulated format.
      2) Changes required in other elements of the work because of the substitution.
      3) Effect on the construction schedule.
      4) Cost, extra credit or statement of no change in contract price.
      5) Any required license fees or royalties.
      6) Availability of maintenance service, and source of replacement materials.
   c. The Engineer shall be the judge of the acceptability of the proposed substitution.
   d. A request for a substitution constitutes that the Contractor:
      1) Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
      2) Will provide the same warranties for the substitution as for the product specified.
      3) Will coordinate the installation of the substitution into the work and make such other changes as may be required to make the work complete in all respects.
      4) Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
      5) Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.
      6) Will absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or miss-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.
4. Engineer will review requests for substitutions with reasonable promptness, and will issue an addendum or notify Contractor, in writing, of the decision to accept or reject the requested substitution.

5. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or if acceptance requires revision to the contract documents.
6. The engineer will review substitution submittals for compliance a maximum of two times. If the submittal or substituted product does not comply with the contract documents on the second submittal, the submittal and product will be rejected and the specified product will be required.
7. The contractor may request further review of the substitution after the second submittal rejection if the contractor agrees in writing to accept responsibility for the cost of additional review time and expenses by the Engineer.
8. In the event a substitution is rejected, supply the products which constituted the basis of design at no change in the contract price.
9. Installation of substitutions without the Owners approval shall be cause of immediate rejection and removal without extra cost to the Owner.

K. Manufacturer's Instructions:
1. Installation of work shall comply with manufacturer's printed instructions.
2. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for clarification. Do not proceed with work without clear instructions.

L. Transportation and Handling: Comply with General Conditions.

M. Storage and Protection:
1. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.
2. Store products to prevent damage by the elements. Space temperature shall be controlled as required to prevent condensation and metal corrosion or damage to electrical or electronic parts are the result of condensation.
3. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.
4. Provide protection as necessary to prevent damage after installation.
5. Products which suffer damage due to improper storage shall not be installed and if found in place, shall be removed and replaced at the contractor’s expense.

N. Cutting and Patching: Comply with the General Conditions.

O. Cleaning Up/Removal of Debris:
1. Comply with the General Conditions.
2. Maintain a clean work area. Construction debris shall be immediately removed from all newly erected work.

P. Operating and Maintenance Manuals: Comply with the General Conditions, but the following are in addition to:
1. Quantity: Comply with the General Conditions.
2. Format: Adequately sized for contents, minimum 1" and maximum 3" spline size, hard cover, view type, 8-1/2" x 11 loose leaf binders. Binder covers to have outer clear vinyl pocket on front cover and spline. Provide correct project designation and contents description in each pocket. Use as many as required. Do not overload binders.
3. Content:
   a. Cover sheet.

b. Table of contents (as follows):
   1) Description of systems.
   2) Design parameters.
c. Point by Point System Check-out: Provide tabulated results indicating compliance with contract document requirements.

4. Detailed Preparation Requirements:
   a. The cover sheet shall list project name, location, architect, structure engineer, mechanical engineer and electrical engineering firm name with address, telephone number and project manager's name for this project.
   b. Each major heading in the table of contents shall have a large distinctive, clearly marked, non-erasable, plastic encased tab.
   c. The description of systems will be provided by the design engineer for insertion at the time of review and turn-over to owner. This description of systems will be an updated version of the narrative included in this Section and will be an overview of the entire system. It will be the basis for the starting of the owner's instruction program.
   d. Each section shall have the following sub-tabs. Sub-tabs shall be similar to the main tabs but of a different color.
      1) Specifications: The specification shall be copied and inserted complete with all addenda.
      2) Submittal: This section shall include all accepted submittal data. If submittal was not required, include technical data as specified.
      3) Installation Instructions: If the product, such as pipe, etc., does not have any written installation instructions, include a statement "Manufacturer's Written Installation Instructions Not Available - Product Installed in Accordance with Specifications and Good Practice".
      4) Operation and Maintenance Instructions: These shall be the written manufacturer's data edited to omit reference to products or data not applicable to this installation.
      5) Parts List: These shall be edited to omit reference to items not applying to this installation.
      6) Equipment Supplier: This section shall include the name, address, and telephone number of the manufacturer's agent and/or service agency supplying or installing and starting up of the equipment.
      7) System Description: This section shall include that portion of the overall description included in the beginning of the manual as it applies to each sub-section. In sections such as pipe, valves and fittings, a statement shall be included "Not Applicable to this Section." Data for this section will be added by the design engineer when the manuals are submitted for review and forwarded to the owner.

Q. Training of Owners Operators:
   1. The manufacturer shall provide a comprehensive training outline for the Owner & Engineer to review within 90 days of final completion.
   2. The manufacturer & contractor shall provide training on the plumbing system, plumbing fixtures, and all water heating systems, per the table below.
   3. The owners shall be given comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of equipment.

4. The contractor shall be responsible for scheduling the training which shall start with classroom sessions followed by hands on training on each piece of equipment. Hands on training shall include start-up, operation in all modes possible, shutdown and any emergency procedures.
5. The manufacturer's representative shall provide the instructions on each major piece of equipment. These sessions shall use the printed installation, operation and maintenance instruction material included in the O&M manuals and shall emphasize safe and proper operating requirements and preventative maintenance.

R. Guarantee of Work:
1. Comply with the General Conditions.
2. Where applicable, furnish manufacturer's written warranty for materials and equipment.
3. Insert warranties in appropriate locations in operating and maintenance manuals.
4. Materials and equipment having seasonal operation limitations, shall be guaranteed for a minimum of one year from date of seasonally appropriate test, and acceptance in writing by the Owner, unless specific Division 22 specifications specify a longer period.

S. System Testing:
1. Provide all necessary labor, materials, and equipment to successfully complete all system testing necessary for building occupancy and owner acceptance.
2. Provide all necessary labor, materials, and equipment to assist contractors of other division to complete system testing necessary for building occupancy and owner acceptance, wherever an inter-relationship between Division 22 and the work of other divisions exists.
3. Tests shall be repeated as necessary until all occupancy and operation permits are granted and the owner accepts the project.

PART 2 – PRODUCTS

Not Applicable

PART 3 – EXECUTION

Not Applicable

END OF SECTION

SECTION 22 05 23
VALVES FOR PLUMBING SYSTEMS

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Automatic Flow Control Valves.
B. Ball valves.
C. Check valves.
D. Drain valve.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced to in the text by the basic designation only.
   1. American National Standards Institute (ANSI).
   2. American Society for Testing and Materials (ASTM).

1.4 SUBMITTALS

A. Submit schedule and cut-sheets indicating service, make and model number, pressure class, end type and usage (i.e., balance, shut-off).
B. Product data shall be included in the operation for maintenance instruction manuals along with installation, operation, and maintenance instructions.
C. Refer to Division 1 for Submittal requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Automatic Flow Control Valves:
   1. Flow Design, Inc.
   2. Griswold Controls.
B. Ball Valves:
   1. Apollo
   2. Viega
   3. Milwaukee Valve.
   4. Nibco, Inc.
   5. Stockham
   6. Victaulic Co. of America.
C. Check Valves:
   1. API International, Inc.

2. Milwaukee Valve
3. Mueller Steam Specialty, Co. (Muessco)
4. Nibco, Inc.
5. Stockham
6. Victaulic Co. of America.
7. Walworth

D. Combination Automatic Flow Control and Shutoff Valves:
1. Flow Design, Inc.
2. Griswold Controls

E. Drain Valves:
1. Apollo.
2. Nibco, Inc.
3. Watts

2.2 FABRICATION

A. Automatic Flow Control Valves:
1. Potable Water Service:
a. Size ½" thru 2-1/2": Brass wye body design, thread or sweat connection, ground joint union, dual temperature and pressure test ports extended to clear required insulation, range 20□F to 230□F rated at 400 psi water. Stainless steel or nickel-plated piston brass orifice and spring, replaceable without removing from installation, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 ft. Valves shall be calibrated for the fluid being pumped. Based on Flow Design, Inc. AutoFlow Model YR

B. Ball Valves:
1. Potable water service:
a. Size 1/4" thru 2". Brass body threaded or sweat connection, stainless steel stem, stainless steel, or aluminum bronze conventional ported ball, teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG.
b. Valves installed in insulated piping to have extended handles to clear insulation. Stem extension shall be made of a non-thermal conducting material with a sleeve to form an insulated vapor seal after the valve is insulated. Based on Nibco T-580-70.

C. Check Valves:
1. Potable Water Service:
a. Horizontal swing check valve:
1) Size 1/4" thru 3". Bronze body thread or sweat connection, "Y" pattern, bronze seat, renewable teflon or bronze swing disc, Class 125. Based on Nibco T-413-B, Y or S-413-B, Y.
2) Size 4" and up. Bronze body, sweat connection, bolted cover, bronze seat, bronze disc holder. Renewable bronze disc, Class 125. Based on Nibco Fig. S-433.
b. Vertical lift check valve.

1) Size 3/8" thru 2". Bronze body threaded or sweat connection, renewable Teflon disc and seat, copper or stainless steel, spring loaded, stainless steel guide pin Class 125. Based on Nibco S-480 or T-480.
2) Size 2-1/2" thru 10". Iron wafer type body, taped lug connection, renewable bronze disc and seat, stainless steel spring loaded, bronze guide pin, Class 125. Based on Nibco W-910.
3) Size 12" and up. Bronze globe body, flanged connection, renewable bronze disc and seat, stainless steel spring loaded, bronze guide pin, Class 125. Based on Nibco F- 910.

D. Combination Automatic Flow Control and Shutoff Valves:
   1. Water Service:
      a. Size ½" thru 2: Brass wye body thread or sweat connection, union, two-temperature and pressure test port extended to clear require insulation, brass or bronze ball valve with stainless steel ball and stem, non-thermal conductive material type actuator extended to clear required insulation for chilled water applications, steel lever type for heating applications. Range 20□F to 230□F rating 400 psi water. Stainless steel or nickel-plated piston brass orifice and spring, replaceable without removing from installation, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 ft. Valves shall be calibrated for the fluid being pumped. Based on Flow Design, Inc. AutoFlow Model AC.

E. Drain valves:
   1. Potable water service:
      a. Size 1/2" and 3/4". Two-piece, adapter loaded, single reduced port type with brass body, iron pipe thread inlet or sweat inlet, 3/4" hose thread outlet, brass cap and chain at outlet, stainless steel stem, stainless steel ball, teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG.
      b. Valves installed in insulated piping to have extended handles to clear insulation. Based on Watts B-6000-CC or B-6001-CC or Nibco T-585-70HC.

PART 3 – EXECUTION

3.1 GENERAL

A. Provide shut-off valves on the inlet and outlet of each piece of equipment at the take-off of each major branch from a header and at the base of each pipe riser in order to facilitate service.
B. Provide drain valves at the base of each pipe riser and at each piece of equipment to facilitate service.
C. Provide locking device on handle of the expansion tank isolation valve to prevent accidental closing.

3.2 INSTALLATION

A. Automatic Flow Control Valves:
   1. Install with taps in upright or vertical position.

2. Tag valve for:
   a. Type of service.
   b. Flow in GPM.
3. The contractor shall assume the responsibility to obtain the necessary gauges and thermometers to properly take the differential pressure and temperature readings from the flow control valves.
4. All flows shall be verified.

B. Ball Valves:
1. Install valves with adequate access to lever actuator.
2. Provide adequate space for actuator handle in the open and closed position and for packing replacement.

C. Check Valves:
1. Horizontal swing check valves: Install valve with swing disc in the pendent position, cover in upright position.
2. Vertical lift check valve:
   a. Install valve in vertical position, upward flow.
   b. Flanged valves will be installed between 125# or 150 ANSI flanges or other flanged valves.
   c. A spool piece a minimum of 6" face to face will be used to separate a vertical lift check valve and a butterfly valve.
   d. Inspect the face of the flange and valve for casting/matching burrs. If burrs exist remove by draw filling prior to gasket placement.

D. Combination Flow Control and Shutoff Valves:
1. Install with taps in upright position in a manner that will allow all the tap to be used as an air vent.
2. Tag valve for:
   a. Type of service.
   b. Flow in GPM.
3. Obtain the necessary gauges and thermometers to properly take the differential pressure and temperature readings from the flow control valve.
4. All flows shall be verified.

E. Drain Valves: Install valves to provide adequate space for hand wheel, access, stem travel, disc replacement cap removal and clearance for easy hose connection without crimping hose.

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Inserts, Shells and Upper Attachments.
B. Pipe Hangers, Rods, Supports and Accessories.
C. Pipe Sleeves.
D. Pipe Seals.
E. Fabricated Steel Support.

1.3 QUALITY ASSURANCE

A. Design of pipe supporting elements shall be in accordance with ANSI B31.1.
B. Fabrication and installation of pipe hangers and supports shall be in accordance with the following Manufacturers Standardization Society (MSS) Standards.
   1. SP-58 Pipe Hangers and Supports: Materials, Design and Manufacture.
   2. SP-69 Pipe Hangers and Supports: Selection and Application.
   3. SP-89 Pipe Hangers and Supports: Fabrication and Installation Practices.
C. Steel angles, channels and plate shall be in accordance with ASTM A36, red primed or hot dipped galvanized for interior applications, and hot galvanized for exterior applications.
D. Bolts, including nuts and washers, used for fabricating steel members shall be in accordance with ASTM A325 and shall be stainless steel or plated for corrosion protection. Plain steel components are unacceptable.
E. Welding of steel members shall be in accordance with AWS D1.1.
F. Steel supports for pipe anchors, pipe guides, and piping supported from below shall be fabricated in accordance with AISC Specification for the Design, Fabrication and Erection of Structural Steel for buildings. If required, the contractor shall include the cost of the services of a structural engineer to design or review the system.

1.4 APPLICABLE PUBLICATIONS

A. Applicable sections of the publications listed below form a part of this Section. The publications are referenced to in the text by the basic designation only.
   1. American Institute of Steel Construction (AISC)
   2. American National Standards Institute (ANSI)
   3. American Society for Testing and Materials (ASTM)
   4. American Welding Society (AWS)
   5. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)
   6. National Fire Protection Association (NFPA)

7. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA).

1.5 SUBMITTALS

A. Submit schedule indicating type of hanger to be used by system and pipe size. Include rod size for each hanger size.
B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
C. Refer to Division 1 for submittal requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Inserts, Shells and Upper Attachments:
   1. Anvil International, Inc.
   2. Carpenter Paterson, Inc.
   3. Cooper B-Line®, Inc.
   4. Elcen Metal Products
   5. Hilti
   6. Michigan Hanger Company
   7. PHD Manufacturing, Inc.
   8. Unistrut®
B. Pipe Hangers, Rods, Supports and Accessories:
   1. Anvil International, Inc.
   2. Carpenter Paterson, Inc.
   3. Cooper B-Line®, Inc.
   4. Elcen Metal Products
   5. Hilti
   6. Michigan Hanger Company
   7. PHD Manufacturing, Inc.
   8. Unistrut®
C. Pipe Sleeves:
   1. Metraflex – Metraseal
   2. Thunderline Corporation - Link Seal
   3. Approved Equal.
D. Pipe Seals:
   1. Metraflex – Metraseal
   2. Thunderline Corporation - Link Seal
   3. Approved Equal.
E. Fabricated Steel Support: As Detailed on Drawings.

2.2 FABRICATION

A. Inserts, Shells and Upper Attachments:
   1. Inserts; MSS Type 18; malleable iron body and nut, galvanized finish, opening in top of insert for reinforcing rod, lateral adjustable. Rated for 1,140 lbs. Based on Anvil Fig. 282.

2. Shells: Steel shell and expander plug, snap off end fastener. Based on Phillips Concrete Fasteners Red Head.
3. Upper Attachments:
   a. Top beam clamps; MSS Type 19: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut. Rating is contingent on rod and bolt size. Based on Anvil Fig. 94.
   b. Bottom Beam Clamp; MSS Type 23: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut, and retaining clip. Rating is contingent on rod and bolt size. Based on Anvil Fig. 86 Clamp and Fig. 89 Retaining Clip (or Fig. 87).
   c. Welded Beam Attachment; MSS Type 22: Carbon steel suitable for eye rod or rod and locknut, rating is contingent on rod and bolt size. Based on Anvil Fig. 66.
   d. Center Beam Clamp; MSS Type 21: Malleable iron jaw and square head bolt and nut with galvanized finish. Rating is contingent on rod and bolt size. Based on Anvil Fig. 134.
   e. Center Beam clamp; MSS Type 29: Forged steel, weldless eye nut, tie rod to secure clamp to beam all with galvanized finish, rating is contingent on rod and bolt size. Based on Anvil Fig. 292 or 292L.

B. Pipe Hangers, Rods, Supports and Accessories:
1. Pipe Hangers:
   a. Clevis Hanger; MSS Type 1: Carbon steel, galvanized for interior and exterior use, sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 260 or 300.
   b. Pipe Rings; MSS Type 10: Carbon steel, galvanized for black steel and insulated pipe copper or copper plated or rubber coated for copper pipe. Threaded swivel sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 69 or Fig. 97C for copper pipe.
   c. Adjustable Roller Hanger; MSS Type 43: Cast iron roll, carbon steel yoke rod roll and hex nut with galvanized finish. Sized to accommodate insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 181.
2. Rods:
   a. Size 3/8" and up: All thread steel rod electro galvanized. Sizing for pipe or equipment support as follows:

Copper Tube, Plastic Fiberglass Reinforced Pipe Size	Steel, Cast Iron or Glass Pipe Size	Rod Size	Max Equip. Load
¼" to 2"	¼" to 2"	3/8"	730 lbs.
2-1/2" to 5"	2-1/2" to 3"	½"	1350 lbs.
6"	4" to 5"	5/8"	2160 lbs
8" to 12"	6"	¾"	3230 lbs.
14"	8" to 12"	7/8"	4480 lbs.
16"	14" to 16"	1"	5900 lbs.
18" to 20"	18" to 20"	1-1/4"	9500 lbs.
22" to 42"	22" to 42"	1-1/2"	13,800 lbs.

   b. Rods may be reduced one size for double rod hangers with 3/8" minimum diameter, or when other paragraphs require a minimum of 2 hangers per section provided the minimum diameter of 3/8" in maintained. Based on Anvil Fig. 146.

3. Supports:
    a. Pipe Saddle; MSS Type 38: Cast iron saddle, black steel lock nut nipple, cast iron reducer all with galvanized finish. Suitable for standard field cut and threaded galvanized steel pipe. Cast iron floor flange. Based on Anvil Fig. 264 Saddle, Fig. 63 Floor Flange.
    b. Pipe Saddle Cold Piping: MSS Type 40. Single bonded unit consisting of a galvanized metal shield and a molded section of rigid polyurethane foam insulation. Rigid urethane foam shall have a density of 4 pounds per cubic foot, a thermal conductivity of 0.13 Btu.in/sq.ft./hr.^{o}F at 75^{o}F mean temperature. Insulation thickness to be equal to thickness specified for pipe being supported.
    c. Adjustable Pipe Roll and Base; MSS Type 46: Cast iron base plate steel stand and roll, adjusting screws with galvanized finish. Based on Anvil Fig. 274.
    d. Welded Steel Bracket; MSS Type 32: Welded carbon steel rate for 1500 lbs., with galvanized finish. Rating is contingent on rod and bolt size. Based on Anvil Fig. 195.
    e. Riser Clamps; MSS Type 8: Carbon steel, galvanized finish for black steel or galvanized pipe, plastic coated for cold steel, copper, glass or brass pipe rated for a minimum of 220 lbs. at 3/4" size. Based on Anvil Fig. 261.
4. Accessories:
    a. Protective Shields; MSS Type 40: Carbon steel, galvanized minimum of 12" length sized for required insulation. Based on Anvil Fig. 167.
    b. Protective Saddles; MSS Type 39: Carbon steel plate, minimum of 12" length, sized for required insulation. Based on Anvil Fig. 160 thru 165.
    c. Steel Turnbuckle; MSS Type 13: Forged steel, galvanized finish with locknuts. Rated at a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 230.
    d. Steel Clevis; MSS Type 14: Forged steel, galvanized finish with steel pin and cotter pin. Rated for a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 299.
    e. Weldless Eye Nut; MSS Type 17: Forged steel, galvanized finish. Rated for a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 290 or 290L.

C. Pipe Sleeves:
1. Wall: Schedule 40 carbon steel pipe sized to accommodate pipe. If sleeves are field cut, coat cut edges with cold galvanizing spray, ZRC or equivalent.
2. Floor or Exterior Walls below Grade: Schedule 40 steel pipe with anchor and water stop hot dip galvanized after fabrication. Sized to accommodate pipe. Sleeve length will be sized to allow a minimum of 1/2" extension below floor or exterior side of a wall below grade and 1-1/2" extension above floor and 1/2" extension on interior side of an exterior wall below grade.
3. Roof: All penetrations of roof to be in accordance with requirements of Division 7 - Thermal and Moisture Protection.
4. Based on Thunderline Corp. Link Seal Wall Sleeve.

D. Pipe Seals: Composition Plastic Pressure Plates, zinc coated bolts, nuts and metal parts, composition rubber sealing element designed for long term stability rated for temperatures of 40°F to +250°F. Based on Thunderline Corp. Link Seal LS Series.

E. Fabricated Steel Supports:
1. Field or shop fabricated. See details on drawings.
2. If not detailed on drawings the contractor is to provide suitable supports as required.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Where applicable install in accordance with the manufacturers written installation instructions.
B. Where supports are in contact with copper pipe provide copper plated support or wrap pipe with sheet lead.
C. Where supports are in contact with glass, aluminum or brass pipe provide plastic coating on supports, or wrap pipe with sheet plastic.
D. General interior supports, including attachments and pipe supports that are plain steel shall be cleaned of all rust, primed, and painted black within one week of installation. At substantial completion all supports shall be free of rust and in a “like new condition”.
E. Hangers and supports, including attachments & pipe support, exposed to weather or located in utility tunnels or accessible utility trenches or subject to spillage shall be hot dip galvanized after fabrication. At substantial completion all supports shall be free of rust and in a “like new condition”.
F. Fabricated steel supports exposed to weather (including pipe supports) or located in utility tunnels and accessible utility trenches or subject to spillage shall be hot dipped galvanized after fabrication, primed and painted black within one week of installation. Cut, welded, drilled, or otherwise damaged surfaces of galvanized coating shall be repaired in accordance with Section 22 02 00. At substantial completion all supports shall be free of rust and in a “like new condition”.

3.2 INSTALLATION

A. Inserts, Shells and Upper Attachments:
    1. Inserts:
        a. Contractor shall have inserts at site and dimensioned location drawings ready at the beginning of the involved concrete work.
        b. Install inserts by securing to concrete forms and inserting reinforcing rod thru the opening provided in the insert in accordance with shop drawings.
        c. Provide necessary supervision while concrete is being poured to correct any misalignment caused by the concrete.
    2. Shells: Size shell length to assure a minimum of 1" solid concrete remaining from shell end to concrete face.
    3. Upper Attachment:
        a. Select proper attachment for building construction.
        b. For plain steel devices, prime with black paint prior to installation.
        c. Adjust attachment location for proper alignment and no more than 4 deg. offset from a perpendicular alignment.
        d. If proper alignment cannot be achieved from the existing building structure provide a trapeze type support size to handle the design load with a minimum safety factor of 5.
B. Pipe Hanger, Rods, Supports and Accessories:
    1. Select proper hanger for piping systems.
    2. The location of hangers and supports shall be coordinated with the structural work to ensure that the structural members will support the intended load.

3. Provide hex head nut on rod at top and bottom of clevis hanger yoke, and at each rod connection to intermediate and upper attachment. Rod nuts shall be securely locked in place.
4. Hanger rods shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing.
5. Hangers shall be fabricated to permit adequate adjustment after erection while still supporting the load. Turnbuckles shall be provided where required for vertical adjustment of the piping.
6. Supports for vertical piping shall be located at each floor or at intervals of not more than 15 feet and at intervals of not more than 8 feet from end of risers. Where supports are provided on intermediate floors spaced 15 feet or less between floors, no additional supports are required other than those specified for end of risers.
7. A hanger or support shall be provided adjacent to each piece of equipment to ensure that none of the pipe weight is supported from the equipment.
8. The maximum spacing between pipe supports for straight runs shall be in accordance with the following chart. If any deviation from the table exists within the manufacturers written installation instructions, whichever spacing reflecting the smaller centerline to centerline dimension shall be used.
   Maximum Horizontal Pipe Hanger and Support Spacing Table:
   a. Steel Pipe (Schedule 40 & 80):
      Up to 1": 7 ft. on center
      1-1/4" and greater: 10 ft. on center
   b. Copper Pipe (Types L, K and M):
      Up to 1-1/4" size: 5 ft. on center
      1-1/2" to 2-1/2": 6 ft. on center
      3" and larger: 10 ft. on center
   c. Ductile Iron and Cast Iron: Two hangers per section length.
   d. Polyvinyl Chloride (PVC):
      Up to 1-1/2": 3 ft. on center
      2" and larger: 4 ft. on center
9. Hanger centerline spacing shall be reduced by 50% in areas of concentrated valves and/or fittings, also no more than a maximum distance of 12 inches from valves, fittings and/or couplings, or 24 inches from a change in direction.
10. Parallel piping may be supported by trapeze hangers consisting of steel angle, channel, or beam suspended by steel rods attached to upper structure. Piping may be supported above, or suspended below, the angle, channel, or beam.
11. Provide protective shields on all cold and dual temperature piping required to be insulated.
12. Provide protective saddles sized to match insulation thickness on all hot piping required to be insulated. Fill void between saddle and pipe with insulation as specified.
13. Provide turnbuckles on all hangers which require leveling or aligning.
14. Provide steel clevis where detailed and/or required.
15. Provide weldless eye nuts on hanger terminations where disassembly or swing may be required. Use in combination with steel clevis.

C. Pipe Sleeves:
1. Secure sleeves to forms for concrete construction. Ensure sleeves are not disengaged or misaligned by concrete placement operations.
2. Provide temporary cap for open end of sleeves to prevent entrance of concrete.

3. Provide temporary internal bracing where required to prevent distortion of sheet metal sleeves by concrete placement operations.
4. Sleeves shall not be installed in structural members, except where indicated or approved.
5. Furnish sleeves to masonry contractor in advance of masonry work. Furnish dimensioned drawings indicating exact location of sleeves.
6. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface, except as indicated otherwise.
7. Sleeves passing through floors in wet areas, such as areas containing plumbing fixtures or floor drains, shall extend a minimum of 4 inches above the finished floor. Sleeves in wet areas shall be enclosed with 4-inch concrete curb.
8. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance all around between the pipe and inside of sleeve, or between jacket over insulation and sleeve.
9. Provide membrane clamping devices on sleeves for waterproof floors.
10. Sleeves are not required in existing structures where openings through existing concrete floors, walls, or roof are core drilled.

D. Pipe Seals:
   1. Provide pipe seals for all pipe sleeves used in:
      a. External walls.
      b. Floor slabs on grade.
      c. Upper floors where spillage may occur.

E. Fabricated Steel Supports: Steel for supports shall be sawcut, with sharp edges ground smooth. After fabrication remove all foreign material, including welding slag and spatter, and leave ready for painting or galvanizing, as applicable.

END OF SECTION

SECTION 22 05 76
FACILITY DRAINAGE PIPING CLEANOUTS

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Cleanouts.

1.3 SUBMITTALS

A. Submit shop drawings in accordance Division 1 for submittal requirements.
B. Each cleanout submittal must be marked to show what area it will be used.

1.4 JOB CONDITIONS

A. Provide protection for all cleanouts against damage during construction. The plumbing contractor shall be responsible to replace any damaged cleanouts.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The manufacturers referenced herein are those that the specifications and drawings are based on. Equipment by other manufacturers will be considered provided all requirements and intent of the specifications are met.

2.2 MATERIALS

A. Cleanouts:
   1. Floor Type (FCO):
      a. Finished Floors - Cast iron adjustable floor level cleanout assembly with round nickel bronze top and plug, with inverted hub and neoprene gasket.
         J. R. Smith Fig. 4033-L
         Josam # 56010-22
         MIFAB #C1100-R
         Watts #CO-200-R
      b. Terrazzo Floors - Cast iron adjustable floor level cleanout assembly with round nickel bronze top and plug, with center lifting device. Top depression to be filled with terrazzo and finished.
         J. R. Smith Fig. 4180, Gasket #4193
         Josam # 56040-13-1
         MIFAB #C1100-UR
         Watts #CO-200-LL

2. Above Floor (CO):
   a. Caulk Ferrule Cleanouts - Cast iron ferrule with countersunk bronze plug.
      J. R. Smith Fig. 4420
      Josam # 58900
      MIFAB #C-1450
      Watts #CO-380
3. Wall Type (WCO):
   a. Wall-Round Cover - Cast iron ferrule with lead seal plug, round stainless-steel cover with center screw.
      J. R. Smith Fig. 4402
      Josam # 58600-CO
      MIFAB #C1450-RD
      Watts #CO-380-RD
   b. Wall-Round Cover - Cast iron ferrule with lead seal plug; chrome plated bronze round frame and cover secured with slotted screws for "face-of-wall".
      J. R. Smith Fig. 4432
      Josam # 58610
      MIFAB #C1300-R
      Watts #CO-300-R

PART 3 – EXECUTION

3.1 INSTALLATION

A. Cleanouts:
   1. Provide cleanouts in all locations shown on the drawings and in all other locations required by The Local Building Code, and as directed by the Local Inspector.
   2. Where special conditions exist, such as the need for a shallow cleanout to meet invert elevations, make changes necessary at no change in contract price and submit drawings or description for approval if requested by the Architect.
   3. Cleanouts shall be the same size as the pipes they serve up to 4 inch, and not less than 4 inch for piping of larger size.
   4. Cleanouts shall be installed not more than 100 feet apart in horizontal drainage piping.
   5. Cleanouts shall be installed in the horizontal piping at each change of direction of the building waste, soil, and storm systems greater than 45 degrees.
   6. A cleanout shall be installed at or near the base of each waste, soil, or rainwater leader stack.
   7. All work this section shall conform to local building/plumbing code.

END OF SECTION

SECTION 22 05 77
FACILITY PLUMBING DRAINS AND ACCESSORIES

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Floor Drains.
B. Floor Sinks
C. Hub Drains.
D. Backwater Valve
E. Trap Primers

1.3 SUBMITTALS

A. Submit shop drawings in accordance with Division 1 Requirements.
B. Each drain submittal must be marked to show what area it will be used.

1.4 JOB CONDITIONS

A. Provide protection for all drains and cleanouts against damage during construction. The Plumbing Contractor shall be responsible to replace any damaged drains.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The manufacturers referenced herein are those that the specifications and drawings are based on. Equipment by other manufacturers will be considered provided all requirements and intent of the specifications are met.

2.2 MATERIALS

A. Floor Drains:
1. FD-1: Shower/Gym/Tiled areas s - Cast iron body, flashing clamp and adjustable square nickel bronze top and “P” trap with trap primer as required by governing authority.
Zurn #ZN415-5S-P
J. R. Smith Fig. 2010-B
Josam #30000-S
Watts #FD-100-M5-7
MIFAB #F1100-C-S5-1

2. FD-2: Mechanical Room/Janitors closet Floor Drain - Cast iron body, flashing clamp and adjustable round nickel bronze top and “P” trap with trap primer as required by governing authority.
   Zurn #ZN415-5S-P
   JR Smith Fig. #2010-B
   Josam # 30000-S
   Watts #FD-100-M5-7
   MIFAB #F100-C-S5-1

B. Hub Drains:
   1. HD-1: Cast iron body, flashing clamp, water dam, cast iron dome strainer with vandal-proof screws. Provide with deep seal "P" trap with trap guard.
      J. R. Smith Fig. 3960
      Josam # 25540
      Watts #RD-200-R-LD-DS-L
      MIFAB #R1100-RS

C. Backwater Valve:
   1. BWV-1: Series coated cast iron backwater valve, offset type, bronze fixed swing-check assembly, bolted gasketed cover, and no-hub connections.
      Josam #67400
      Watts #BV-200
      MIFAB #BV1000

D. Trap Primer:
   1. TPV-1: For floor drains. Mechanical trap primer. Install on a 1 1/2" or smaller line. Trap primer valve with a (4) four outlet distribution system. Install per manufacturer’s recommendations.
      Precision Plumbing Products Oregon #1 Trap primer valve.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Drains:
   1. Unless otherwise specified, drains to be complete with strainers, trim, flashing and appurtenances and constructed of cast iron with painted finish.
   2. Set all floor drains level and at proper elevations to surrounding floor area to provide smooth and uniform drainage area.
   3. Unless noted otherwise, provide a trap for each floor drain of a material to match the pipeline to which it discharges.
   4. Provide drains in all locations shown on the Architectural and Plumbing drawings. Drains to be of the types specified herein and sized as shown on the plumbing drawings. Refer to the Architectural drawings for additional installation details.
   5. Actual sizes and quantities of all drains shall be determined from the drawings.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Piping Systems Insulation.
B. Accessories.

1.3 QUALITY ASSURANCE

A. All products within the conditioned air stream or active plenums shall comply with the NFPA 90A Flame/Smoke rating of 25/50 and comply with UL 181 erosion limitations. Fire hazard ratings shall be as determined by NFPA-255, "Method of Test of Surface Burning Characteristics of Building Materials" - ASTM E84 or UL 723.
B. All adhesives, cements, finishes, jackets, etc., shall be UL listed or labeled for use as applied to insulation and designed specifically for use in the installation.
C. All insulation shall be installed in accordance with National Commercial & Industrial Insulation Standards (NCIA).

1.4 SUBMITTALS

A. Submit schedule indicating type of insulation, thickness, vapor barrier or coating by system and size.
B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
C. Submit details of insulated removable covers using the actual equipment dimensions, concrete base sizes and piping arrangements.
D. Refer to Division 1 for submittal requirements.

1.5 GENERAL REQUIREMENTS

A. Factory-applied insulation is specified under the applicable equipment Section of these specifications. It is listed here for reference only.
B. Packages and standard containers of materials shall be delivered unopened to job site and shall have the manufacturer's label attached giving a complete description of the material.
C. All rain leader piping and roof drain bodies shall be insulated within the building to above grade. Materials are specified elsewhere herein.

1.6 DEFINITIONS

A. The term "exposed" means exposed to view in finished spaces, in equipment rooms, in fan rooms, in closets, in utility corridors, in tunnels, on roof, in storage rooms, and in other spaces as indicated.
B. The term "concealed" means concealed from view, and includes all spaces not defined as exposed.
C. The term "unconditioned" space shall mean all places where the temperature surrounding the pipe has not been conditioned consistent with conditioned spaces, and shall include mechanical equipment rooms, non-active ceiling plenums, and non-accessible chases. This term shall also include conditioned spaces where the humidity levels are allowed to rise above 70% RH.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fiberglass Insulation:
   1. Owens-Corning Fiberglas
   2. Knauf Fiberglass
   3. CertainTeed
   4. Johns Manville
B. Closed Cell Elastomeric Insulation:
   1. Armacell LLC
   2. Johns Manville
   3. Rubatex

2.2 PIPE INSULATION REQUIREMENTS

	Thickness	Type
A. Condensate Drain (C):		
All Sizes	1/2"	Closed Cell Elast.
B. Dom. Cold Water (CW):		
Up to 4”	--	Not Required
5” through 14”	--	Not Required
C. Dom. Hot Water (HW) (HWR):		
Conditioned Space		
Up to 2”	1”	Rigid Fiberglass
2-1/2” through 4	1"	Rigid Fiberglass
5" through Larger	1-1/2”	Rigid Fiberglass
Unconditioned Space		
Up to 2”	1”	Rigid Fiberglass
2-1/2” through 4	1-1/2"	Rigid Fiberglass
5" through Larger	2"	Rigid Fiberglass
D. Hub Drains Receiving		
Condensate – All Sizes	1/2”	Closed Cell Elast.
Condensate - All Sizes	1/2"	Closed Cell Elast.
E. Storm water Drains		
All sizes	3/4"	Rigid Fiberglass

2.3 MATERIALS

A. Pipe Insulation (to 450F):
   1. Rigid Fiberglass: Resin bonded fibrous glass, flame retardant, factory applied all service jacket vapor barrier with self sealing pressure sensitive lap joints, molded to accommodate pipe, maximum vapor permeance of .02 perm/in. and a puncture resistance of 50 units, minimum density 4.0 lb./cf., maximum conductivity per 1" thickness of .23 at 75°F, .29 at 200°F and .43 at 400°F mean temperature. Based on Knauf Pipe Insulation.
   2. Closed Cell Elastomeric (Small Pipe Sizes up to 5 Inches): Flexible, elastomeric, closed cellular, tubular molded to accommodate piping, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, nonabsorbent, ozone resistant, minimum density of 4 lb./cf., maximum conductivity per 1" thickness of .27 at 75°F mean temperature. Based on Armacell LLC AP Armaflex and Self-seal Armaflex 2000.
   3. Closed Cell Elastomeric (Large Pipe Sizes, 6" and Larger): Sheet type, flexible, elastomeric, closed cellular, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, nonabsorbent, ozone resistant, minimum density of 4 lb./cf., maximum conductivity per 1" thickness of 2.7 at 75°F mean temperature. Based on Armacell LLC Armaflex II.

B. Accessories:
   1. Corner angles shall be minimum 28-gauge, 1 inch by 1 inch aluminum adhered to 2 inches by 2-inch heavy kraft paper.
   2. Glass tape shall be a minimum density of 1.6 ounces per square yard, 4 inch wide with a 10 x 10 thread count per inch of width. Glass cloth shall be untreated.
   3. Staples shall be outward clinching type, Type 304 or 316 stainless steel in accord with ASTM A 167 or Monel® coated.
   4. Wire shall be soft annealed galvanized, or copper, 16 gauge, or nickel copper alloy.
   5. Closed cell elastomeric insulated finish shall be a white water based flexible, acrylic latex enamel equal to WB Armaflex finish.
   6. Insulation Tape: Closed cell elastomeric insulation: 2" wide x 1/8" thick.
   7. Elastomeric Insulation Adhesive: Air drying contact adhesive for securing sheets to flat or curved metal surfaces and joining seams and butt joints of elastomeric insulation. Suitable for temperatures to 180F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method.
   8. Vapor Barrier Mastic: Air drying flexible water-based mastic used for applying a vapor barrier joint with glass cloth at insulation joints. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Maximum Perm rating of 0.08., Childers Products Company, Inc. CP-35 Chil Therm® WB, Foster Products Corp. Product Data 30-80 Foster Vapor Safe® Coating, Marathon Industries, Inc. 590 LO-PERM, Richard's Paint Manufacturing CO., Inc. VBM-4, Vimasco Corp. 749 Vapor-Blok, or equal.
   9. Acrylic Latex Finish and Sealers:
      a. Elastomeric Insulations: Air drying flexible water-based finish used for finishing flexible elastomeric insulation. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Armacell LLC WB Armaflex finish.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install all insulation in strict accordance with the manufacturers written installation instructions.
B. All insulation work shall be performed by skilled mechanics regularly engaged in the insulation trade.
C. Properly coordinate the insulation work with the other trades so that installation is performed with a minimum of conflict.
D. Insulation shall not be applied on any piping system requiring testing until testing is completed and approved by Owner's Representative.
E. Insulation shall not be applied until all systems are clean, dry, free of dirt, dust, or grease.
F. The finished installation shall present a neat and acceptable appearance which includes but is not limited to all jackets smooth, all vapor barriers sealed properly, no evidence of "ballooning" of the jackets, or sagging insulation, all valves, dampers, gauges, unions, etc. accessible. The Owner's Representative shall be the final judge of acceptance of workmanship.
G. All equipment nameplates on hot equipment shall be left uncovered. All equipment nameplates on cold equipment shall have a removable section sized to expose the nameplate. This section shall be clearly marked "NAMEPLATE".
H. If proper maintenance procedures require access to the insulated equipment removable panels, sections or covers shall be provided to accomplish this. These access devices shall be constructed in a manner to assure easy access and sturdy construction. The contractor shall assume the responsibility to coordinate all equipment requiring insulation to be either factory or field insulated.
I. Insulation and accessories shall be applied only at suitable application temperature and conditions as recommended by the manufacturer. Do not apply insulation to any surface while it is wet.
J. Insulation shall be protected from moisture and weather during storage and installation.
K. Insulation which has sustained moisture damage, torn jackets, or other damage due to improper storage or other reasons shall not be used. If evidence of this is sighted the Owner's representative reserves the right to require the insulating contractor to remove any and/or all insulation until the Owner's Representative is satisfied that there is no longer any inferior insulation installed on this project.
L. Insulation, fabric, and jacketing shall be protected from damage during construction. Damage by the insulator shall be repaired without cost to the Owner. Damage by others shall be reported in writing to the contractor.
M. The insulation subcontractor is responsible for proper material storage at the work site.
N. Work performed prior to receipt of approved documents or submittals, later proving to be incorrect or inappropriate, shall be promptly replaced by the contractor without cost to the purchaser.
O. Insulation shall not be installed until adequate access and clearances at control mechanisms, dampers, sleeves, columns, and walls have been provided.
P. All insulation at handholes, access doors or other openings, and adjacent to flanges and valves shall be neatly finished where exposed to view.
Q. All materials, accessories and methods of installation and fabrication are subject to the Owner's Representatives inspection and approval during any phase of the work.

R. The insulation subcontractor shall prevent the accumulation of insulation debris in the buildings and on the premises of the Owner.
S. The insulation subcontractor shall be responsible for his own safety program at the work site and shall provide instruction on safe practices for his workers assigned to the project. All employees are subject to the work rules at the job site.
T. The insulation subcontractor shall familiarize himself with the progress and execution of the job and notify the proper parties of interferences and any problems with the proper installation of his materials.

3.2 INSTALLATION

A. Pipe Insulation:
1. General:
a. All locations where the insulated surface is supported by hangers, the insulation shall be protected by shields or saddles properly skimmed to maintain a smooth outer surface, and proper insulation thickness. Chilled water piping, 3" and over shall have a section of foamglas insulation installed between the pipe and shield. 3 and 4" to be 12" long, 5" and 6" to be 18" long and 8" and over, 24" long. If the possibility exists that the hanger may conduct the temperature of the conveyed medium and thus cause condensation or personal injury due to high temperature, the hanger shall also be insulated. Joints between foamglas and pipe insulation shall be properly sealed.
b. All devices connected to or in line with the piping system shall be insulated greater than or equal to the connecting piping. This includes but is not limited to valves, air separators, expansion tanks, control valves, control devices, gauge connections, thermometer stems, chemical feed equipment, piping flexible connectors, etc. This is particularly important on ice water and refrigerant lines.
c. The insulation at threaded unions in steam and hot water piping shall be tapered and terminated with cement and glass lagging cloth and lagging adhesives.
d. Insulate exterior surfaces of all anchors and guides for chilled water and dual temperature piping systems.
e. A complete moisture and vapor barrier shall be installed wherever insulation is penetrated by hangers or other projections through insulation and in contact with cold surfaces for which a vapor seal is specified.
f. Cover fittings, flanges, unions, valves, anchors, and accessories with pre-molded or segmented insulation of the same thickness and material as the adjoining pipe insulation. Where nesting size insulation is used overlap pipe insulation 2 inches or one pipe diameter. Fill voids with insulating cement and trowel smooth. Elbows shall have not less than 3 segments per elbow. Secure insulation with wire or tape until finish is applied. Blanket inserts in lieu of pre-molded or segmented insulation is not allowed. Cover fittings with preformed PVC fitting covers.
g. Wrap all pressure gauge taps, thermometer wells and all other penetrations through insulation with closed cell insulation tape so as to prevent condensation.
h. Seal all raw edges of insulation.

i. For piping supported by hangers outdoors, apply a rain-shield to prevent water entry.

2. Rigid Fiberglass:
   a. Provide PVC fitting covers for all fittings.
   b. Align all jacket seams.
   c. Assure all vapor barriers are properly sealed.
   d. Provide PVC jacket over all exposed insulation in the equipment room.
   e. All corner angels below 6'-10" shall have padded insulation and be marked with yellow stripes.
3. Closed Cell Elastomeric:
   a. All joints shall be sealed with adhesives.
   b. Where the thickness is to be obtained by use of two layers of insulation, install with staggered joints.
   c. Finish:
      1) Concealed Indoors: No additional finish.
      2) Exposed Indoors: Provide PVC jacket over all insulation.
      3) Concealed Indoors: Provide PVC jacket over fittings fabricated from insulation sections or sheet.
      4) Outdoors: Provide aluminum pipe jacket.

END OF SECTION

SECTION 22 11 16
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Domestic Water (CW/HW/HWR) Piping.

1.3 DEFINITIONS

A. The pipe sizes given in this document shall be construed nominal.

1.4 QUALITY ASSURANCE

A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products and shall be of the manufacturer's most recent design that is in regular production.
B. Each item provided under this section shall meet the requirements for that item as installed and used, in accordance with the following standards:
   1. Metallic Piping Systems employing mechanical joints and grooved-end pipe - ASME/ANSI B-31.9
   2. All other metallic piping - ASME/ANSI B31.1
C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.
D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.
B. The work and materials listed in this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications.
C. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.
   1. American National Standards Institute (ANSI) Standards
   2. American Petroleum Institute (API) Specification
   3. American Society of Mechanical Engineers (ASME) Publications
   4. American Society for Testing and Materials (ASTM) Publications
   5. American Welding Society (AWS) Publication
   6. American Water Works Association (AWWA) Standards
   7. Cast Iron Soil Pipe Institute (CISPI) Standards

8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications
9. National Fire Protection Association (NFPA) Standards
10. National Sanitation Foundation (NSF) Testing Laboratory Standards.
11. Plastic Pipe Institute (PPI) Manual.
12. Plumbing and Drainage Institute.
13. Underwriters Laboratories (UL).

1.6 SUBMITTALS

A. All submittals shall be made in accordance with Division 1 Requirements.
B. Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, pipefittings, valves, and joints. Include the basic designation of the publication applicable for each type of material and method.
C. Submit current welder qualifications for all welders proposed for this project. Welding certificates shall be for the company performing the welding at this project as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.
D. Submit certified welding inspection reports as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Domestic (Potable) Water (CW/HW/HWR) Piping
System Design Pressure: 150 psig.
1. Piping, 8" and smaller - Above grade, copper tube, Type “L”, hard temper, ASTM B88. Wrought cooper or bronze fittings, solder joint, pressure rated, ASTM B16.22-95; or cast bronze fittings, solder joint, pressure rated, ASME B16.18-R94.
2. Piping, 4” and smaller – Below grade, copper tube, Type “K”, hard temper, ASTM B88. Wrought copper or bronze fittings, solder joint, pressure rated, ASTM B16.22-95; or cast bronze fittings, solder joint, pressure rated, ASME B16.18-R94.
3. Water main pipe and fittings, piping 5” and larger:
   a. Ductile iron pressure pipe, bell and spigot or mechanical joint, Class 51, 150 psi working pressure, ANSI Standard A21.51. Ductile iron fittings, ANSI Standard A21.11. Include cement mortar lining, ANSI Standard A21.4.
   b. PVC – ASTM D1784, D1785, SDR 18; fittings PVC-ASTM D2466; joints solvent D2564 or ASTM D1869 ring gasket; NSF Standard 14 & 61.
4. One-half inch (1/2”) trap primer wastewater feed line to floor drains, same as domestic water, Type “L”, except soft-drawn copper.
5. Temperature and pressure relief lines and drain pan lines same as domestic water, Type “L” hard-drawn copper in a return air plenum.
6. Piping above slab/grade pipe, size 1/2” to 2-1/2” may be Type “L” ASTM B-88 copper tubing.
7. Pipe Fittings, 4" and smaller - Below ground installation: Wrought Copper, ANSI B16.22.
8. Pipe fittings, 5" and larger - Below ground installation: Ductile Iron, Class 150, Cement mortar lined, with mechanical joint and/or plain ends as required. The fitting mechanical joints shall match the joints of the pipe and shall be in accordance with ANSI/AWWA C111/A21.11.

9. Solder for factory fabricated fittings: Lead-free per FPC.
10. Brazing for Mechanically formed tee fittings: Brazing may be:
    a. 5% silver, 6% phosphorus, balance copper, 1190°F melting point. AWS A5.8 number BcuP -3. J.W. Harris Stay-Silv® 5 or equal.
    b. 15% silver, 5% phosphorus, balance copper, 1190°F melting point. AWS 5.8 number BCuP-5. J.W. Harris Stay-Silv® 15 or equal.
    c. 6% silver, 6.1% phosphorus, balance copper, 1190°F melting point. QQ-B-654A number BcuP -5. J.W. Harris Dynaflow® 5 or equal
11. Bolts for ductile iron mechanical joints shall be square-headed, carbon steel, ASTM A-307, Grade B. Nuts shall be heavy-duty hex type full nuts; ASTM A-194, Grade 2.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General:
    1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
    2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors, and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
    3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
    4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
    5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
    6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
    7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
    8. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.

9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required.
   Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.
10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways, and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
12. Piping found to have water hammer or other objectionable vibrations which cannot be eliminated by proper grading or other natural means, shall be braced, trapped, or hung with shock absorbing hangers and equipped with mechanical shock absorbers, flexible pipe connections or otherwise silenced using approved means.
13. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
14. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
15. Avoid bushings. Reducing fittings shall be used wherever practical.
16. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
17. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.

18. Copper tubing and galvanized steel shall not be mixed in any one run of piping.
19. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The centerline radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
20. Threaded joints shall be made with tapered threads in accordance with ANSI B2.1 and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint is made up a maximum of 3 threads shall be visible.
21. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
22. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.
23. Connections between plastic and metallic pipe, between plastic and glass pipe, and between metallic and glass pipe, shall be made with transition fittings manufactured for the specific purpose.
24. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Plumbing Systems Additional Requirements:
1. Bends, plugs, or tees in water service lines, except soldered or screwed joints, shall be braced or clamped. The connection between the water service line and the domestic water distribution line shall be anchored by means of tie rods and pipe clamps.
2. Before connecting the domestic water system to underground supply connections, each supply connection shall be thoroughly flushed of all foreign matter.
3. Vertical cast iron soil pipe hubs inside buildings shall extend 6 inches above concrete slab-on-grade floors.
4. Provide test tees with screwed plugs in waste and vent systems to isolate sections of system previously tested from section of system under test. Distance between test tees on vertical lines shall not exceed static height allowable for system pressure limitations. All joints in test tees, including plugs, shall be tested under pressure as specified for system tests.
5. Joints between cast iron pipe and copper tube shall be made by using a brass-caulking ferrule and properly soldering the copper tube to the ferrule prior to pouring the lead.
6. Joints between cast iron and vitrified clay piping shall be made using either hot-poured bitumastic compound, or by a preformed elastomeric ring conforming to ASTM C564. The ring shall, after ramming, completely fill the annular space between the cast iron spigot and the vitrified clay hub.
7. Joints between copper tubing and threaded pipe shall be made by the use of brass adapters or dielectric fittings. The joint between the copper tubing and the fitting shall be soldered, and the connection between the threaded pipe and the fitting shall be a standard pipe size screw joint.
8. Joints between steel and cast-iron pipe shall be either caulked or threaded or made with approved adapter fittings.
9. Install horizontal drainage piping in uniform alignment at uniform slopes that will produce a computed velocity of not less than 2-feet per second when flowing half full, or a minimum of 1/8" per ft. unless noted otherwise.

10. The underground water service pipe and the building sewer shall be not less than 10 feet apart horizontally, and shall be separated by undisturbed, or compacted, earth, unless the following requirements are satisfied:
    a. The water service pipe and the building sewer may be installed in the same trench, provided written approval is given by the plumbing official and the following conditions are met:
        1) The bottom of the water service pipe at all points shall be not less than 12 inches above the top of the sewer line at its highest point.
        2) The water service pipe shall be placed on a solid shelf excavated at one side of the common trench.
        3) The number of joints in the service pipe shall be kept to a minimum.
        4) The materials and joints in the sewer pipe shall be installed in such manner, and shall possess the necessary strength and durability, to prevent the escape of solids, liquids, and gases there from under all known adverse conditions such as corrosion, strains due to temperature changes, settlements, vibration, and superimposed loads.
        5) Where the water service line must cross the building sewer line, the bottom of the water service line within 10 feet of the point of crossing shall be at least 12 inches above the top of the sewer line. The sewer line shall be of cast iron, with leaded or mechanical joints, within 10 feet of the point of crossing.
        6) Domestic water lines shall be disinfected.
11. Provide access panel for all valves located above non-accessible ceiling. Coordinate with Architectural plans for exact locations.
12. Provide clean-outs at the base of all sanitary waste and vent stacks.
13. When a PVC piping system is employed, the final rough-in piping shall transition to Type “L” copper tubing at penetration of wall construction to the fixture. The copper piping rough-in shall employ the usage of the “Hold Rite” support system to prevent movement of branch tubing. No exceptions.
14. Installation of copper tubing shall be per FPC, ASTM B32-96, and per Copper Development Association and ASTM B828-92-E01.
15. Install plugs or caps on all openings during the construction phase. The temporary plug shall be cap of same material as pipe. Duct tape is unacceptable for use as a plug for the construction phase.
16. All penetrations of piping through walls shall be made insect proof, (i.e., penetrations of waste arms, hot and cold-water piping through walls below sinks, lavatories, water closets, etc.). The escutcheon plate does constitute an “insect proof” closure.
17. Teflon tape shall be used on threaded connections. Expansion loops on hot water system shall be installed per manufacturer’s instructions to suit temperature and pipe run.
18. Mechanically formed branch connections, commonly termed extruded outlets, shall be made in a continuous operation consisting of producing a pilot hole, drawing out the tube/pipe surface to form an outlet and facing of the outlet rim (including beveling when required). An integral pipe heating operation may be included, after the cutting of the pilot hole on Schedule 40 wall thickness. The outlet device shall be fully adjustable to insure proper tolerance and complete uniformity of the joint. Materials should have a minimum elongation of 20-25% to be acceptable for forming.

19. The extruded outlet and butt weld connection shall be in accordance with ASME Boiler and Pressure Vessel Code, as listed under ANSI B31 Standards.

C. Plastic Pipe Systems Additional Requirements:
   1. Joints between plastic pipe and other materials shall be subject to the following requirements:
      a. Joints between different grades of plastic pipe shall be made by use of an approved adapter fitting.
      b. Joints between the hub of cast-iron soil pipe and plastic pipe shall be made by use of a mechanical joint of the compression or mechanical sealing type.
      c. Joints between plastic pipe and cast-iron pipe, steel pipe, glass pipe, copper tube, and other piping materials shall be made by use of an approved adapter fitting.
   2. Plastic pipe, fittings, and solvent cement used for domestic hot and cold-water service shall bear the NSF seal for potable water.
   3. Plastic pipe, fittings, and solvent cement shall not be used in systems where temperature, and operating pressure plus system static head, exceeds materials temperature and pressure limitations.
   4. Plastic vent piping shall not pass-through roofs, firewalls, or fire partitions. Plastic waste and vent piping shall be installed in fire rated pipe chases when passing through floors or approved fire stop sleeve.

D. Mechanical Joint System Additional Requirements: Install in strict accordance with the manufacturer's written installation instructions.

3.2 WELDING, BRAZING, AND SOLDERING

A. Operator and Procedure Qualifications: All welding and/or brazing operators and all welding and brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

B. Welding:
   1. All pipe welding performed under this division of the specifications shall be examined in accordance with ANSI B31.1 requirement for each piping system. The pipe weld examination is hereby made a part of the work of this division of the specifications. An independent outside inspection firm, regularly performing this type of examination, shall be hired by the contractor or subcontractor performing the welding as part of the work of their contract. The examination shall be performed by a representative of the Inspection Company (hereafter called the Inspector) who is qualified and certified for each examination method required.
   2. The Inspection Company performing the examination shall certify in writing that all pipe welds performed under this contract conform to the requirements of ANSI B31.1 for each piping system and to all other governing codes.
   3. Before final acceptance of the welded piping, certified test reports shall be submitted for review. The reports shall include the following data: name and location of project, date of test, type of piping system, working pressure and temperature, standard used for testing and applicable test method, number and location of welds tested and names of persons performing test.
   4. Welders and procedures for fire protection system piping qualified in accordance with NFPA No. 13.

C. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".

D. Soldering: Joints in copper tubing shall be made with solder type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self-cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid or a petroleum-based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxyacetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

3.3 TESTING OF PIPING SYSTEMS:

A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:
   1. Plumbing related systems shall be tested with water at not less than a 10 foot head. The water shall be kept in the systems for a period of not less than 15 minutes prior to start of visual examination. In lieu of water test, the systems may be tested with air at a uniform pressure of 5 psig, with no loss in pressure for a period of not less than 15 minutes.
   2. Domestic Water Distribution Systems shall be tested with water at the system working pressure, but not less than 100 psig. Joints will be visually examined for leaks.
   3. Domestic Water Service System shall be tested with water at 150 psig. Joints will be visually examined for leaks.
   4. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.
B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 24 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.
C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed, and approval is granted.
D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.
E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems and blow out piping with compressed air to remove trapped water.
F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.
G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.
H. Disconnect pressure boosting apparatus, or vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.

I. During tests, isolate system components that have test pressures less than pressures specified for system tests.
J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

3.4 CLEANING OF PIPING SYSTEMS

A. Plumbing piping systems shall be thoroughly cleaned as described in Section 22 11 17 - Disinfection of Domestic Water Lines. The chlorination and disinfections process shall be witnessed by a representative of the owner and provide a written Certification, as such.

END OF SECTION

SECTION 22 11 17
DISINFECTION OF DOMESTIC WATER LINES

PART 1 - GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Provide personnel, equipment, and supplies, disinfect domestic hot and cold-water systems, and flush out systems at completion of treatment.

1.3 DEFINITIONS

A. Disinfectant Residual means the quantity of disinfectant in treated water.
B. pH Factor means the measure of alkalinity and acidity in water.
C. ppm means parts per million.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced.
   1. American Waterworks Association (AWWA) Standards.
   2. Standard Methods for the Examination of Water & Wastewater (14th edition).

1.5 QUALITY ASSURANCE

A. Water Treatment Contractor: At least 5 years experience performing work specified herein.
B. Bacteriological Laboratory: State certification.

1.6 SUBMITTALS

A. General: Submit product literature for approval in accordance with Division 1.
B. Water Treatment Contractor's evidence of experience: Submit three (3) copies.
C. Bacteriological Laboratory's evidence of certification: Submit three (3) copies.
D. Test Reports: Submit four (4) copies as follows:
   1. Disinfection Report, include:
      a. Date issued.
      b. Project name and location.
      c. Treatment Contractor's name, address, and phone number.
      d. Type and form of Disinfectant used.
      e. Time and date of Disinfectant injection start.
      f. Time and date of Disinfectant injection completion.
      g. Test locations.
      h. Initial and 24-hour Disinfectant Residuals in ppm for each outlet tested.
      i. Time and date of flushing start.

j. Time and date of flushing completion.
k. Disinfectant Residual after flushing in ppm for each outlet tested.

2. Bacteriological Report. Include:
   a. Date issued.
   b. Project name and location.
   c. Laboratory's name, certification number, address, and phone number.
   d. Time and date of water sample collection.
   e. Name of person collecting samples.
   f. Test locations.
   g. Time and date of laboratory test start.
   h. Coliform bacteria test results for each outlet tested.
   i. Certification that water conforms or fails to conform to bacterial standards or fails to conform to bacterial standards of Federal Safe Drinking Water Act.
   j. Bacteriologist's signature.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protect against damage and contamination.
B. Maintain caution labels on hazardous materials.
C. Maintain storage room dry and with temperatures as uniform as possible between 60°F and 80°F.
D. Do not store Caustic Soda directly on floor colder than 55°F.

1.8 PROTECTION

A. Provide necessary signs, barricades, and notices to prevent any person from accidentally consuming water or disturbing system being treated.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall conform to the respective publications and other requirements specified herein.
B. Disinfectant: Free chlorine; liquid, powder, tablet, or gas.
C. Alkali: Caustic Soda or Soda Ash.
D. Acid: Hydrochloric (Muriatic) type.

PART 3 – EXECUTION

3.1 INSPECTION

A. Prior to starting work verify that domestic water system is completed and cleaned.
B. Notify Contractor about defects requiring correction.
C. Do not start work until conditions are satisfactory.

3.2 PREPARATION OF WATER FOR TREATMENT

A. Verify pH factor of water to be treated.
B. If pH factor is less than 7.2, introduce sufficient Alkali during Disinfectant injection.
C. If pH factor is greater than 7.6, introduce sufficient Acid during Disinfectant injection.

3.3 SYSTEM TREATMENT

A. Injection Disinfectant throughout system to obtain 50 to 80 ppm residual.
B. Starting at outlet closest to water source, bleed water from each outlet until water produces odor of Disinfectant. Repeat process at each outlet throughout system. If odorless Disinfectant is used testing is required to determine if Disinfectant is fully dispersed throughout system.
C. Test for Disinfectant Residual at each of the following locations:
    1. Ends of piping runs.
    2. Remote outlets.
    3. At least 15% of outlets on each floor where directed by Architect, but in no case less than 2 outlets.
D. Maintain Disinfectant in system for 24 hours.
E. If Disinfectant Residual is less than 25 ppm, repeat system treatment.

3.4 FLUSHING

A. Remove Disinfectant from system; permit no more than residual rate of incoming water or 1.0 ppm, whichever is greater.

3.5 BACTERIOLOGICAL TEST

A. Instruct Bacteriological Laboratory to take water samples no sooner than 24 hours after flushing system.
B. Take water samples at each of the following locations:
    1. Where water enters system.
    2. Ends of piping runs.
    3. Remote outlets.
    4. At least 10% of outlets on each floor other than those used for testing Disinfectant Residual, where directed by Architect, but in no case less than two (2) outlets.
C. Analyze water samples in accordance with AWWA Standard Methods for the Examination of Water & Wastewater, 14th edition.
D. If bacteriological test proves water quality to be unacceptable, repeat system treatment until water quality is acceptable.

END OF SECTION

SECTION 22 13 16
SANITARY DRAIN, WASTE AND VENT PIPING

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Sanitary Drain, Waste and Vent (DWV).

1.3 DEFINITIONS

A. Pipe sizes given in this document are nominal.

1.4 QUALITY ASSURANCE

A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products and shall be of the manufacturer's most recent design that is in regular production.
B. Each item provided under this section shall meet the requirements for that item as installed and used.
C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.
D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.
B. The work and materials listed in this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications.
C. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.
    1. American National Standards Institute (ANSI) Standards
    2. American Petroleum Institute (API) Specification
    3. American Society of Mechanical Engineers (ASME) Publications
    4. American Society for Testing and Materials (ASTM) Publications
    5. American Welding Society (AWS) Publication
    6. American Water Works Association (AWWA) Standards
    7. Cast Iron Soil Pipe Institute (CISPI) Standards
    8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications
    9. National Fire Protection Association (NFPA) Standards

10. National Sanitation Foundation (NSF) Testing Laboratory Standards.
11. Plastic Pipe Institute (PPI) Manual.
12. Underwriters Laboratories (UL)

1.6 SUBMITTALS

A. All submittals shall be made in accordance with Division 1 requirements.
B. Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, fittings, valves, hangers and supports. Include the designation of the publication applicable for each type of material and method.
C. Submit current welder qualifications for all welders proposed for this project. Welding certificates shall be for the company performing the welding at this project as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.
D. Submit certified welding inspection reports as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Sanitary Drain, Waste and Vent (DWV) Piping:
   1. Underground sanitary piping:
      a. No-hub cast iron pipe and fittings, CISPI Standard 301, ASTM A-888-98el.
      b. No-hub couplings, CISPE Standard 310-97.
      c. Charlotte Seal Gaskets, ASTM C-564-97, CISPI-HSN.
      d. Warco-Quik-Tite Gaskets, ASTM C-564-94, CISPI-HSN.
      e. Schedule 40, PVC-DWV drainage pattern, conforming to the following standards:
         1) ASTM D-1784 – Rigid PVC Vinyl Components.
         2) ASTM D-1785 – PVC Plastic Pipe, Schedule 40.
         3) ASTM D-2665 – PVC Drain, Waste and Vent Pipe and Fittings.
         4) ASTM D-2564 – Solvent Cements for PVC Pipe and Fittings.
         5) NSF Standard 14 – Plastic Piping Components and Related Materials.
      f. Pipe Size 15” – PVC pipe and fittings, ASTM D-3034 or ASTM F-679, SDR 35 gasket.
      g. Pipe Size 18”, 21”, 24” and 27” – PVC pipe and fittings, ASTM F-679, SDR 35 gasket.
      h. PP Schedule 40 polypropylene, ASTM D635 and ASTM F1412, drainage pattern, mechanical joint stainless-steel components, ASTM B117. Polypropylene shall be used where indicated on the drawings and as specified herein.
   2. Above-ground sanitary and vent piping:
      a. No-hub cast iron pipe and fittings, CISPI Standard 301, ASTM A-888-98el.
      b. No-hub couplings, CISPI Standard 310.
      c. Charlotte Seal Gaskets, ASTM C-564, CISPI-HSN.
      d. Warco-Quik-Tite Gaskets, ASTM C-564-97, CISPI-HSN.
      e. 2” and smaller Type DWV hard-drawn copper tubing, ASTM B-306 with copper drainage pattern and (lead-free) solder 95-5 Tin-antimony.
      f. Schedule 40, PVC-DWV drainage pattern, conforming to the following standards:

1) ASTM D-1784 – Rigid PVC Vinyl Components.
2) ASTM D-1785 – PVC Plastic Pipe, Schedule 40.
3) ASTM D-2665 – PVC Drain, Waste and Vent Pipe and Fittings.
4) ASTM D-2564 – Solvent Cements for PVC Pipe and Fittings.
5) NSF Standard 14 – Plastic Piping Components and Related Materials.

3. ½" to 1": Same as domestic water, Type "L" hard-drawn, or Schedule 40 PVC pipe and solvent joint fittings.
4. 1-1/4" to 2" copper drainage tube, DWV Kitchen (Kitchen sinks and equipment waste).
5. Soda conduits shall be long sweep PVC conduit ells (R=24 inches) with solvent joints.
6. Elevator sump pump discharge pipe, inside pit shall be Schedule 40 galvanized steel A53/A106 with black, cast iron drainage fittings with threaded joints. Discharge piping beyond elevator pit wall, below slab, to be similar to sanitary waste, Schedule 40 PVC-DWV.
7. PVC Foam core DWV pipe, ASTM F891, is not and shall not be approved under any circumstances nor installed on this project.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General:
1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors, and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.

8. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.
10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways, and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
12. Piping found to have water hammer or other objectionable vibrations which cannot be eliminated by proper grading or other natural means, shall be braced, trapped, or hung with shock absorbing hangers.
13. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut, or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
14. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
15. Avoid bushings. Reducing fittings shall be used wherever practical.
16. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
17. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.

18. Copper tubing and galvanized steel shall not be mixed in any one run of piping.
19. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
20. Threaded joints shall be made with tapered threads in accordance with ANSI B2.1 and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint is made up a maximum of 3 threads shall be visible.
21. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
22. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.
23. Connections between plastic and metallic pipe, between plastic and glass pipe, and between metallic and glass pipe, shall be made with transition fittings manufactured for the specific purpose.
24. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Plumbing Systems Additional Requirements:
   1. Bends, plugs, or tees in water service lines, except soldered or screwed joints, shall be braced or clamped. The connection between the water service line and the domestic water distribution line shall be anchored by means of tie rods and pipe clamps.
   2. Before connecting the domestic water system to underground supply connections, each supply connection shall be thoroughly flushed of all foreign matter.
   3. Vertical cast iron soil pipe hubs inside buildings shall extend 6 inches above concrete slab-on-grade floors.
   4. Provide test tees with screwed plugs in waste and vent systems to isolate sections of system previously tested from section of system under test. Distance between test tees on vertical lines shall not exceed static height allowable for system pressure limitations. All joints in test tees, including plugs, shall be tested under pressure as specified for system tests.
   5. Joints between cast iron pipe and copper tube shall be made by using a brass-caulking ferrule and properly soldering the copper tube to the ferrule prior to pouring the lead.
   6. Joints between cast iron and vitrified clay piping shall be made using either hot poured bitumastic compound, or by a preformed elastomeric ring conforming to ASTM C564. The ring shall, after ramming, completely fill the annular space between the cast iron spigot and the vitrified clay hub.
   7. Joints between copper tubing and threaded pipe shall be made by the use of brass adapters or dielectric fittings. The joint between the copper tubing and the fitting shall be soldered, and the connection between the threaded pipe and the fitting shall be a standard pipe size screw joint.
   8. Joints between steel and cast-iron pipe shall be either caulked or threaded or made with approved adapter fittings.
   9. Install horizontal drainage piping in uniform alignment at uniform slopes that will produce a computed velocity of not less than 2 feet per second when flowing half full, or a minimum of 1/8" per ft. unless noted otherwise.

10. The underground water service pipe and the building sewer shall be not less than 10 feet apart horizontally, and shall be separated by undisturbed, or compacted, earth, unless the following requirements are satisfied:
    a. The water service pipe and the building sewer may be installed in the same trench, provided written approval is given by the plumbing official and the following conditions are met:
        1) The bottom of the water service pipe at all points shall be not less than 12 inches above the top of the sewer line at its highest point.
        2) The water service pipe shall be placed on a solid shelf excavated at one side of the common trench.
        3) The number of joints in the service pipe shall be kept to a minimum.
        4) The materials and joints in the sewer pipe shall be installed in such manner, and shall possess the necessary strength and durability, to prevent the escape of solids, liquids, and gases there from under all known adverse conditions such as corrosion, strains due to temperature changes, settlements, vibration, and superimposed loads.
        5) Where the water service line must cross the building sewer line, the bottom of the water service line within 10 feet of the point of crossing shall be at least 12 inches above the top of the sewer line. The sewer line shall be of cast iron, with leaded or mechanical joints, within 10 feet of the point of crossing.
11. Provide access panel for all valves located above non-accessible ceiling. Coordinate with Architectural plans for exact locations.
12. Provide clean-outs at the base of all sanitary waste and vent stacks.
13. Installation of copper tubing shall be per FPC, ASTM B32-96, and per Copper Development Association and ASTM B828-92-E01.
14. Install plugs or caps on all openings during the construction phase. The temporary plug shall be cap of same material as pipe. Duct tape is unacceptable for use as a plug for the construction phase.
15. All penetrations of piping through walls shall be made insect proof, (i.e., penetrations of waste arms, hot and cold-water piping through walls below sinks, lavatories, water closets, etc.). The escutcheon plate does constitute an “insect proof” closure.
16. Mechanically formed branch connections, commonly termed extruded outlets, shall be made in a continuous operation consisting of producing a pilot hole, drawing out the tube/pipe surface to form an outlet and facing of the outlet rim (including beveling when required). An integral pipe heating operation may be included, after the cutting of the pilot hole on Schedule 40 wall thickness. The outlet device shall be fully adjustable to insure proper tolerance and complete uniformity of the joint. Materials should have a minimum elongation of 20-25% to be acceptable for forming.
17. The extruded outlet and butt weld connection shall be in accordance with ASME Boiler and Pressure Vessel Code, as listed under ANSI B31 Standards.

C. Plastic Pipe Systems Additional Requirements:
    1. Joints between plastic pipe and other materials shall be subject to the following requirements:
        a. Joints between different grades of plastic pipe shall be made by use of an approved adapter fitting.
        b. Joints between the hub of cast iron soil pipe and plastic pipe shall be made by use of a mechanical joint of the compression or mechanical sealing type.

c. Joints between plastic pipe and cast-iron pipe, steel pipe, glass pipe, copper tube, and other piping materials shall be made by use of an approved adapter fitting.

2. Plastic pipe, fittings, and solvent cement used for domestic hot and cold-water service shall bear the NSF seal for potable water.
3. Plastic pipe, fittings, and solvent cement shall not be used in systems where temperature, and operating pressure plus system static head, exceeds materials temperature and pressure limitations.
4. Plastic vent piping shall not pass-through roofs, firewalls, or fire partitions. Plastic waste and vent piping shall be installed in fire rated pipe chases when passing through floors or approved fire stop sleeve.
5. Plastic piping materials shall not be installed in air plenums, air chambers, or airshafts.

3.2 WELDING, BRAZING, AND SOLDERING

A. Operator and Procedure Qualifications: All welding and/or brazing operators and all welding and brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

B. Welding:
   1. All pipe welding performed under this division of the specifications shall be examined in accordance with ANSI B31.1 requirement for each piping system. The pipe weld examination is hereby made a part of the work of this division of the specifications. An independent outside inspection firm, regularly performing this type of examination, shall be hired by the contractor or subcontractor performing the welding as part of the work of their contract. The examination shall be performed by a representative of the Inspection Company (hereafter called the Inspector) who is qualified and certified for each examination method required.
   2. The Inspection Company performing the examination shall certify in writing that all pipe welds performed under this contract conform to the requirements of ANSI B31.1 for each piping system and to all other governing codes.
   3. Before final acceptance of the welded piping, certified test reports shall be submitted for review. The reports shall include the following data: name and location of project, date of test, type of piping system, working pressure and temperature, standard used for testing and applicable test method, number and location of welds tested and names of persons performing test.
   4. Welders and procedures for fire protection system piping qualified in accordance with NFPA No. 13.

C. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".

D. Soldering: Joints in copper tubing shall be made with solder type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self-cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid or a petroleum-based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxyacetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

3.3 TESTING OF PIPING SYSTEMS:

A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:
   1. General: Furnish everything required for the tests. Notify Architect/Engineer at least 48 hours before any testing is performed. Independent Agent/Owner shall verify pressure test and sign off. Report to be furnished to Architect/Engineer. Testing shall be performed at the completion of each phase of the project.
   2. Plumbing related systems shall be tested with water at not less than a 10-foot head. The water shall be kept in the systems for a period of not less than 15 minutes prior to start of visual examination. In lieu of water test, the systems may be tested with air at a uniform pressure of 5 psig, with no loss in pressure for a period of not less than 15 minutes.
   3. The building sewer shall be tested by insertion of a test plug at the point of connection with the public sewer and filled with water under a head of not less than 10 feet, with no drop in water level for a period of not less than 15 minutes.
   4. Domestic Water Distribution Systems shall be tested with water at the system working pressure, but not less than 100 psig and not for not less than 4 continuous hours. Joints will be visually examined for leaks.
   5. Domestic Water Distribution Systems utilizing Viega Pro-*Press* fittings with SC Feature Contour Design shall be initially tested at a minimum of ½ psig but not more than 85 psig. Joints shall be visually examined for leaks.
   6. Domestic Water Service System shall be tested with water at 150 psig. Joints will be visually examined for leaks.
   7. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.
B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 72 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.
C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed, and approval is granted.
D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.

E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems and blow out piping with compressed air to remove trapped water.
F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.
G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.
H. Disconnect pressure boosting apparatus, or vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.
I. During tests, isolate system components that have test pressures less than pressures specified for system tests.
J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

END OF SECTION

SECTION 22 14 13
FACILITY STORM DRAINAGE PIPING

PART 1 – GENERAL

1.1 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. Refer to Section 22 05 00 for requirements pertaining to Common Work Results for Plumbing Systems.

1.2 WORK INCLUDED

A. Storm Water (ST) Piping.

1.3 DEFINITIONS

A. The pipe sizes given in this document are nominal.

1.4 QUALITY ASSURANCE

A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products and shall be of the manufacturer's most recent design that is in regular production.
B. Each item provided under this section shall meet the requirements for that item as installed and used.
C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.
D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.
B. The work and materials listed in this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications.
C. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.
   1. American National Standards Institute (ANSI) Standards
   2. American Petroleum Institute (API) Specification
   3. American Society of Mechanical Engineers (ASME) Publications
   4. American Society for Testing and Materials (ASTM) Publications
   5. American Welding Society (AWS) Publication
   6. American Water Works Association (AWWA) Standards
   7. Cast Iron Soil Pipe Institute (CISPI) Standards
   8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications

9. National Fire Protection Association (NFPA) Standards
10. National Sanitation Foundation (NSF) Testing Laboratory Standards.
11. Plastic Pipe Institute (PPI) Manual.
12. Plumbing and drainage institute.
13. Underwriters Laboratories (UL)

1.6 SUBMITTALS

A. All submittals shall be made in accordance with Section 22 05 00 requirements.
B. Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, pipefittings, valves, and joints. Include the basic designation of the publication applicable for each type of material and method.
C. Submit current welder qualifications for all welders proposed for this project. Welding certificates shall be for the company performing the welding at this project as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.
D. Submit certified welding inspection reports as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Storm Water (ST) Piping
   1. Underground piping:
      a. No-hub cast iron pipe and fittings, CISPI Standard 301, ASTM A-888-98el.
      b. No-hub couplings, CISPE Standard 310-97.
      c. Charlotte Seal Gaskets, ASTM C-564-97, CISPI-HSN.
      d. Warco-Quik-Tite Gaskets, ASTM C-564-94, CISPI-HSN.
      e. Schedule 40, PVC-DWV drainage pattern, conforming to the following standards:
         1) ASTM D-1784 – Rigid PVC Vinyl Components.
         2) ASTM D-1785 – PVC Plastic Pipe, Schedule 40.
         3) ASTM D-2665 – PVC Drain, Waste and Vent Pipe and Fittings.
         4) ASTM D-2564 – Solvent Cements for PVC Pipe and Fittings.
         5) NSF Standard 14 – Plastic Piping Components and Related Materials.
      f. Pipe Size 15” – PVC pipe and fittings, ASTM D-3034 or ASTM F-679, SDR 35 gasket.
      g. Pipe Size 18”, 21”, 24” and 27” – PVC pipe and fittings, ASTM F-679, SDR 35 gasket.
      h. PP Schedule 40 polypropylene, ASTM D635 and ASTM F1412, drainage pattern, mechanical joint stainless-steel components, ASTM B117. Polypropylene shall be used where indicated on the drawings and as specified herein.
   2. Above-ground piping:
      a. No-hub cast iron pipe and fittings, CISPI Standard 301, ASTM A-888-98el.
      b. No-hub couplings, CISPI Standard 310.
      c. Charlotte Seal Gaskets, ASTM C-564, CISPI-HSN.
      d. Warco-Quik-Tite Gaskets, ASTM C-564-97, CISPI-HSN.
      e. 2” and smaller Type DWV hard-drawn copper tubing, ASTM B-306 with copper drainage pattern and (lead-free) solder 95-5 Tin-antimony.

f. Schedule 40, PVC-DWV drainage pattern, conforming to the following standards:
   1) ASTM D-1784 – Rigid PVC Vinyl Components.
   2) ASTM D-1785 – PVC Plastic Pipe, Schedule 40.
   3) ASTM D-2665 – PVC Drain, Waste and Vent Pipe and Fittings.
   4) ASTM D-2564 – Solvent Cements for PVC Pipe and Fittings.
   5) NSF Standard 14 – Plastic Piping Components and Related Materials.

3. Steamers, commercial type dishwashers, commercial laundry equipment, and similar high temperature drainage piping, including the deep seal P-Trap from the floor drain to main branch run, shall be cast iron or polypropylene, no exceptions.
4. ½" to 1": Same as domestic water, Type "L" hard-drawn, or Schedule 40 PVC pipe and solvent joint fittings.
5. 1-1/4" to 2" copper drainage tube, DWV Kitchen (Kitchen sinks and equipment waste).
6. Soda conduits shall be long sweep PVC conduit ells (R=24 inches) with solvent joints.
7. Elevator sump pump discharge pipe, inside pit shall be Schedule 40 galvanized steel A53/A106 with black, cast iron drainage fittings with threaded joints. Discharge piping beyond elevator pit wall, below slab, to be similar to sanitary waste, Schedule 40 PVC-DWV.
8. PVC Foam core DWV pipe, ASTM F891, is not and shall not be approved under any circumstances nor installed on this project.

2.2 MECHANICAL JOINT SYSTEMS

A. General:
   1. All couplings, fittings, and gaskets shall be the products of a single manufacturer.
   2. Valve ends shall be compatible with the couplings used on the connecting piping.
B. Pipe Wall Thickness (Schedule Number):
   1. Where rolled groove joints are used, the pipe wall thickness may, in some cases, be decreased below that specified for the particular fluid system. In all cases, the minimum pipe wall thickness shall be in accordance with ANSI/ASME B31.9, Chapter II, using 150% of the system operating pressure as the design pressure.
   2. Pipe having cut (machined) grooves shall have a nominal wall thickness of not less than the wall thickness specified for Schedule 40 pipe of the particular pipe size.
   3. Non-metallic pipe shall not be joined with grooved-end pipe mechanical joints.
C. Couplings:
   1. Mechanical joint couplings shall be of the external type, for use with cut or rolled-groove end pipes, fittings, and valves.
   2. Couplings shall be self-centering and shall engage and lock-in-place the grooved-end pipes, fittings, and gaskets.
   3. All couplings shall be of the rigid style. Flexible couplings shall not be used without the written approval of the Engineer.
   4. Couplings shall be Ductile Iron, ASTM A536; or malleable iron, ASTM A47, and shall be designed for not less than 250 psig at 230 Deg. F.
   5. The coupling assembly shall be held together by two or more track-head, oval-neck steel bolts, ASTM A183.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General:
1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors, and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
8. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.

10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways, and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
12. Piping found to have water hammer or other objectionable vibrations which cannot be eliminated by proper grading or other natural means, shall be braced, trapped, or hung with shock absorbing hangers and equipped with air chambers, mechanical shock absorbers, flexible pipe connections or otherwise silenced using approved means.
13. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut, or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
14. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
15. Avoid bushings. Reducing fittings shall be used wherever practical.
16. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
17. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.
18. Copper tubing and galvanized steel shall not be mixed in any one run of piping.
19. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The centerline radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
20. Threaded joints shall be made with tapered threads in accordance with ANSI B2.1 and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint is made up a maximum of 3 threads shall be visible.
21. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
22. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.
23. Connections between plastic and metallic pipe, between plastic and glass pipe, and between metallic and glass pipe, shall be made with transition fittings manufactured for the specific purpose.

24. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

C. Plumbing Systems Additional Requirements:
   1. Bends, plugs, or tees in water service lines, except soldered or screwed joints, shall be braced or clamped. The connection between the water service line and the domestic water distribution line shall be anchored by means of tie rods and pipe clamps.
   2. Before connecting the domestic water system to underground supply connections, each supply connection shall be thoroughly flushed of all foreign matter.
   3. Vertical cast iron soil pipe hubs inside buildings shall extend 6 inches above concrete slab-on-grade floors.
   4. Provide test tees with screwed plugs in waste and vent systems to isolate sections of system previously tested from section of system under test. Distance between test tees on vertical lines shall not exceed static height allowable for system pressure limitations. All joints in test tees, including plugs, shall be tested under pressure as specified for system tests.
   5. Joints between cast iron pipe and copper tube shall be made by using a brass-caulking ferrule and properly soldering the copper tube to the ferrule prior to pouring the lead.
   6. Joints between cast iron and vitrified clay piping shall be made using either hot poured bitumastic compound, or by a preformed elastomeric ring conforming to ASTM C564. The ring shall, after ramming, completely fill the annular space between the cast iron spigot and the vitrified clay hub.
   7. Joints between copper tubing and threaded pipe shall be made by the use of brass adapters or dielectric fittings. The joint between the copper tubing and the fitting shall be soldered, and the connection between the threaded pipe and the fitting shall be a standard pipe size screw joint.
   8. Joints between steel and cast-iron pipe shall be either caulked or threaded or made with approved adapter fittings.
   9. Install horizontal drainage piping in uniform alignment at uniform slopes that will produce a computed velocity of not less than 2 feet per second when flowing half full, or a minimum of 1/8" per ft. unless noted otherwise.
   10. The underground water service pipe and the building sewer shall be not less than 10 feet apart horizontally, and shall be separated by undisturbed, or compacted, earth, unless the following requirements are satisfied:
      a. The water service pipe and the building sewer may be installed in the same trench, provided written approval is given by the plumbing official and the following conditions are met:
         1) The bottom of the water service pipe at all points shall be not less than 12 inches above the top of the sewer line at its highest point.
         2) The water service pipe shall be placed on a solid shelf excavated at one side of the common trench.
         3) The number of joints in the service pipe shall be kept to a minimum.
         4) The materials and joints in the sewer pipe shall be installed in such manner, and shall possess the necessary strength and durability, to prevent the escape of solids, liquids, and gases there from under all known adverse conditions such as corrosion, strains due to temperature changes, settlements, vibration, and superimposed loads.

5) Where the water service line must cross the building sewer line, the bottom of the water service line within 10 feet of the point of crossing shall be at least 12 inches above the top of the sewer line. The sewer line shall be of cast iron, with leaded or mechanical joints, within 10 feet of the point of crossing.

11. Provide access panel for all valves located above non-accessible ceiling. Coordinate with Architectural plans for exact locations.
12. Provide clean-outs at the base of all sanitary waste and vent stacks.
13. When a PVC or CPVC piping system is employed, the final rough-in piping shall transition from CPVC to Type "L" copper tubing at penetration of wall construction to the fixture. The copper piping rough-in shall employ the usage of the "Hold Rite" support system to prevent movement of branch tubing. No exceptions.
14. Installation of copper tubing shall be per FPC, ASTM B32-96, and per Copper Development Association and ASTM B828-92-E01.
15. Install plugs or caps on all openings during the construction phase. The temporary plug shall be cap of same material as pipe. Duct tape is unacceptable for use as a plug for the construction phase.
16. All penetrations of piping through walls shall be made insect proof, (i.e., penetrations of waste arms, hot and cold-water piping through walls below sinks, lavatories, water closets, etc.). The escutcheon plate does constitute an "insect proof" closure.
17. Installation of CPVC tubing shall be per State of Florida Plumbing Code, "PPFA Installation Handbook for CPVC hot and Cold Water Piping" including Flow Guard Gold, Noveon, Inc. Contractor shall certify that he has been trained by manufacturer on techniques for installation of CPVC tubing systems. Manufacturer shall warranty materials and labor for a 5-year period against all leaks using CPVC tubing. CPVC tubing shall not be installed in the laundry or in areas where piping is subject to extreme physical damage, (i.e., the kitchen).
18. Teflon tape shall be used on threaded connections. A CPVC/brass adapter nipple shall be installed where piping penetrates wall to connect to flush valves. Cast brass "drop-ear" elbows shall be secured to wall construction for copper run out to hose bibs and shower heads. CPVC stub-outs for lavatories and sinks may be used. CPVC shall not be used within 1'-0" of the gas water heater's flue vent or for hot water supply and return piping between gas water heater and storage tank. Expansion loops on hot water system shall be installed per manufacturer's instructions to suit temperature and pipe run.
19. Mechanically formed branch connections, commonly termed extruded outlets, shall be made in a continuous operation consisting of producing a pilot hole, drawing out the tube/pipe surface to form an outlet and facing of the outlet rim (including beveling when required). An integral pipe heating operation may be included, after the cutting of the pilot hole on Schedule 40 wall thickness. The outlet device shall be fully adjustable to insure proper tolerance and complete uniformity of the joint. Materials should have a minimum elongation of 20-25% to be acceptable for forming.
20. The extruded outlet and butt weld connection shall be in accordance with ASME Boiler and Pressure Vessel Code, as listed under ANSI B31 Standards.

D. Plastic Pipe Systems Additional Requirements:
   1. Joints between plastic pipe and other materials shall be subject to the following requirements:
      a. Joints between different grades of plastic pipe shall be made by use of an approved adapter fitting.
      b. Joints between the hub of cast iron soil pipe and plastic pipe shall be made by use of a mechanical joint of the compression or mechanical sealing type.

c. Joints between plastic pipe and cast-iron pipe, steel pipe, glass pipe, copper tube, and other piping materials shall be made by use of an approved adapter fitting.

2. Plastic pipe, fittings, and solvent cement used for domestic hot and cold-water service shall bear the NSF seal for potable water.
3. Plastic pipe, fittings, and solvent cement shall not be used in systems where temperature, and operating pressure plus system static head, exceeds materials temperature and pressure limitations.
4. Plastic vent piping shall not pass-through roofs, firewalls, or fire partitions. Plastic waste and vent piping shall be installed in fire rated pipe chases when passing through floors or approved fire stop sleeve.
5. Plastic piping materials shall not be installed in air plenums, air chambers, or airshafts.

E. Mechanical Joint System Additional Requirements: Install in strict accordance with the manufacturer's written installation instructions.

3.2 WELDING, BRAZING, AND SOLDERING

A. Operator and Procedure Qualifications: All welding and/or brazing operators and all welding and brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.
B. Welding:
   1. All pipe welding performed under this division of the specifications shall be examined in accordance with ANSI B31.1 requirement for each piping system. The pipe weld examination is hereby made a part of the work of this division of the specifications. An independent outside inspection firm, regularly performing this type of examination, shall be hired by the contractor or subcontractor performing the welding as part of the work of their contract. The examination shall be performed by a representative of the Inspection Company (hereafter called the Inspector) who is qualified and certified for each examination method required.
   2. The Inspection Company performing the examination shall certify in writing that all pipe welds performed under this contract conform to the requirements of ANSI B31.1 for each piping system and to all other governing codes.
   3. Before final acceptance of the welded piping, certified test reports shall be submitted for review. The reports shall include the following data: name and location of project, date of test, type of piping system, working pressure and temperature, standard used for testing and applicable test method, number and location of welds tested and names of persons performing test.
   4. Welders and procedures for fire protection system piping qualified in accordance with NFPA No. 13.
C. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".
D. Soldering: Joints in copper tubing shall be made with solder type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self-cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid or a petroleum-based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder

hardens. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxyacetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

3.3 TESTING OF PIPING SYSTEMS:

A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:
   1. Plumbing related systems shall be tested with water at not less than a 10-foot head. The water shall be kept in the systems for a period of not less than 15 minutes prior to start of visual examination. In lieu of water test, the systems may be tested with air at a uniform pressure of 5 psig, with no loss in pressure for a period of not less than 15 minutes.
   2. The building sewer shall be tested by insertion of a test plug at the point of connection with the public sewer and filled with water under a head of not less than 10 feet, with no drop in water level for a period of not less than 15 minutes.
   3. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.
B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 72 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.
C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed, and approval is granted.
D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.
E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems and blow out piping with compressed air to remove trapped water.
F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.
G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.
H. Disconnect pressure boosting apparatus, or vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.
I. During tests, isolate system components that have test pressures less than pressures specified for system tests.
J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

END OF SECTION

SECTION 23 02 00
BASIC MATERIALS AND METHODS OF HVAC SYSTEMS

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Access doors.
B. Piping and equipment identification.
C. Electrical requirements.
D. Painting.
E. Concrete work.
F. Fabricated steel supports.
G. Excavation, trenching and backfilling.
H. Placing of equipment.

1.3 RELATED WORK

A. DIVISION 9 - FINISHES (Access Doors - Painting).
B. DIVISION 3 - CONCRETE.
C. DIVISION 31- SITEWORK (Excavation).

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced.
   1. American Institute of Steel Construction (AISC) Publications
   2. American National Standards Institute (ANSI) Standards
   3. American Society for Testing and Materials (ASTM) Publications
   4. American Welding Society (AWS) Publications
   5. Underwriters Laboratories, Inc. (UL) Standards

1.5 SUBMITTALS

A. General: Where submittals are required, comply with Division 1requirements.
B. Shop Drawings:
   1. Submit drawings of fabricated steel supports where proposed supports are not in accordance with details on drawings, or where drawings do not detail supports. Submittal for acceptance is required.
   2. Submit drawings indicating locations of all access doors proposed to be installed in ductwork. Submittal for acceptance is required.
C. Product Data: Submittal for other than fabricated steel supports is not required. Product data for the following shall be included in the operation and maintenance manuals. Submittal for acceptance is not required.
   1. Access doors.

2. Piping and equipment identification.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Access Doors:
   1. Acudor
   2. Elmodor Manufacturing, Co.
   3. Karp Metal Associates, Inc.
   4. Larsen's Manufacturing Co.
   5. Milcor
   6. Engineer-approved Equal
B. Piping and Equipment Identification:
   1. Communications Technology Corp.
   2. Craftmark Identification Systems, Inc.
   3. EMED Co., Inc.
   4. Florida Marking Products, Inc.
   5. Marking Services, Inc.
   6. Seton Name Plate Corp.
   7. W.H. Brady Co., Signmark Division
   8. Engineer-approved Equal

2.2 FABRICATION

A. Access doors:
   1. Access doors: UL labeled where installed in fire rated walls, partitions, and ceilings. Door rating shall be not less than wall, partition, or ceiling rating.
   2. Frames: 16-gauge steel, flush trim, with corners welded and ground smooth, masonry anchor strap for masonry walls, bolt holes for mounting in framed openings.
   3. Non-fire rated doors: 13-gauge steel, concealed continuous piano hinge with dust flap, flush screwdriver operated lock with stainless steel cam and studs.
   4. Fire rated doors: 20-gauge steel welded pan type, concealed continuous piano hinge with stainless steel pins, key-operated latch bolt, interior latch release, automatic door closer, automatic door latch when door closes. The door panel shall contain 2- inch thick insulation in sandwich type construction.
   5. Finish of doors and frames: Prime coat of rust inhibitive baked enamel, except as specified otherwise.
   6. Finish of doors and frames in wet areas, and in areas with surfaces subject to wet cleaning: No. 4 satin stainless steel.
B. Piping and Equipment Identification:
   1. Pipe markers: Sub-surface printed plastic, with protective undercoating. Markers shall be permanently curled for snap-on installation for pipe sizes (including insulation) up to 6" diameter. For external diameters above 8". Marker shall be secured using cable ties for indoor use and stainless-steel banding or ultraviolet resistant plastic for exterior use. Markers for outdoor installation shall be over-laminated with Tedlar™ on polyester ultraviolet damage and fading. Markers shall identify the pipe contents and direction of flow through 360-degree visibility range. Marker size, letter size, letter color, wording and background color shall be in accord with ANSI A13.1 – Scheme for the Identification of Piping Systems. Based on Marking Services Inc. Model MS-970 Coiled Plastic Markers for indoor use and Model MS-995 Maxilar Marker for exterior use.

2. Valve tags: Contractors Option:
   a. Indoor:
      1) 19-gauge brass, 1-1/2-inch round, with 1/4-inch-high black pipe service letter abbreviation above 1/2-inch-high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.
      2) 1/16-inch-thick plastic, 1-1/2" round, with ¼ inch high black pipe service abbreviation above 1/2-inch-high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.
   b. Outdoor Service:
      1) 19-gauge brass, 1-1/2-inch round, with 1/4-inch-high black pipe service letter abbreviation above 1/2-inch-high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.
      2) 19-gauge Type 304 stainless steel, 1-1/2" round, with ¼ inch high pipe service abbreviation above 1/2-inch-high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 stainless wire meter seal or #6 Type 304 stainless steel bead chain with locking link. Based on Marking Services, Inc.
3. Valve chart frame: Self-closing, satin-finished, extruded aluminum with glass window, 8-1/2 inch by 11-inch chart size.
4. Equipment nameplates:
   a. Indoor: Shall be 1/16-inch-thick plastic with black satin surface and white core. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4-inch-high lettering for equipment and 3/4 inch by 2-1/2 inch, with 3/16-inch-high lettering for ceiling grid labeling. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre-drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.
   b. Outdoor: Shall be 125 Mil rigid plastic constructed of printed legend sealed between two layers of chemically resistant plastic to resist ultraviolet damage. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4-inch-high lettering for equipment. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre-drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.
   c. Based on Marking Services Inc. Model MS-215 Max-Tex.

C. Electrical Requirements: Product description not applicable to this Section.
D. Painting: Product specified in Division 9 - FINISHES.
E. Concrete Work: All work is provided under Division 3.
F. Fabricated Steel Supports:
   1. Steel angles, channels, and plate shall be in accordance with ASTM A36.
   2. Steel members, including fasteners, exposed to weather shall be galvanized.

G. Excavation, Trenching, and Backfilling: Product description not applicable.
H. Placing of Equipment: Product description not applicable.

PART 3 – EXECUTION

3.1 GENERAL

A. Installation of materials and equipment shall be in accord with the manufacturer's written instructions, except as specified.

3.2 INSTALLATION

A. Access Doors:
   1. Furnish access doors for installation under Division 9 - FINISHES.
   2. Deliver access doors to the appropriate trade well in advance of the time they are needed so as to avoid unnecessary delay of the work.
   3. Access doors shall be sized as indicated on drawings. If no size is given, provide access door of size suitable for servicing equipment or valve. Unless otherwise noted, the minimum size for an access door shall be 12" x 12".
   4. Access doors shall be provided where indicated and if not indicated, where required.
   5. Access doors shall be installed so as to allow full door swing.
   6. Where full swing and access is not possible, removable doors shall be provided.
   7. Access doors not required in lay-in tile ceilings.
B. Piping and Equipment Identification:
   1. Install pipe markers adjacent to each valve and fitting, at each branch connection, on each side of wall, floor, and ceiling penetrations, where entering and leaving underground areas, and at minimum 40 foot spacing on horizontal and vertical pipe runs. Markers shall be arranged for easy reading at eye level.
   2. Provide valve tags on all valves exposed or concealed unless otherwise noted.
   3. Attach valve tag to stem of each valve to be tagged. Valve numbers shall follow in sequence the Owner's existing valve numbers, where applicable.
   4. Provide a marker for each valve and equipment to be tagged, located above lift-out tile ceilings. The marker shall be 1/16-inch-thick plastic with a satin surface and white core. Color of the marker shall match color of piping identification system. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be ¾ inch by 2-1/2 inch, with 3/16-inch-high lettering for ceiling grid labeling. Plate manufacturer shall furnish suitable adhesive for permanently attaching plate to ceiling grid.
   5. Provide a minimum of 4 valve charts. Chart information shall indicate job name, Contractor name, date of installation, valve number, valve location, valve type, valve purpose, and system in which installed. Mount framed chart in equipment room and insert copy of chart in each operating and maintenance manual under separate tabbed section labeled "Valve Chart". Where project drawings include a piping flow schematic, request AutoCAD file from Engineer and label all of the valves according to the valve chart and frame in an 18” x 24” frame in main mechanical or pump room.

6. Provide air and water flow diagrams installed in waterproof, laminated frames on the wall in each Mechanical Room. Air flow diagrams shall show locations of dampers, sensors, and exhaust fans associated with the air handling unit. Water flow diagrams shall show shut-off valves and control valve locations.
7. Permanently affix nameplate to each item of equipment using stainless steel pop rivets. Where irregular surface impedes direct attachment of plates, affix plate to sheet metal bracket and attach bracket to equipment with screws, bolts, or suitable adhesive from nameplate manufacturer.
8. Refrigeration System - Additional Requirements:
   a. Marking and Signage:
      (1) Provide a permanent sign containing the following information:
         (a) Name and address of installer.
         (b) Kind of refrigerant.
         (c) Lbs. of refrigerant.
         (d) Field test pressure applied.
      (2) Provide a permanent sign: Main electrical supply, i.e., main compr. disc.
      (3) Provide metal tags with 0.5" letters:
         (a) Shut-off valves to each vessel, i.e., L.P. receiver shut-off.
         (b) Relief valve.
      (4) Piping shall be marked as either:
         (a) Refrigerant - High Pressure - Liquid or Hot Gas.
         (b) Refrigerant - Low Pressure - Suction, Pumped Liquid Supply or Pumped Liquid Return.

C. Electrical Requirements: Refer to Division 26 for electrical requirements.

D. Painting:
1. All equipment shall be furnished with a factory- applied galvanized, prime paint, or finish paint finish. Touch-up damaged surfaces of equipment immediately.
2. Paint for galvanized surfaces shall be in accordance with ASTM A780 using zinc rich compound.
3. Paint wooden mounting backboards with two coats of gray enamel prior to making attachments to the board.
4. For quality control refer to DIVISION 9 - FINISHES.
5. Remove all dirt, rust, scale, grease, pipe dope, solder flux, and welding slag from all surfaces to be painted.
6. Paint immediately, under this Division, all damaged galvanized surfaces. Paint galvanized metal surfaces behind grilles with two coats of flat black paint.
7. Apply rust inhibitive primer to ferrous surfaces of shop fabricated steel supports.
8. Paint immediately under this division all field and shop welded joints in piping or equipment supports with 2 coats of grey metal primer.
9. All exposed piping shall have a PVC jacket, per ANSI Standard with the following colors:

a.	Chilled water supply	Dark blue
b.	Chilled water returns	Light blue
c.	Condensate piping	Orange
d.	Hot water supply	Dark orange
e.	Hot water returns	Light orange
f.	Glycol water supply	Aluminum Jacket
g.	Glycol water return	Aluminum Jacket

E. Concrete Work:
   1. Concrete pads and curbs for supports of equipment shall be a minimum of 4" high with chamfered edges and sized for approved equipment. Furnish drawings to Division 3 Contractor.
   2. Surfaces of concrete shall be troweled smooth. When forms are removed, fill voids with cement and rub smooth with rubbing stone.
   3. Do not pour concrete when ambient temperature is less than 40°F and falling.

F. Fabricated Steel Supports:
   1. Because of the small scale of the drawings, details of equipment support are not always shown. It shall be the responsibility of the contractor to provide supports as required for safe and adequate support.
   2. Fabricated steel supports and ladders may be shop or field-fabricated and shall be in accord with details on drawings.
   3. When details are not indicated, the contractor shall submit proposed support detail for review. The contractor shall bear all cost in producing this detail in the bid. This includes but is not limited to structural engineering support.
   4. Steel members shall be saw cut, with corners ground smooth, and shall be assembled with welded or bolted connections at Contractor's option. Connections shall be in accord with specified AISC Publications.

G. Excavation, Trenching, and Backfilling:
   1. Definitions:
      a. Satisfactory material includes all materials except those classified "unsatisfactory", "unyielding" or "unstable".
      b. Unsatisfactory material includes those materials containing roots, organic matter, trash, debris, frozen materials, stones larger than 3 inches in any dimension, and materials classified by ASTM D 2487 as OL, OH, and PT.
      c. Unyielding material consists of rock and gravely soils with stones greater than 3 inches in any dimension, or as defined by the pipe or tank manufacturer, whichever is smaller.
      d. Unstable material consists of material too wet to properly support the pipe or tank.
      e. Select granular material consists of well-graded sand, gravel, crushed gravel, crushed stone, or crushed gravel, crushed stone, or crushed slag composed of hard, tough, and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve, and no less than 95 percent by weight passing the 1-inch sieve. The maximum allowable aggregate size shall be 3 inches, or the maximum size recommended by the pipe or tank manufacturer, whichever is smaller.
   2. Excavation, trenching, and backfilling for site utility piping systems as specified in DIVISION 31 - SITEWORK.

H. Placing of Equipment:
   1. Coordinate setting of equipment with the requirements of other trades so as to avoid conflicts and to insure compatibility. Equipment shall not block access for installation of other equipment.
   2. Set base mounted equipment on permanent and finished supports. Temporary support, if any, shall be removed prior to making final pipe, duct, or electrical connections to equipment.
   3. Adjust suspended equipment to final elevation prior to making pipe, duct or electrical connections.

4. Exercise caution during equipment placing operations to ensure that structure is not overloaded.
5. Do not move heavy equipment across floor or roof of insufficient load bearing capacity to support such equipment. Provide bracing or shoring as required or use crane to place equipment directly on permanent and finished support.
6. Secure all roof mounted equipment to the structure adequately to resist overturning, uplift and sliding forces for basic wind speeds indicated for this location in Figure 1609 of the Florida Building Code, Latest Edition.
7. Guards shall be provided where appliances, equipment, fans, or other components that require service are located within 10 feet of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches above the floor, roof, or grade below. The guard shall extend not less than 30 inches beyond each end of such appliance, equipment, fan or component and the top of the guard shall be located not less than 42 inches above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21-inch-diameter sphere and shall comply with the loading requirements for guards specified in the Florida Building Code.

END OF SECTION

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC SYSTEMS

PART 1 – GENERAL

1.1 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. Comply with Sections 01 33 00 – Submittal Procedures and 01 60 00 – Material Equipment and Approved Equals.

1.2 ARTICLES INCLUDED

A. Definitions.
B. Permits, Fees and Notices.
C. Applicable Publications.
D. Code Compliance.
E. Scope of Work.
F. Record Drawings.
G. Intent of Drawings and Specifications.
H. Quality Assurance
I. Submittals.
J. Product Requirements Equals and Substitutions.
K. Manufacturer’s Instructions.
L. Transportation and Handling.
M. Storage and Protection.
N. Cutting, Patching and Demolition.
O. Cleaning Up/Removal of Debris.
P. Operating and Maintenance Manuals.
Q. Training of Owners Operators.
R. Guarantee of Work.
S. System Testing.

1.3 ARTICLES

A. Definitions:
   1. The term "As indicated" means as shown on drawings by notes, graphics, or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "scheduled" and "specified" have same meaning as "indicated” and are used to assist the reader in locating particular information.
   2. The term "Provide", means furnish and install as part of the work covered in Division 23.
   3. The term "Furnish" means furnish only, for installation, as part of this contract, by other Divisions.
   4. The term "Install only" means to install under the work of Division 23 equipment furnished by other Divisions, or by the Owner.
   5. The term "Owner's Representative" when referenced herein shall be the Architect or the Engineer acting as his designated representative unless otherwise noted.

6. The term "design" as it pertains to the work of this division shall describe the basic intent, component sizing, component relationships and overall architecture of the Plumbing system. The design is generally schematic in nature and will require specific detailing after the accepted products are determined.
7. The term "detail" as it pertains to the work of this division shall describe the work required by the contractor to assure a fully coordinated installation of the material and equipment supplied. When requested, the contractor shall produce detailed shop drawings or sketches indicating the actual placement of the equipment or material supplied; also including how the equipment or material interfaces with work of other sections or divisions within the contract documents.
8. The term "workman-like manner" as it pertains to the work of this division shall describe a neat well-organized high-quality installation system (piping, etc.). Routing shall be well thought out providing adequate service clearance and maximum use of space. Equipment placement shall exhibit proper clearances for service. All lines (piping, etc.) shall be run straight and true, parallel, or perpendicular to building structure neatly supported.
9. For additional definitions refer to the General Conditions.

B. Permits, Fees and Notices: Comply with the General Conditions.
C. Applicable Publications:
   1. Publications listed in each Section form a part of that Section to the extent referenced.
   2. When a standard is specified by reference, comply with requirements of that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.
   3. The Publication or Standard is the publication in effect as of the bid date, except when a specific date is listed.
D. Code Compliance:
   1. Life Safety Code - NFPA 101
   2. Florida Building Code 2020
   3. Florida Accessibility Code, 2020
   4. National Electric Code 2017
   5. Florida Mechanical Code 2020
   6. State Requirements for Educational Facilities (SREF), 2014
   7. NFPA Standards, Latest Edition.
E. Scope of Work: The work to be performed under this Division consists of the satisfactory completion of all HVAC as indicated in the Contract Documents.
F. Record Drawings: Comply with the General Conditions.
G. Intent of Drawings and Specifications:
   1. The intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment, and workmanship, and to provide operable plumbing systems complete in every respect.
   2. Existing conditions, dimensions, etcetera, depicted on the drawings are taken from the "as-built" drawings of the original construction supplemented by field observation. The contractor is cautioned to field verify all existing conditions, dimensions, etcetera, notifying the Owner's Representative of any discrepancies other than those minor in nature, for direction, prior to ordering or fabricating equipment or materials. Anything mentioned in the specifications and not shown on the drawings or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawing and specifications, the more stringent shall govern, unless the discrepancy conflicts with applicable codes, wherein the code shall govern.

3. The drawings are diagrammatic, intending to show general arrangement, capacity and location of system components, and are not intended to be rigid in detail. Final placement of equipment, other system components, and coordination of all related trades shall be the contractor's responsibility.
4. Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets and fittings may not be shown but shall be provided at no additional change in contract cost.
5. In the event of a conflict, the Owner's Representative will render an interpretation in accordance with the General Conditions.

H. Quality Assurance:
1. All equipment furnished under this Division shall be listed and labeled by U.L., ETL or a nationally recognized testing laboratory (NRTL).
2. Material furnished under this Division shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such material and shall be the latest design.
3. Materials shall be the best of their respective kinds. Materials shall be new except where the specifications permit reuse of certain existing materials.
4. Work provided for in these specifications shall be constructed and finished in every part in a workmanlike manner.
5. All items necessary for the completion of the work and the successful operation of a product shall be provided even though not fully specified or indicated on the drawings.
6. All work to be performed by qualified and experienced personnel specifically trained in their respective field.
7. All work of this division shall be carefully interfaced with the work of other divisions to assure a complete, functioning system or systems.

I. Submittals:
1. In addition to all other submittal requirements elsewhere in the contract documents, the contractor shall comply with the following.
2. Submittal for acceptance is required only on those items specifically requested in the specification section that applies.
3. For products and equipment that do not require a submittal for acceptance, submit a separate letter for each specification section certifying that all products and equipment will be provided in compliance with the contract documents.
4. Provide submittal data in accordance with the General Conditions and/or as listed below.
5. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that the submittals will be needed in order to meet construction schedule. This schedule shall be submitted prior to or in conjunction with the first submittal. Processing of submittals may be delayed pending the receipt of this schedule at the reviewer’s discretion.
6. Submittal data shall be presented in a clear and thorough manner and referenced to the specification section.
    a. Where applicable, data shall be identified by reference to sheet and detail, schedule or room numbers, equipment or unit number as shown on Contract Drawings.
7. Prepare performance and product data as follows:
    a. Clearly mark each copy to identify pertinent products or models, delete non-pertinent data.
    b. Show performance characteristic and capacities.

c. Show dimensions and clearances required.
d. Show wiring or piping diagrams and controls.
e. Clearly list any deviation in the submittals from the requirements of the contract documents.
f. Include installation requirements.

8. Manufacturer's standard schematic drawings and diagrams:
   a. Modify drawings and diagrams to delete information not applicable to the work of this project.
   b. Supplement standard information to provide information specifically applicable to the work of this project.
9. Prohibition of Asbestos and PCB:
   a. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound of material containing or incorporating asbestos or PCB, is prohibited. The requirements of this specification for complete and operating mechanical systems shall be met without the use of asbestos or PCB.
   b. Prior to the Final Review field visit the Contractor shall certify in writing that the equipment and materials installed in this Project under this Division 22 contain no asbestos or PCB. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB. This statement shall be signed by a duly authorized agent of the manufacturer.
10. Letter of Certification: Where a submittal is not required, provide letter certifying that the work will be completed in strict accordance with the specified requirements. In the event the contractor wishes to alter the requirements of the specification for whatever reason, this should be clearly explained in this letter noting that this alteration may require additional submittal requirements.
11. Schedules: Where schedules are called for, submit schedule indicating which products will be used and to what extent by system, location, size, etc.
12. Where samples are requested, samples shall be of sufficient size and quantity to clearly illustrate:
    a. Functional characteristics of the product, with integral related parts and attachment devices.
    b. Full range of color, texture, and pattern.
    c. Where a mock-up is specified, erect at the Project site, in a location acceptable to the Owner's Representative. Size or area shall be that specified or as agreed upon during pre-construction or other job site meetings.
    d. Where mock-up is not a permanent part of the installation, remove mock-ups at conclusion of work or when acceptable to the Owner's Representative.
13. The Contractor shall:
    a. Review Shop Drawings, Product Data and Samples prior to submission.
    b. Determine and verify:
       1) Field measurements.
       2) Field construction criteria.
       3) Catalog numbers and similar data.
       4) Conformance with specifications.

5) All submittals have been properly interfaced with the requirements of this and other divisions of work so as to assure a complete, functioning system in accordance with the contract documents.
Provide ¼" drawings of ALL mechanical rooms, with dimensions clearly indicating equipment maintenance clearances and electrical NEC required clearances. NO mechanical room walls shall be built until the engineer and the owner have approved the shop drawings for the mechanical equipment and clearances.

c. Coordinate each submittal with requirements of the work and of the Contract Documents. Clearly identify any deviations in the submittals from requirements of the Contract Documents. Any deviations not specifically disclosed in the submittal shall be solely at the risk of the Contractor and shall be subject to discovery at any time. Any undisclosed deviations shall be corrected by the Contractor to comply with the requirements of the Contract Documents at no cost to the Owner regardless of the action code accorded the submittal by the Owner's Representative.

d. Do not release equipment for shipment, begin fabrication or work on any items requiring submittals for acceptance until all submittals are returned with the Owner's Representative acceptance.

e. Make submittals promptly, and in such sequence as to cause no delay in the work or in the work of any other contractor.

14. Number of Submittals: Comply with the Division 1, Specification Section 01 33 00 – Submittal Procedures.

15. Submittals shall contain:
    a. The date of submission and the dates of any previous submissions.
    b. The Project title and number.
    c. Contract identification.
    d. The names and phone numbers including personal contact of:
        1) Contractor.
        2) Supplier.
        3) Manufacturer.
    e. Identification of the product, with the specification section number and contract document description clearly indicated.
    f. Field dimensions clearly identified as such.
    g. Relation to adjacent or critical features of the work or materials.
    h. Applicable standards.
    i. Identification of deviations from Contract Documents.
    j. Identification of revisions on re-submittals.
    k. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
    l. Each submittal shall be limited to a single specification section. Submittals shall not be grouped with other sections in common binders or under common control sheets except as defined in paragraph m. below. Each submittal shall have a cover/control sheet containing the information listed above (a thru k) and have a minimum of 8" x 3" clear space for the general contractors, engineers, and architects review stamp.

m. The first group of submittals shall be sent in a minimum of one (or if required) two hard cover view type 3-ring binder(s) White, sized to hold 8-1/2" x 11" sheets:
   1) Binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3" (provide additional binders if 3" size is not sufficient to properly hold submittals).
   2) Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket. Description sheets are to be white with black letters, minimum of 11" high and full width of pocket. Description is to describe project and match project drawing/project manual description.

n. Submittals not complying with these requirements may be returned with no action taken at the reviewer's discretion.

16. Re-submittals shall contain:
   a. The date of re-submission and the dates of all previous submissions.
   b. A copy of the Engineer's comments from the previous submittal.
   c. An itemized response to each of the Engineer's comments specifically outlining the changes or corrections being made. As an example, this could be either noting the page(s) of the previous submission that are affected and what changes have been made or noting specific additional information being provided.
   d. Submittals not complying with these requirements may be returned with no action taken at the reviewer's discretion.
   e. Turnaround time and copies as indicated in Section 01 33 00 – Submittal Procedures.
17. The Owner's Representative will (if they so desire):
   a. Review submittals promptly and where special attention is requested, review in accordance with the schedule required.
   b. Review the submittal for general compliance with the contract documents. The contractor is responsible for quantities, dimensions, placement of the product, coordination with all other trades occupying the space, maintain service clearance, function, and compliance with the written installation instructions.
   c. Determine the appropriate action for the submittal. Action codes will be as follows:
      - "NO EXCEPTIONS TAKEN" - Copies will be distributed as indicated under above schedule.
      - "NOTE MARKINGS/CONFIRM" - Final but Restricted Release; General Contractor may proceed with fabrication, taking into account the necessary corrections on submittal and with Contract Documents. General Contractor must submit a confirmation letter to remove restriction and allow shop drawings on the project site. A sample of a confirmation letter is enclosed herein.
      - "NOTE MARKINGS/RESUBMIT" - General Contractor may proceed with fabrication, taking into account the necessary corrections. Corrected shop drawings shall be resubmitted before fabrication of this work is complete to obtain a different action marking. Do not allow drawings marked "Resubmit" to be used in connection with installation of the Work.

- "REJECTED/RESUBMIT" - General Contractor will be required to resubmit shop drawings in their entirety. No fabrication or installation shall be started until shop drawings so marked have been completely revised, resubmitted, and marked by Architect according to preceding Paragraphs a. or b.

d. Turnaround time will be per Division 1.
e. Review comments will be per Division 1.

18. Resubmission requirements for "as specified" products.
    a. Make any corrections or changes in the submittals required by the Owner's Representative and resubmit until accepted.
    b. A submittal shall only be reviewed a maximum of 3 times. If upon the second resubmission an accepted action cannot be rendered (No Exceptions Noted or Make Corrections as Noted), the contractor shall supply the basis of design product and bear all costs incurred by the Owner's Representative during the review process until an accepted submittal is achieved.
19. The Contractor shall maintain one copy of all accepted submittal data including letters of compliance in a job site file.

J. Product Requirements, Equals and Substitutions: *Comply with the General Conditions, but the following are in addition to:*
    1. In addition to all other requirements for submittals, equals and substitutions elsewhere in the contract documents, the contractor shall comply with the following:
    2. Product Requirements:
        a. The specifications sections under Article 2.1 "ACCEPTABLE MANUFACTURER", lists suppliers found acceptable for this project. The names listed are manufacturers who meet the minimum acceptable standards that this project dictates. The list is furnished as a guide. Even though a manufacturer is named, he must still provide the type and quality of equipment specified as well as equipment that will fit within the allotted space and within the design weight allowance, etc. Being named does not imply permission for that manufacturer to provide an alternative product or design. Other manufacturers not named will be considered to be equal providing they furnish a product of the type and quality specified.
        b. In certain cases, foundations and/or structural supports or electrical requirements for equipment specified in this Division are provided under other divisions of the specifications. Where an alternate acceptable manufacturer's product is provided, this contractor shall coordinate the revised requirements and include an allowance for any cost differential.
        c. If the list, under Article 2.1 "ACCEPTABLE MANUFACTURERS" names only one manufacturer followed by "No Substitutions" that product shall be supplied.
    3. Substitutions: *Comply with the General Conditions, but the following are in addition to:*
        a. A substitution is defined as any product not meeting the requirements as outlined in PART 2 - PRODUCTS. A different design accomplishing the same result will be considered a substitution. The same design requiring a larger motor, or more space or a structural change to accommodate larger weight, etc., will be considered a substitution. If a manufacturer who is not listed as an "ACCEPTABLE MANUFACTURER" wants to have his product considered as an equal or as a substitution, he shall submit details to the Engineer 10 days in advance of bid date and a decision will be rendered. If necessary, a clarification will be issued in the form of an Addendum. No substitution requests shall be considered after the Bid.

b. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including.
   1) Comparison of the qualities of the proposed substitution with that specified in tabulated format.
   2) Changes required in other elements of the work because of the substitution.
   3) Effect on the construction schedule.
   4) Cost, extra credit or statement of no change in contract price.
   5) Any required license fees or royalties.
   6) Availability of maintenance service, and source of replacement materials.

c. The Engineer shall be the judge of the acceptability of the proposed substitution.

d. A request for a substitution constitutes that the Contractor:
   1) Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
   2) Will provide the same warranties for the substitution as for the product specified.
   3) Will coordinate the installation of the substitution into the work and make such other changes as may be required to make the work complete in all respects.
   4) Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
   5) Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.
   6) Will absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or mis-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.

4. Engineer will review requests for substitutions with reasonable promptness, and will issue an addendum or notify Contractor, in writing, of the decision to accept or reject the requested substitution.
5. Substitutions <u>will not</u> be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or if acceptance requires revision to the contract documents.
6. The engineer will review substitution submittals for compliance a maximum of two times. If the submittal or substituted product does not comply with the contract documents on the second submittal, the submittal and product will be rejected and the specified product will be required.
7. The contractor may request further review of the substitution after the second submittal rejection if the contractor agrees in writing to accept responsibility for the cost of additional review time and expenses by the Engineer.
8. In the event a substitution is rejected, supply the products which constituted the basis of design at no change in the contract price.
9. Installation of substitutions without the Owners approval shall be cause of immediate rejection and removal without extra cost to the Owner.

K. Manufacturer's Instructions:
   1. Installation of work shall comply with manufacturer's printed instructions.
   2. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for clarification. Do not proceed with work without clear instructions.

L. Transportation and Handling: Comply with General Conditions.

M. Storage and Protection:
   1. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.
   2. Store products to prevent damage by the elements. Space temperature shall be controlled as required to prevent condensation and metal corrosion or damage to electrical or electronic parts are the result of condensation.
   3. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.
   4. Provide protection as necessary to prevent damage after installation.
   5. Products which suffer damage due to improper storage shall not be installed and if found in place, shall be removed and replaced at the contractor’s expense.

N. Cutting and Patching: Comply with the General Conditions.

O. Cleaning Up/Removal of Debris:
   1. Comply with the General Conditions.
   2. Maintain a clean work area. Construction debris shall be immediately removed from all newly erected work.

P. Operating and Maintenance Manuals: *Comply with the General Conditions, but the following are in addition to:*
   1. Quantity: Comply with the General Conditions.
   2. Format: Adequately sized for contents, minimum 1" and maximum 3" spline size, hard cover, view type, 8-1/2" x 11 loose leaf binders. Binder covers to have outer clear vinyl pocket on front cover and spline. Provide correct project designation and contents description in each pocket. Use as many as required. Do not overload binders.
   3. Content:
      a. Cover sheet.
      b. Table of contents (as follows):
         1) Description of systems.
         2) Design parameters.
      c. Point by Point System Check-out: Provide tabulated results indicating compliance with contract document requirements.
   4. Detailed Preparation Requirements:
      a. The cover sheet shall list project name, location, architect, structure engineer, mechanical engineer and electrical engineering firm name with address, telephone number and project manager’s name for this project.
      b. Each major heading in the table of contents shall have a large distinctive, clearly marked, non-erasable, plastic encased tab.
      c. The description of systems will be provided by the design engineer for insertion at the time of review and turn-over to owner. This description of systems will be an updated version of the narrative included in this Section and will be an overview of the entire system. It will be the basis for the starting of the owner’s instruction program.

d. Each section shall have the following sub-tabs. Sub-tabs shall be similar to the main tabs but of a different color.
   1) Specifications: The specification shall be copied and inserted complete with all addenda.
   2) Submittal: This section shall include all accepted submittal data. If submittal was not required, include technical data as specified.
   3) Installation Instructions: If the product, such as pipe, etc., does not have any written installation instructions, include a statement "Manufacturer's Written Installation Instructions Not Available - Product Installed in Accordance with Specifications and Good Practice".
   4) Operation and Maintenance Instructions: These shall be the written manufacturer's data edited to omit reference to products or data not applicable to this installation.
   5) Parts List: These shall be edited to omit reference to items not applying to this installation.
   6) Equipment Supplier: This section shall include the name, address and telephone number of the manufacturer's agent and/or service agency supplying or installing and starting up of the equipment.
   7) System Description: This section shall include that portion of the overall description included in the beginning of the manual as it applies to each sub-section. In sections such as pipe, valves and fittings, a statement shall be included "Not Applicable to this Section." Data for this section will be added by the design engineer when the manuals are submitted for review and forwarded to the owner.

Q. Training of Owners Operators: (Refer to Appendix A)
   1. The manufacturer shall provide a comprehensive training outline for the Owner & Engineer to review within 90 days of final completion.
   2. The manufacturer & contractor shall provide 24 hours of training on the plumbing system, plumbing fixtures, and all water heating systems.
   3. The owners shall be given comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of equipment.
   4. The contractor shall be responsible for scheduling the training which shall start with classroom sessions followed by hands on training on each piece of equipment. Hands on training shall include start-up, operation in all modes possible, shutdown and any emergency procedures. The manufacturer's representative shall provide the instructions on each major piece of equipment. These sessions shall use the printed installation, operation and maintenance instruction material included in the O&M manuals and shall emphasize safe and proper operating requirements and preventative maintenance.

R. Guarantee of Work:
   1. Comply with the General Conditions.
   2. Where applicable, furnish manufacturer's written warranty for materials and equipment.
   3. Insert warranties in appropriate locations in operating and maintenance manuals.
   4. Materials and equipment having seasonal operation limitations shall be guaranteed for a minimum of one year from date of seasonally appropriate test, and acceptance in writing by the Owner, unless specific Division 23 specifications specify a longer period.

S. System Testing:
   1. Provide all necessary labor, materials, and equipment to successfully complete all system testing necessary for building occupancy and owner acceptance.
   2. Provide all necessary labor, materials, and equipment to assist contractors of other division to complete system testing necessary for building occupancy and owner acceptance, wherever an inter-relationship between Division 23 and the work of other divisions exists.
   3. Tests shall be repeated as necessary until all occupancy and operation permits are granted and the owner accepts the project.
   4. Testing schedule requirements per the Table below:

Training Schedule

Div.	Training Description	Sub-contractor	Demo. Date	Time	Hours	Comments	Personnel to attend training
	Energy Management System				40 hours	On the job owner training conducted by a technician fully qualified to conduct such training.	
	HVAC Systems				80 hours	Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. See specifications for complete list of training requirements.	
	Chillers/ Packaged Pumping Equipment				2-8 hour	Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. See specifications for complete list of training requirements.	

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 23 05 13
MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Starters for all motors furnished under this Division, except where starters are provided in a motor control center by Electrical Specifications or where motors require adjustable frequency drives.
B. Motors for equipment furnished under this Section.

1.3 SUBMITTALS

A. Motor Starters:
   1. Submission for acceptance is required. Provide a schedule indicating duty, motor HP, starter size and heater size.
   2. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
B. Motors:
   1. Submission for acceptance is required. All three phase motors are based on NEMA Premium™ efficiency motors as described below by the minimum allowable efficiency. As a result, all motor starting codes are based on Code letter F or greater as defined by NEC Article 430. In the event that a manufacturer provides a motor with a code letter less than F, the overcurrent protection of the motor shall be coordinated with the Electrical Contractor to comply with NEC Article 430.
   2. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

1.4 APPLICABLE PUBLICATIONS

A. NEMA Publication ICS.
B. NEMA Publications MG-1, MG-2, MG-13.

1.5 QUALITY ASSURANCE

A. All starters to be standard product of single manufacturer.
B. Motor efficiencies in accordance with IEE Standard 112 Method B as defined by NEMA MG1-1.23, a. and b.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Starters:
   1. Allen Bradley
   2. Cutler Hammer
   3. General Electric
   4. Siemens
   5. Square D
   6. Engineer-approved Equal
B. Motors:
   1. A.O. Smith/Century E-Plus
   2. Baldor Electric Company, Premium Efficiency.
   3. Emerson Electric Company, U.S. Electrical Motors Div., Premium Efficiency Type 'DE' & 'RE'.
   4. The Louis Allis Company, High Efficiency.
   5. General Electric Company, Premium Efficiency Energy Saver®
   6. Reliance Electric Manufacturing Company, XE™ Premium Efficiency Motors.
   7. Engineer-approved Equal

2.2 FABRICATION – MOTOR STARTERS

A. Starters - Full Voltage, Single Speed, Magnetic:
   1. Full voltage, non-reversing magnetic as scheduled.
   2. 3 phase, 60 Hz, voltage as scheduled.
   3. Electronic overload relay protection in all phases.
   4. Manual reset in cover.
   5. Under voltage release.
   6. Hand-off-automatic selector switch.
   7. Red and green panel lights that are multi-LED style. Full voltage lamps are not acceptable.
   8. Size to suit motor being controlled.
   9. Control transformer for 120-volt control, fused and grounded in accordance with NEC.
   10. Non-fused disconnect switch.
   11. Starters located indoors to have NEMA 1 General Purpose Enclosure. Starters located outdoors or in unheated spaces to have NEMA 3R watertight and dust tight enclosure.
   12. Solderless lugs.
   13. Two N.O. auxiliary contacts.
   14. Starter for all motors shall include three-phase power monitor as manufactured by Time Mark Corporation Model 258 or equal, providing solid state protection by opening starter for loss of any phase, low voltage of any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage. Monitor shall be UL recognized.
B. Starters - Reduced Voltage - Part Winding:
   1. Reduced voltage, part winding, magnetic for 50-50 winding split.
   2. 3 phase, 60 Hz, voltage as scheduled.
   3. Electronic overload relay protection in all six leads.
   4. Manual reset in cover.

5. Under voltage release.
6. Hand-off-automatic selector switch.
7. Red and green panel lights that are multi-LED style. Full voltage lamps are not acceptable.
8. Minimum size NEMA 1.
9. Control transformer for 120-volt control, fused and grounded in accordance with NEC.
10. Non-fused disconnect switch.
11. Starters located indoors to have NEMA 1 General Purpose Enclosure. Starters located outdoors or in unheated spaces to have NEMA 3R watertight and dust tight enclosure.
12. Solderless lugs.
13. Two N.O. auxiliary contacts.
14. Set electronic overload relays for 50% of rated full load current.
15. Starter for all motors shall include three-phase power monitor as manufactured by Time Mark Corporation Model 258 or equal, providing solid state protection by opening starter for loss of any phase, low voltage of any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage. Monitor shall be UL recognized.

C. Starters - Two Speed - One Winding:
1. Full voltage, non-reversing, magnetic.
2. 3 phase, 60 Hz, voltage as scheduled.
3. Variable torque.
4. Electronic overload relay protection for each phase and for each speed.
5. Manual reset in cover.
6. Under voltage release.
7. Fast-slow-off-auto selector switch.
8. Adjustable time deceleration for transition from high to low speed.
9. Pilot lights that are multi-LED style. Full voltage lamps are not acceptable.
10. Control transformer for 120 V control, fused and grounded in accordance with NEC.
11. Non fused disconnect switch.
12. Starters located indoors to have NEMA 1 General Purpose Enclosure. Starters located outdoors or in unheated spaces to have NEMA 3R watertight and dust tight enclosure, except that starters located in cooling tower enclosures shall be NEMA 3R.
13. Solderless lugs.
14. Two N.O. auxiliary controls per speed.
15. Starter for all motors shall include three-phase power monitor as manufactured by Time Mark Corporation Model 258 or equal, providing solid state protection by opening starter for loss of any phase, low voltage of any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage. Monitor shall be UL recognized

D. Manual Starters:
1. Bi-metal type thermal overload protection in all phases of type to cause switch handle to assume mid position on overload.
2. Quick break operating mechanism and silver contacts.
3. Pressure type terminals.
4. Mechanism trip free so contacts cannot be reclosed until bimetallic strip cools.
5. Starters located indoors to have NEMA 1 General Purpose Enclosure. Starters located outdoors or in unheated spaces to have NEMA 3R watertight and dust tight enclosure.

6. Manual starters for three phase motors shall utilize a full voltage single speed, magnetic starter as specified in paragraph 2.2-A. A toggle switch shall be provided to facilitate the manual control specified of the magnetic starter.

2.3 FABRICATION – MOTORS

A. 3/4 HP and Larger Horsepower Motors:
1. NEMA Premium™ efficiency type having the following minimum efficiencies:

Minimum Nominal Full-Load Motor Efficiency (%)						
	Open Motors			Totally Enclosed		
Number of Poles	Pole	Pole	Pole	Pole	Pole	6-Pole
Speed (RPM)	3600 RPM	1800 RPM	1200 RPM	3600 RPM	1800 RPM	1200 RPM
HP						
0.75	---	85.5	---	---	85.5	---
1	82.5	85.5	82.5	77.0	85.5	82.5
1.5	84	86.5	86.5	84.0	86.5	87.5
2	85.5	86.5	87.5	85.5	86.5	88.5
3	85.5	89.5	88.5	86.5	89.5	89.5
5	86.5	89.5	89.5	88.5	89.5	89.5
7.5	88.5	91	90.2	89.5	91.7	91.0
10	89.5	91.7	91.7	90.2	91.7	91.0
15	90.2	93	91.7	91.0	92.4	91.7
20	91	93	92.4	91.0	93.0	91.7
25	91.7	93.6	93	91.7	93.6	93.0
30	91.7	94.1	93.6	91.7	93.6	93.0
40	92.4	94.1	94.1	92.4	94.1	94.1
50	93	94.7	94.1	93.0	94.5	94.1

2. Drip proof, except motors located outdoors to be TEFC or as otherwise specified.
3. Continuous duty, 40°C ambient.
4. Regreasable ball bearing design.
5. Speed/Torque curves shall be NEMA Design B so that overload protection provided by standard motor starters will be adequate to prevent over-heating during stall or slightly prolonged motor acceleration.
6. Class B insulation, except motors for variable speed drive application to be specially built for Adjustable Frequency Drive (AFD) duty and include Class F insulation and be suitable for operation down to 10% on fan and pump applications.
7. Assembly to meet application.
8. 1.15 service factor.
9. Suitable for starter type as scheduled on drawings or in Specification Section 15056 – Motor Starters.
10. Slide bases as required.
11. 60 Hz. terminal box large enough to accommodate the required conduit and wiring.
12. 200-, 208-, 230- or 460-volt, 3 phases as scheduled.

B. Fractional Horsepower Motors:
   1. Permanent split capacitor.
   2. 115-volt, 1 phase, 60 Hz.
   3. Thermally protected.
   4. Other features of motors supplied as an integral part of a factory assembly shall be acceptable as the manufacturer's standard based on acceptance of the assembly as a whole.

PART 3 – EXECUTION

3.1 GENERAL

A. Furnish starters for all motors furnished under Division 23 except where starters are provided in motor control center by Division 26.
B. Receive, unload, and deliver starters to electrical contractor on job-site for storage, uncrating and installation by Division 26.
C. Furnish all necessary wiring diagrams to Division 26 for installation and power wiring.
D. Starter Schedule:
   1. All motors up to and including 40 HP at 460 V or 20 HP at 200V shall be provided with full voltage starters.
   2. Motors over 40 HP at 460V or 20 HP at 200V shall be provided with reduced voltage starters, either part-winding or auto-transformer.
   3. Single phase motors requiring automatic start/stop to be provided with manual starter and controlled by pilot relay.
   4. Cooling tower motors, where specified to be two speed shall be two-speed: one winding type.
   5. Pump and fan motors listed as adjustable or variable speed to be controlled by adjustable frequency drive units specified in Section 23 05 17.
E. Starters to be mounted where indicated on the drawings or within sight of the motor controlled.
F. Starters may be mounted directly to masonry, CMU or concrete walls using appropriate fastening methods. When the wall is an exterior wall or any wall where condensation may occur, provide appropriate stand-off, i.e., Unistrut channel).
G. Starters may be mounted directly to equipment such as factory or field-built AHU. In this case, through bolts and backing plates along with an appropriate stand-off shall be used. Seal all holes. Self-tapping screws with exposed ends will not be acceptable.
H. When starters are required to be located in areas where walls are not available, provide a Unistrut type frame securely mounted to floor adequately braced to form a rigid mounting surface.
I. Starters shall be generally mounted with the center of the unit at 60" above the finished floor. Service clearance shall be provided in accordance with the National Electric Code and under no circumstances less than the following:

Voltage to Ground	Minimum Clearance Distance
110V or 120V	3'-0"
208V, 220V, 240V or 277V	3'-6"
460V or 480V	4'-0"
Greater than 480V	5'-0"

J. Starters shall be accessible.
K. Provide housekeeping pad for all floor mounted starters.

3.2 MOTORS – INSTALLATION

A. Motors:
   1. Install in accordance with requirements of the duty.
   2. Lugs to be provided under this Division.
   3. All motors shall have overload protection as required by NEC. Any motor without integral protection shall have a starter that provides overload protection furnished by Division 23.

END OF SECTION

SECTION 23 05 17
ADJUSTABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Adjustable frequency drive units (AFD) for all motors identified as operating at variable speed.

1.3 QUALITY ASSURANCE

A. All adjustable frequency drives and bypass assemblies and control panel enclosures must be the product of a single manufacturer.
B. AFD shall be UL or ETL listed. Components used in all options shall be UL listed. The entire AFD and bypass assembly shall be U.L. marked with a short circuit current rating of at least 100,000 amperes. The VFD short circuit rating shall be posted in the operating instructions or on the product label. This shall be in compliance with the UL listing and rating requirement.
C. The AFD shall be designed to meet the power line transient conditions defined within ANSI/IEEE C62.41-1991 and shall have a voltage withstand rating of 6 KV in accordance with UL 1449.
D. AFD shall be in certified for with FCC emission limits for Class A computing devices. If required to meet these limits, isolation transformers, and/or line filters shall be provided.
E. Ambient noise generated by the AFD shall be limited to an amount equal to 3 dbA greater than the fan or pump system noise level at design rpm. If acoustic enclosures are required to meet these limitations provide same with the AFD.
F. AFD manufacturer shall submit an analysis to certify that the drive, when installed in the electrical distribution system shown on the Contract Documents is in compliance with the requirements of IEEE 519 - 1992. The Point of Common Coupling (PCC) shall be defined as the secondary lugs of the Utility Company Transformer. The transformer impedance shall be 5.75% with the appropriate short circuit current based on this value.
G. AFD and option design and construction thereof shall comply with all applicable provisions of the latest National Electrical Code.
H. Power components shall undergo burn in to ensure product function. Circuit boards shall be tested under thermal cycling and the complete unit shall be tested under full load conditions to ensure maximum product reliability.
I. A Factory Authorized Service Engineer is to be provided for start up which shall include verification of proper installation and wiring. Inspect all components, circuit boards and control wiring. Ensure proper power source and control signal. Apply power and provide full operational testing and calibration. Also provide a minimum of 16 hours training for Owner’s operators.

J. Provide full (5) five-year on-site parts and labor warranty including travel time and expense. Warranty period shall begin at date of final completion.
K. AFD's shall be fully protected during the duration of construction of the project. Units shall be covered to protect from all dirt, dust, and debris. Contractor will be responsible for replacing any unit that has dirt, dust, or debris infiltration into the unit.
L. The supplier shall offer a service support group which shall be able to provide the following additional services; not included in this contract:
   1. Emergency service calls.
   2. Overnight service parts.
   3. Service contracts.
   4. In-plant training of client personnel in basic troubleshooting.
   5. Coordinate enrollment of client personnel in factory-held service schools.

1.4 SUBMITTALS

A. Submission for acceptance is required. Submittal shall show compliance with all paragraphs and statements listed in part 2 below.
B. A complete harmonic analysis showing compliance with IEEE 519 - 1992 shall be provided with the submittal as defined in paragraph 1.3 above.
C. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
D. Submit in accordance with Division 1 requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Adjustable Frequency Drive Units:
   1. ASEA Brown Bovari (ABB)
   2. Century (MagnaTek)
   3. Cutler Hammer
   4. Danfoss/Graham
   5. Square D
   6. Toshiba
   7. Trane
   8. Engineer-approved Equal

2.2 EQUIPMENT REQUIREMENTS

A. Adjustable Frequency Drive:
   1. The adjustable frequency drive shall convert either 208/230 or 460 volt ±10%, three phase, 60 HZ (± 2 HZ) utility power to adjustable voltage/frequency, three phase, AC power for stepless motor control from 5% to 105% of base speed.
   2. The adjustable frequency drive (AFD) shall produce an adjustable AC voltage/frequency output for complete motor speed control using transistorized sine coded PWM technology, and an input power factor near unity over the entire speed range. The AFD shall not produce excessive or objectionable motor acoustical noise. The AFD shall not induce voltage line notching back to the utility line and total harmonic distortion (THD) shall not exceed the limits set in IEEE Std. 519 -1992 when installed in the electrical distribution system shown on the Contract Documents. The AFD shall be automatically controlled by a grounded electronic control signal.

3. The AFD shall be self contained, totally enclosed in a NEMA 1 ventilated cabinet and capable of operation between 0° and 40°C except where located outdoors enclosure to be NEMA 3R or 4X watertight and dust-tight enclosure, depending on the manufacturers offering. The entire AFD assembly shall be mounted in a common enclosure requiring only a power in and a power out connection.
4. The AFD maximum output current rating shall be as follows:

Horsepower (HP)	FLA @ 208 V	FLA @ 460 V
5	16.7	7.6
7-1/2	24.2	11.0
10	28.0	14.0
15	46.2	21.0
20	59.4	27.0
25	----	34.0
30	----	40.0
40	----	52.0
50	----	65.0
60	----	77.0
75	----	99.0
100	----	124.0

5. AFD shall be a minimum of 97% efficient at 100% rated output power, 60 HZ.
6. The AFD shall have the following basic features:
   a. Operator control interface.
      1) Hand/Off/Auto operator switch.
      2) Panel mounted digital display capable of indicating unit status, frequency, and fault diagnostics, including overcurrent, overvoltage, overheating, ground fault or short circuit.
   b. Electronic control follower board, 0-5 VDC, 0-10 VDC or 4-20 mA or 0-135 ohms (coordinate requirement with controls contractor).
   c. Minimum/maximum adjustable speeds (Minimum speed factory set at 12 HZ, maximum speed factory set at 60 HZ, may vary based on application).
   d. Manual speed potentiometer control for use when AFD is in manual control mode.
   e. Adjustable linear timed acceleration and deceleration for soft starting/stopping (adjustable from 1-300 sec) recommended range 20-60 seconds depending on inertial load. Factory set at 60 seconds.
   f. 3-80 HZ controlled speed range (factory set at maximum frequency of 60 HZ).
   g. Output terminals for remote frequency meter and ammeter.
   h. RFI/EMI filter.
   i. Manual bypass circuit with three contactors to provide full speed starter operation for motors 100 HP and less and an electronic, solid state, full-wave, soft-start controller for all motors 125 HP and larger for operation in the event of AFD electronics failure complete with disconnect and overload protection in all three phases. Provide a three-phase power monitor as manufactured by Time Mark Corporation Model 258 or equal, providing solid state protection by opening starter for loss of any phase, low voltage or any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage. Monitor shall be UL recognized.

j. Line circuit breaker disconnect (door-interlocked) with current limiting fuses on the line side of the circuit breaker having a minimum AIC rating of 200,000 Amps. The disconnect switch shall have a minimum short circuit rating of 100,000 amps.
k. Provide line impedance reactors to the power line to reduce the total harmonic distortion (THD) level to that allowed by IEEE 519-1992. If the harmonic distortion level required by IEEE 519-1992 can be met without these devices, they may be omitted.
l. Isolation transformer with electrostatic shields for optimum noise protection and phase shifting capability shall be provided where the addition of line impedance reactors will not lower the total harmonic distortion (THD) level to that allowed by IEEE 519 - 1992. If the harmonic distortion level required by IEEE 519 - 1992 can be met with only line reactors, then phase shifting isolation transformers may be omitted.

7. The AFD controller shall include the following protective circuits/features:
   a. Current limit shall be provided at 100% of the motor FLA. If current exceeds 100% of the motor current, the AFD will slow down the motor. If the current continues to rise the AFD shall shutdown on overcurrent. Current limit will be adjustable by qualified service personnel for application of AFD to smaller than nameplate motors.
   b. Current limit/soft stall feature - current limit/soft stall allows continuous operation while in an overload condition. It limits the current by slowing down the frequency. The soft stall feature will be field set and the current limit adjusted to 100% of the motor FLA or drive FLA whichever is smaller.
   c. Instantaneous electronic trip - automatically safely shutdown motor if:
      1) Current exceeds 200% of design.
      2) Phase-to-phase output short circuit occurs.
      3) Phase-to-ground output short circuit occurs.
      4) Phase loss occurs.
   d. The AFD shall be programmable to provide restart automatically, if desired, when input line returns to normal in the event of:
      1) Intermittent power outage.
      2) Phase loss.
      3) Overvoltage shutdown.
      4) Intermittent voltage spike.
   e. Insensitive to incoming power phase.
   f. Line-to-line fault protection.
   g. Line-to-ground short-circuiting and accidental motor grounding protection.
   h. Electronic overload protection.
   i. Over-temperature protection.
8. The AFD shall be designed and constructed to operate within the following service conditions:
   a. Elevation up to 3300 feet without derating.
   b. Ambient temperature range - 0°C to 40°C.
   c. Atmosphere – non-condensing relative humidity to 90%.
   d. AC line voltage variation - 10% to +10%.
   e. AC line frequency variation ± 2 HZ.
9. Bases of Design: Danfoss FC102 or Trane TR200.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Adjustable Frequency Drive:
1. Furnish adjustable frequency drive for each motor identified as requiring an adjustable frequency drive or variable speed operation.
2. Receive, unload, and deliver drives to electrical contractor on jobsite for storage, uncrating and installation by Division 26.
3. Furnish all necessary wiring diagrams to electrical contractor for installation and power wiring.
4. Coordinate the purchased equipment with the motor served and with the automatic temperature control system, paying specific attention to the signal sent and received and the ground source.
5. Start-up shall be by a factory trained field service engineer. Start-up shall be done with the cooperation of the control's contractor. The minimum speed shall be set for 20% at the AFD. The control signal shall be full scale so that the minimum speed will be 20% (adjustable).
6. AFD to be mounted where indicated on the drawings or within sight of the motor controlled.
7. Where a remote disconnect is provided for a motor controlled by an adjustable frequency drive, coordinate with the supplier of the disconnects to ensure that a late make, early break auxiliary contact rated for ten amps continuous duty is provided on the disconnect. This auxiliary contact must be wired into the AFD start circuit to ensure shutdown of the AFD in the event of the disconnect being opened.
8. AFD may be mounted directly to masonry, CMU or concrete walls using appropriate fastening methods, including back plates. When the wall is an exterior wall or any wall where condensation may occur, provide appropriate stand-off, i.e., (Uni-strut channel).
9. AFD may be mounted directly to equipment such as factory or field-built AHU. In this case, through bolts and backing plates along with an appropriate stand-off shall be used. Seal all holes. Self-tapping screws with exposed ends will not be acceptable.
10. When AFD is required to be located in areas where walls are not available, provide a Unistrut type frame securely mounted to floor adequately braced to form a rigid mounting surface.
11. AFD shall be generally mounted with the center of the unit at 60" above the finished floor. Service clearance shall be provided in accordance with the National Electric Code and under no circumstances less than the following:

Voltage to Ground	Minimum Clearance Distance
110V or 120V	3'-0"
208V, 220V, 240V or 277V	3'-6"
460V or 480V	4'-0"
Greater than 480V	5'-0"

12. Adjustable frequency drives shall be accessible.
13. Provide housekeeping pad for all floor mounted adjustable frequency drives.
14. After installation, phase rotation of each adjustable frequency drive shall be verified to match between bypass operation mode and normal operation modes.

END OF SECTION

SECTION 23 05 18
CONTROL WIRING

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Building Control System Wiring - Section 23 09 00.
B. Water Treatment Equipment Interlock Wiring.
C. Fire Protection Systems Wiring.
D. Plumbing Systems Wiring.
E. Control Circuit for Adjustable Frequency Drive Alternator.
F. Interior & Exterior Lighting Control Wiring, including relays and contactors.

1.3 DEFINITIONS

A. Control Wiring: All wiring, high or low voltage other than power wiring, required for the proper operation of the mechanical systems.
B. Power Wiring: All line voltage wiring to the mechanical equipment. Line voltage which also serves as a control circuit, such as a line voltage thermostat, or involves interlocking with a damper, shall be considered control wiring.

1.4 QUALITY ASSURANCE

A. All work will be in accordance with the requirements of the National Electrical Code – Latest Edition.

1.5 SUBMITTALS

A. Submittals are not required.

PART 2 – PRODUCTS

2.1 MATERIALS

A. All material used in the completion of the wiring under this section will comply with the requirements of Division 26 Electrical and Section 23 09 00 – Instrumentation and Controls for HVAC.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Cooperate completely with the contractor for Division 26.
B. Provide all conduit, wire and accessories necessary to complete the control wiring as specified under WORK INCLUDED.
C. Because of variations in requirements from manufacturer to manufacturer, all details may not be included in the Contract Documents. This sub-contractor must obtain approved coordinated wiring diagrams before proceeding with the control wiring.
D. All control wiring shall be properly installed in an approved raceway system or when allowed, run exposed in concealed spaces. All control wiring run in exposed areas shall be in an approved raceway unless otherwise noted.
E. Control wire run exposed shall be neatly bundled and routed parallel and/or perpendicular to building structure or equipment casing. Routing of wire shall be so that it does not interfere, chafe, or obstruct service or maintenance of the equipment served.
F. Exposed control wire shall be properly secured and/or supported within equipment encloses. Cable shall be secured on no greater than 18" centers.
G. All openings made for the passing of control wire shall be properly bushed to prevent chafing. Hole size shall be suitable for the quantity of wires or tubing passing through while allowing for ease of pulling and future expansion. Oversized holes beyond these requirements are not allowed.
H. Holes made within air handling equipment which may allow the transfer or bypassing of air shall be properly sealed after wire is pulled. Expanding foam sealant and proper backing material will be acceptable. Seal shall be suitable for maximum unit operating pressures.
I. Attachments of control devices, raceway and cable supports shall be made with proper attachments. Self-drilling screws which result in exposed end will not be acceptable. Bolts and nuts shall be used with bolt head exposed to view. All fasteners located where exposed to weather or moisture shall be stainless steel or cadmium plated.
J. Any opening, holes or cuts in equipment enclosures or building structure not used shall be neatly sealed. On equipment, the seal or patch shall be of similar material sealed and painted to match.
K. The control contractor shall clean all unused or scrap material from the equipment enclosure.
L. All control wire shall be identified by proper cable identification methods. Verify how cables shall be labeled with the Owner's Representative prior to the start of work. All termination shall be labeled and labels clearly visible.
M. All control devices, cabinets, equipment, and raceways shall be labeled. Verify how the hardware shall be labeled with the Owner's Representative prior to the start of work.
N. Splices in control wire are not allowed unless the length of run is too great to allow for a continuous run. When splices become necessary, they shall be solder connected with heat shrink tubing. When raceway is used, all splices shall be in junction boxes.

O. Control devices (i.e., flow switches), connected to cold equipment where the possibility of condensation may occur shall be vapor-proof type. The connecting conduit shall be properly sealed with spray type foam after the wires are pulled through. If this is not possible, a weatherproof junction box shall be close mounted to the device to allow for proper moisture sealing. Conduit connections shall be sealed with a silicon type caulk/sealant.
P. All control devices or wiring located exposed to weather or moisture shall be in an approved raceway system. This system shall be properly supported and sealed to prohibit moisture convection or transfer. Provide flexible conduit similar to seal tight for connection to all equipment. EMT and set screw fittings are not acceptable. All exterior raceways shall be IMC (Intermediate Metallic Conduit) or better with threaded fittings.
Q. Where a disconnect switch is mounted between an adjustable frequency drive and the motor, the disconnect must have a late make, early break auxiliary contact. This contact shall be wired into the AFD control circuit so that the control circuit is disconnected before the power circuit it broken.
R. BCS Contractor to fully review the electrical drawings for interlock wiring required for exterior and interior lighting control. BCS contractor to coordinate with the electrical contractor all relays, contactors, programming, and wiring required.
S. BCS Contractor shall provide all conduit, wire, and accessories necessary to complete the interior lighting control interlock if not provided by the electrical contractor.

END OF SECTION

SECTION 23 05 19
METERS, GAGES AND ACCESSORIES FOR HVAC PIPING

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Flow Measuring Meter - Venturi Type.
B. Strainers.
C. Thermometers and Accessories.
D. Pressure Gauges and Accessories.
E. Pressure and Temperature Test Ports.
F. Pressure and Temperature Test Kit.
G. Pump Suction Diffuser.
H. Differential Pressure Type Flow Switch.
I. Install Miscellaneous Control Devices.

1.3 SUBMITTALS

A. Submit schedule of all products used. Include make, model and size. When multiple products will be used, generic size and flow range will be acceptable.
B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
C. Submit in accordance with Division 1 requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Flow Measuring Stations - Venturi Type:
   1. Aeroquip Corporation (BARCO)
   2. Flow Design, Inc.
   3. Gerand, Inc.
   4. Victaulic Co. of America
   5. Engineer-approved Equal
B. Strainers:
   1. Crane
   2. ITT Grinnell
   3. O.C. Keckley
   4. Mueller Steam Specialty Co. (MUESSCO).
   5. RP&C Division, Conbraco Industries, Inc.
   6. Victaulic Co. of America
   7. Wheatley Gaso, Inc.
   8. Engineer-approved Equal

C. Thermometers and Accessories:
   1. Duro Instrument Corp.
   2. Taylor
   3. H.O. Trerice
   4. Weiss
   5. Weksler
   6. Winter's Thermogauges
   7. Engineer-approved Equal
D. Pressure Gauges and Accessories:
   1. Ashcroft
   2. Duro Instrument Corp.
   3. H.O. Trerice
   4. Weiss
   5. Weksler
   6. Winter's Thermogauges
   7. Engineer-approved Equal
E. Pressure and Temperature Test Ports:
   1. Peterson Equipment Co., Inc.
   2. Sisco P/T Plugs
   3. Engineer-approved Equal
F. Pressure and Temperature Test Kit:
   1. Peterson Equipment Co., Inc.
   2. Sisco P/T Plugs
   3. Engineer-approved Equal
G. Pump Suction Diffuser:
   1. Armstrong Pump Co.
   2. Bell and Gossett
   3. Flow Conditioning Corp.
   4. Mueller Steam Specialty Co (MUESSCO).
   5. Taco, Inc.
   6. Victaulic Co. of America
   7. Wheatley Gaso, Inc.
   8. Engineer-approved Equal
H. Differential Pressure Type Flow Switch:
   1. Allen Bradley 836-T-D400 Series
   2. Engineer-approved Equal.

2.2 FABRICATION

A. Strainers:
   1. "Y" Pattern:
      a. HVAC Water Service:
         1) Size 1/4" thru 2": Cast iron body, threaded connection, threaded blow-off cover, removable stainless-steel screen .045" perforations, rated at 450 PSIG. Temperature and pressure test port extended to clear required insulation on each side of strainer. Based on Mueller Steam Specialty Co. (MUESSCO) #11M.

2) Size 2-1/2" and up: Cast iron body, flanged connection, flanged blow-off cover. Blow-off cover tapped for blow-off valve, removable stainless-steel screen .045" perforations, rated at 125 PSIGG. If grooved mechanical system is in use a "T" type grooved end, ductile iron body, available with blow off, 304 SS removable screen, choice of mesh size. Temperature and pressure test port extended to clear required insulation on each side of strainer. Based on Mueller Steam Specialty Co. (MUESSCO) #751.

2. Basket Strainer:
   a. HVAC Water Service:
      1) Size 4" and up: Cast iron body, flanged connection, flanged cover, cover tapped for air vent, body tapped for drain valve, removable stainless-steel basket .125" perforations rated at 150 PSIG. Based on Mueller Steam Specialty Co. (MUESSCO) #165.

B. Thermometers and Accessories:
   1. Industrial Reading Non-Mercury Type:
      a. Construction: Adjust angle, 9" scale with lagging extension brass well, of the blue dye (only) fill type and guaranteed accurate to ± one scale division with appropriate graduation. Thermometer shall have glass front to exclude dirt and dust. Thermometers containing mercury are not acceptable. Thermometers installed outdoors shall be specifically designed and weatherproofed for this application.
      b. Stem Length:
         1) 6" pipe and smaller 3-1/2"
         2) 8" to 12" pipe 6"
         3) For storage tanks 9"
      c. Ranges:
         1) Chilled and condenser water: 0 to 120°F or 0 to 100°F as available.
         2) Domestic & heating hot water: 30 to 240°F
      d. Based on Weksler Type EG5H-9
   2. Bi-Metal Dial Type:
      a. Construction: 5" dial, adjust-angle, with lagging brass extension well. Stainless steel case bezel, fittings, and stem. Head assembly sealed against dust, fumes, and moisture with glass window. Accuracy of ± 1% of thermometer range and also be externally adjustable.
      b. Stem Length:
         1) 6" pipe and under 2-1/2"
         2) 8" to 12" pipe 4-1/2"
         3) For storage tanks 7-1/2"
      c. Range:
         1) Chilled and condenser water 0 to 150°F
         2) Domestic & heating hot water20 to 240°F
      d. Based on Weksler Type AF.
   3. Thermometer Well: Construction - Brass or ductile iron body, with lagging extension, length to accommodate thermometer stem length. Based on Weksler.

C. Pressure Gauges and Accessories:
   1. Pressure Gauges:

a. Construction: 4-1/2" dial, high impact polypropylene case, 1/4" bottom connection, 1/2% accuracy in accordance with ANSI B40.1 - 1974 Grade A. Stainless steel rotary with stainless steel pinion gear; stainless steel sector gear; stainless steel link. Stainless steel bourdon tube, 316 stainless steel socket and slotted adjustable pointer.
b. Case of black high impact polypropylene suitable for surface or direct mounting and with bottom connection. For outdoor locations, provide glycerin filled gauges.
c. Range: Ranges shall be so selected to indicate pressure reading in midpoint of scale selected.
d. For condenser water, ice water and other open system pumps, provide a compound gauge with dial calibrated to read in. hg. vac. as well as pressure.
e. Based on Weksler Model AA44-2 and AY44-2.

2. Ball Valve Shut-Off: See Ball Valves Section 23 05 23.
3. Manifold Valves (Trumpet Valve) (Water): 2, 3 or 4 port - Brass body, spring return, push button brass valves, 1/4" compression connections. Gauges tap at top, calibrated gauge test port with gauge cock. 125 PSIG rated, 20°F to 220°F range. Based on Flow Conditioning Corporation Hydronic Indicator System.
4. Piston type snubber: Brass body, threaded connections, suitable for mounting horizontal or vertical (required at pump inlet and discharge). Based on Weksler Type RS-1.
5. Filter type snubber: Brass body, threaded connection, micro metallic stainless-steel filter. (For all gauges except pump service). Based on Weksler Type BW42.

D. Pressure and Temperature Test Ports:
1. Brass or stainless-steel body with threaded cap and gasket, length to extend past insulation.
2. Two self-closing valves with intermediate pocket for added pressure protection. Sized for standard 1/8" probe.
3. Range: 20°F to 230°F.
4. Rating: 250 PSIG water.
5. Based on Peterson Equipment Co., Inc. "Pete's Plug" Model 110 or 110XL.

E. Pressure and Temperature Test Kit:
1. Pressure-temperature test kits consisting of 0-100 PSIG pressure gauge with adapter, 25-125°F testing thermometer, 0-220°F testing thermometer, gauge adopted and protective carrying cast and master air vent assembly.
2. Provide 2 test kits to the Standards & Design Office at the closeout of the project.
3. Based on Peterson Equipment Co., Inc., Series 1500 Test Kit.

F. Pump Suction Diffuser:
1. End Suction Diffuser:
a. Construction: Cast iron angle type body with inlet vanes and combination diffuser-strainer-orifice cylinder with 3/16" diameter openings for pump protection flanged connection. A permanent magnet shall be located within the flow stream and shall be removable for cleaning. The orifice cylinder shall be equipped with a disposable fine mesh strainer, which shall be removed after system start-up. Orifice cylinder shall be designed to withstand pressure differential equal to pump shutoff head and shall have a free area equal to five times cross section area of pump suction opening. Vane length shall be no less than 2-1/2 times the pump connection diameter. Unit shall be provided with adjustable support foot to carry weight of suction piping. Body tapped for pressure gauge and strainer blow-down. Based on Bell and Gossett.

b. Size: Inlet system pipe. Outlet pump suction size. When an inlet size pipe size by pump suction size diffuser is not available, provide an inlet size by size nearest to pump suction and a flanged eccentric reducer from pump suction diffuser outlet size to pump suction size.

2. Double Suction Diffuser:
   a. Construction: Angle type cast iron body with 125# ANSI flanged inlet and outlet connections, exit vane, cast bronze venturi rings, and double inlet stainless steel orifice cylinder assembly arranged for service removal from either end of cylinder. A threaded blow-down connection shall be located to remove accumulated debris. Inlet and outlet connections shall be equipped with 1/4" gauge tappings. Diffusers shall be equipped with start-up strainer which shall be removed after initial operation. Orifice cylinders shall be selected to withstand a pressure differential equal to pump shut-off head. Clean unit pressure drop at 10 fps pump suction velocity shall not exceed 2 PSIG. Based on Flow Conditioning Corp.
   b. Size: Inlet system pipe. Outlet pump suction size. When an inlet size pipe size by pump suction size diffuser is not available, provide an inlet size by size nearest to pump suction and a flanged eccentric reducer from pump suction diffuser outlet size to pump suction size.
3. Grooved End Suction Diffuser:
   a. Construction: Body, coupling, end cap shall be of ductile iron conforming to ASTM A-536, with enamel coating. Diffuser shall be 304 SS with 3/16" diameter holes. Start up bronze 16 mesh screen shall be removed after system start up. Unit shall have two 1/4" plugged bosses for pressure taps. A 3/4" plug shall be provided on the base for draining. Unit shall be provided with 1-1/4" Schedule. 40 pipe support. Vane length shall be no less than 2-1/2 times the pump connection diameter. Based on Victaulic
   b. Size: Inlet system pipe. Outlet pump suction size. When an inlet size pipe size by pump suction size diffuser is not available, provide an inlet size by size nearest to pump suction and a flanged eccentric reducer from pump suction diffuser outlet size to pump suction size.

G. Differential Pressure Type Flow Switch:
   1. Switch to have bellows suitable for 175 PSIG.
   2. Suitable for use with water.
   3. Adjustable pressure difference (Hi-Low).
   4. Adjustable differential (Cut out to cut in).
   5. Pulsation snubber.
   6. NEMA-12 enclosure.

PART 3 – EXECUTION

3.1 GENERAL

A. Install in accordance with manufacturers written installation instructions.

3.2 INSTALLATION

A. Strainers:
   1. "Y" Patterns:
      a. Strainers preceding automatic steam control valves shall be installed with the strainer branch in the horizontal position to eliminate the formation of a water pocket in the strainer branch.
      b. All non-steam “Y” pattern strainers shall be installed with the strainer branch in the downward vertical position.
      c. For all “Y” pattern strainers, provide blow-off valve assembly consisting of ball-type drain valve with hose end cap and pipe nipple.
      d. Provide pressure-temperature test plugs before and after each strainer.
   2. Basket Strainer:
      a. Install basket strainer on housekeeping pad with rubber mat between pad and strainer (See Section 23 05 48 or specs on rubber mat).
      b. Provide manual air vent in top of cover.
      c. Provide ball valve nipple and plug for drain valve assembly. Valve to be 3/4" unless otherwise noted.
      d. Provide pressure-temperature test plugs before and after each strainer.

B. Thermometers and Accessories:
   1. Install and adjust thermometers for optimum visibility.
   2. Provide thermometers where indicated on schematic flow diagram or schematic equipment details.
   3. Install thermometers in compatible thermometer wells.

C. Pressure Gauges and Accessories:
   1. Install and adjust gauge for optimum visibility.
   2. Provide ball valve shut-off for all hydronic gauges.
   3. Provide a manifold valve to facilitate the use of a single gauge to monitor pressure differential from various points of a single piece of equipment (i.e., pump; strainer suction; pump suction; pump discharge, etc.). Mount valve for optimum visibility and access.
   4. In lieu of the trumpet valves the contractor may assemble individual components using ball valves as the isolation valve provided the same functions of the trumpet valve are duplicated.
   5. Provide piston type snubbers for pump service.
   6. Provide filter type snubbers for all other fluid services.
   7. Open shut-off valve only enough to obtain accurate reading. Valve to gauge to be closed at all other times.

D. Pressure and Temperature Test Ports:
   1. Install in upright or vertical position as indicated on schematic flow diagram or schematic equipment details.
   2. Install in tee or welded outlet.

E. Pressure and Temperature Test Kit: Turn complete kits in good working condition over to Owner, when the Owner takes over the building.

F. Pump Suction Diffuser:
   1. Provide suction diffuser for each end suction pump unless design provides for 5 diameters of straight pipe upstream of suction inlet.
   2. Support weight of suction diffuser independent of pump.

3. Provide blow-down tap sized nipples, 90^{o}F, ball valve and plug for blow-down valve assembly.
4. After system has been thoroughly cleaned and flushed and prior to turning over to Owner, remove the fine mesh strainer. Turn the strainer over to Owner.

G. Differential Pressure Type Flow Switch:
1. Install in accordance with manufacturer's instructions. Located tape between shut-off valve and vessel.
2. Settings of pressure differential pressure as required pressure difference and to provide proper protector flow or no flow per catalog data.
3. Wire time delay relay to permit start-up with no flow condition. Delay can be omitted where manufacturer has time delay integral with control circuit.
4. Install a pressure and temperature test port within three feet downstream of each differential pressure switch connection to piping system for use in verifying calibration of BAS readouts.

H. Install miscellaneous control devices such as thermometer wells, tees for flow measuring stations, connections for differential pressure sensors, etc.

END OF SECTION

SECTION 23 05 23
VALVES FOR HVAC PIPING

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Automatic Flow Control Valves.
B. Ball valves.
C. Butterfly valves.
D. Check valves.
E. Combination Automatic Flow Control and Shutoff Valves.
F. Combination Strainer and Shutoff Valves.
G. Valves for Mechanical Joint Systems.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced to in the text by the basic designation only.
   1. American National Standards Institute (ANSI).
   2. American Society for Testing and Materials (ASTM).

1.4 SUBMITTALS

A. Submit schedule and cut-sheets indicating service, make and model number, pressure class, end type and usage (i.e., balance, shut-off).
B. Product data shall be included in the operation for maintenance instruction manuals along with installation, operation, and maintenance instructions.
C. Submit in accordance with Division 1 requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Automatic Flow Control Valves:
   1. Flow Design, Inc.
   2. Nexus Controls
   3. Griswold Controls
   4. Engineer-approved Equal
B. Ball Valves:
   1. Apollo
   2. Crane Company
   3. Hammond Valve
   4. Milwaukee Valve.

5. Nibco, Inc.
6. Watts
7. Engineer-approved Equal

C. Butterfly Valves:
1. API International, Inc.
2. Bray International, Inc.
3. Crane Company
4. Demco
5. DeZurik
6. Grinnell
7. Hammond Valve
8. Keystone Valve Co., U.S.A.
9. Milwaukee Valve
10. Mueller Steam Specialty, Co. (Muessco)
11. Nibco, Inc.
12. Engineer-approved Equal

D. Check Valves:
1. API International, Inc.
2. Hammond Valve
3. Milwaukee Valve
4. Mueller Steam Specialty, Co. (Muessco)
5. Nibco, Inc.
6. Walworth
7. Engineer-approved Equal

E. Combination Automatic Flow Control and Shutoff Valves:
1. Flow Design, Inc.
2. Nexus Controls
3. Griswold Controls
4. Engineer-approved Equal

F. Combination Strainer and Shutoff Valves:
1. Flow Design, Inc.
2. Nexus Controls
3. Griswold Controls
4. Engineer-approved Equal

G. Valves for Mechanical Joint Systems: Where a mechanical joint system is proposed, valves shall be furnished by the system supplier where appropriate and shall be equal to those specified.

2.2 FABRICATION

A. Automatic Flow Control Valves:
1. HVAC or Potable Water Service:
a. Size ½" thru 2-1/2": Brass wye body design, thread or sweat connection, ground joint union, dual temperature and pressure test ports extended to clear required insulation, range 20°F to 230°F rated at 400 psi water. Stainless steel or nickel-plated piston brass orifice and spring, replaceable without removing from installation, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 ft. Valves shall be calibrated for the fluid being pumped.

b. Size 2-1/2" thru 12": Ductile iron body, wafer style connection, dual temperature and pressure test ports, range 20°F to 230°F rated at 150 psi. Stainless steel or nickel-plated piston brass orifice and spring, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 ft. Valves shall be calibrated for the fluid being pumped.

B. Ball Valves:
   1. HVAC water service:
      a. Size 1/4" thru 2". Two-piece, adapter loaded, full port type with brass body, threaded or sweat connection, stainless steel stem, stainless steel ball, teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG.
      b. Valves installed in insulated piping to have extended handles to clear insulation. Stem extension shall be made of a non-thermal conducting material with a sleeve to form an insulated vapor seal after the valve is insulated.

C. Butterfly Valves:
   1. HVAC water service – Above Ground Use:
      a. Size 2-1/2" thru 4": 416 stainless steel stem, lug wafer body drilled and tapped for isolation and removal of downstream piping, cast iron or ductile iron body, long neck body extended to allow for a minimum of 2" insulation, aluminum bronze or stainless-steel disc, bubble tight EPDM seat, infinite position, memory stop handle. Class 150, 20°F to 210°F range. Based on Nibco LD-2000-3.
      b. Size 6" and up: As described above with totally enclosed weatherproof gear actuator with indicator and memory stop. Based on Nibco LD-2000-5 for sizes 6” to 12”.
      c. Size 2-1/2" - 12" grooved end: Ductile iron body to ASTM A-536 with PPS coating and ductile iron disc to ASTM A-536. 2-1/2" - 4" to have infinitely variable memory stop handle. Valves 6" and above to have gear operator. Valve has bubble tight shut off up to 300 psi and 230°. Valve will have a bracket allowing up to 2" insulation.
      d. Valves installed in insulated piping to have extended handles to clear insulation.
   2. HVAC water service – Below Ground Use:
      a. Size 2-1/2" and above: 416 stainless steel stem, lug wafer body drilled and tapped for isolation and removal of downstream piping, cast iron or ductile iron body, long neck body extended to allow for a minimum of 2" insulation, aluminum bronze or stainless-steel disc, bubble tight EPDM seat. Totally enclosed weatherproof, permanently lubricated gear actuator with operating not complying with ASWWA C504.

D. Check Valves:
   1. HVAC water service.
      a. Horizontal swing check valve:
         1) Size 1/4" thru 2". Bronze body threaded or sweat connection, "Y" pattern, bronze seat, renewable teflon or bronze, swing disc, 125 lb. SWP-200 lb. WOG (non-shock).

2) Size 2-1/2" and up. Iron body flanged connection, bolted cover, bronze seat, renewable bronze swing disc, brass hinge pin, 125 lb. SWP-200 lb. WOG (non-shock).

b. Vertical lift check valve.
1) Size 3/8" thru 2". Bronze body, threaded or sweat connection, renewable teflon disc and seat, copper or stainless-steel spring loaded, stainless steel or silicone bronze stem, Class 125.
2) Size 2-1/2" thru 10". Iron wafer type body, taped lug connection, renewable bronze disc and seat, stainless steel spring loaded, bronze guide pin, Class 125.
3) Size 12" and up. Iron globe body, flanged connection, renewable bronze disc and seat, stainless steel spring loaded, bronze guide pin, Class 125. Size 2-1/2" thru 12" (grooved end): Ductile iron body, grooved end connection 316 SS disc, EPDM seat, with tilted disc for 2-1/2 - 3", and dual disc 4" thru 12". Valve may be installed horizontally or vertically for temperature ratings up to 230°.

E. Combination Automatic Flow Control and Shutoff Valves:
1. HVAC or Potable Water Service:
a. Size ½" thru 2: Brass wye body thread or sweat connection, union, two-temperature and pressure test port extended to clear require insulation, brass or bronze ball valve with stainless steel ball and stem, non-thermal conductive material type actuator extended to clear required insulation for chilled water applications, steel lever type for heating applications. Range 20°F to 230°F rating 400 psi water. Stainless steel or nickel-plated piston brass orifice and spring, replaceable without removing from installation, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 ft. Valves shall be calibrated for the fluid being pumped.

F. Combination Strainer and Shutoff Valves:
1. HVAC or Potable Water Service:
a. Size ½" thru 2": Brass body, thread or sweat connection, ground joint union, temperature and pressure test port extended to clear required insulation (on each side of the valve), ball valve with non-thermal conductive material type actuator extended to clear required insulation for chilled water applications, lever type for heating applications. Removable stainless strainer, 40 mesh for .25 gpm and up, 20 mesh for 1.25 gpm and up. Unit side drain and strainer blow-down valve. Rated at 400 PSIG.

G. Valves for Mechanical Joint Systems: Valves shall be constructed as described above for the type used.

PART 3 – EXECUTION

3.1 GENERAL

A. Provide shut-off valves on the inlet and outlet of each piece of equipment at the take-off each major branch from a header and at the base of each pipe riser in order to facilitate service.

B. Provide drain valves at the base of each pipe riser and at each piece of equipment to facilitate service.
C. Provide locking device on handle of the expansion tank isolation valve to prevent accidental closing.
D. All valves and accessories located in the thermal storage loop shall be rated for 50% ethylene glycol and down to 20 ºF.

3.2 INSTALLATION

A. Flow Control Valves:
   1. Install with taps in upright or vertical position.
   2. Tag valve for:
      a. Type of service.
      b. Flow in GPM.
   3. The contractor shall assume the responsibility to obtain the necessary gauges and thermometers to properly take the differential pressure and temperature readings from the flow control valves.
   4. All flows shall be verified.
B. Ball Valves:
   1. Install valves with adequate access to lever actuator.
   2. Provide adequate space for actuator handle in the open and closed position and for packing replacement.
   3. Provide infinite position handle with memory stop on the outlet of all heat exchangers for balancing purposes.
C. Butterfly Valves:
   1. Install valve between face of 125# or 150 standard ANSI flanges or standard grooved couplings.
   2. Assure unrestricted valve movement after installation. Valves should be installed with stem of valve parallel to floor.
D. Check Valves:
   1. Horizontal swing check valves: Install valve with swing disc in the pendent position, cover in upright position.
   2. Vertical lift check valve:
      a. Install valve in vertical position, upward flow.
      b. Flanged valves will be installed between 125# or 150 ANSI flanges or other flanged valves.
      c. A spool piece a minimum of 6" face to face will be used to separate a vertical lift check valve and a butterfly valve.
      d. Inspect the face of the flange and valve for casting/matching burrs. If burrs exist remove by draw filling prior to gasket placement.
      e. Grooved end check valves shall be installed with standard grooved couplings.
E. Combination Flow Control and Shutoff Valves:
   1. Install with taps in upright position in a manner that will allow all the taps to be used as an air vent.
   2. Tag valve for:
      a. Type of service.
      b. Flow in GPM.
   3. Obtain the necessary gauges and thermometers to properly take the differential pressure and temperature readings from the flow control valve.
   4. All flows shall be verified.

F. Combination Strainer and Shutoff Valves:
   1. Install with taps in upright position in a manner that will allow the tap to be used as an air vent.
   2. All strainers shall be blown down prior to turning system over to Owner.

G. Valves for Mechanical Joint Systems: Valves shall be installed as described above for the type used.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Inserts, Shells and Upper Attachments.
B. Pipe Hangers, Rods, Supports and Accessories.
C. Pipe Sleeves.
D. Pipe Seals.
E. Duct Hangers and Supports.
F. Duct Sleeves.
G. Fabricated Steel Support.

1.3 QUALITY ASSURANCE

A. Design of pipe supporting elements shall be in accordance with ANSI B31.1.
B. Fabrication and installation of pipe hangers and supports shall be in accordance with the following Manufacturers Standardization Society (MSS) Standards.
   1. SP-58 Pipe Hangers and Supports: Materials, Design and Manufacture.
   2. SP-69 Pipe Hangers and Supports: Selection and Application.
   3. SP-89 Pipe Hangers and Supports: Fabrication and Installation Practices.
C. Steel angles, channels and plate shall be in accordance with ASTM A36, red primed or hot dipped galvanized for interior applications, and hot galvanized for exterior applications.
D. Bolts, including nuts and washers, used for fabricating steel members shall be in accordance with ASTM A325 and shall be stainless steel or plated for corrosion protection. Plain steel components are unacceptable.
E. Welding of steel members shall be in accordance with AWS D1.1.
F. Duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible as applicable.
G. Steel supports for ducts, pipe anchors, pipe guides, and piping supported from below shall be fabricated in accordance with AISC Specification for the Design, Fabrication and Erection of Structural Steel for buildings. If required, the contractor shall include the cost of the services of a structural engineer to design or review the system.

1.4 APPLICABLE PUBLICATIONS

A. Applicable sections of the publications listed below form a part of this Section. The publications are referenced to in the text by the basic designation only.
   1. American Institute of Steel Construction (AISC)

2. American National Standards Institute (ANSI)
3. American Society for Testing and Materials (ASTM)
4. American Welding Society (AWS)
5. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)
6. National Fire Protection Association (NFPA)
7. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA).

1.5 SUBMITTALS

A. Submit schedule indicating type of hanger to be used by system and pipe size. Include rod size for each hanger size.
B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
C. Submit in accordance with Division 1 requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Inserts, Shells and Upper Attachments:
   1. Anvil International, Inc.
   2. Carpenter Paterson, Inc.
   3. Cooper B-Line, Inc.
   4. Elcen Metal Products
   5. Hilti
   6. Michigan Hanger Company
   7. PHD Manufacturing, Inc.
   8. Unistrut.
B. Pipe Hangers, Rods, Supports and Accessories:
   1. Anvil International, Inc.
   2. Carpenter Paterson, Inc.
   3. Cooper B-Line, Inc.
   4. Elcen Metal Products
   5. Hilti
   6. Michigan Hanger Company
   7. PHD Manufacturing, Inc.
   8. Unistrut.
C. Pipe Sleeves:
   1. Metraflex – Metraseal
   2. Thunderline Corporation - Link Seal
D. Pipe Seals:
   1. Metraflex – Metraseal
   2. Thunderline Corporation - Link Seal
E. Duct Hangers and Supports: Fabricated per Specifications
F. Duct Sleeves: Fabricated per Specifications
G. Fabricated Steel Support: As Detailed on Drawings.

2.2 FABRICATION

A. Inserts, Shells and Upper Attachments:
1. Inserts; MSS Type 18; malleable iron body and nut, galvanized finish, opening in top of insert for reinforcing rod, lateral adjustable. Rated for 1,140 lbs. Based on Anvil Fig. 282.
2. Shells: Steel shell and expander plug, snap off end fastener. Based on Phillips Concrete Fasteners Red Head.
3. Upper Attachments:
    a. Top beam clamps; MSS Type 19: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut. Rating is contingent on rod and bolt size. Based on Anvil Fig. 94.
    b. Bottom Beam Clamp; MSS Type 23: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut, and retaining clip. Rating is contingent on rod and bolt size. Based on Anvil Fig. 86 Clamp and Fig. 89 Retaining Clip (or Fig. 87).
    c. Welded Beam Attachment; MSS Type 22: Carbon steel suitable for eye rod or rod and locknut, rating is contingent on rod and bolt size. Based on Anvil Fig. 66.
    d. Center Beam Clamp; MSS Type 21: Malleable iron jaw and square head bolt and nut with galvanized finish. Rating is contingent on rod and bolt size. Based on Anvil Fig. 134.
    e. Center Beam clamp; MSS Type 29: Forged steel, weldless eye nut, tie rod to secure clamp to beam all with galvanized finish, rating is contingent on rod and bolt size. Based on Anvil Fig. 292 or 292L.

B. Pipe Hangers, Rods, Supports and Accessories:
1. Pipe Hangers:
    a. Clevis Hanger; MSS Type 1: Carbon steel, galvanized for interior and exterior use, sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 260 or 300.
    b. Pipe Rings; MSS Type 10: Carbon steel, galvanized for black steel and insulated pipe copper or copper plated or rubber coated for copper pipe. Threaded swivel sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 69 or Fig. 97C for copper pipe.
    c. Adjustable Roller Hanger; MSS Type 43: Cast iron roll, carbon steel yoke rod roll and hex nut with galvanized finish. Sized to accommodate insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 181.
2. Rods:
    a. Size 3/8" and up: All thread steel rod electro galvanized. Sizing for pipe or equipment support as follows:

Copper Tube, Plastic Steel, Cast Iron or Fiberglass Reinforced Glass Max Equip.

Pipe Size (In.)	Max Equipment Pipe Size (In.)	Rod Size (In.)	Load (Lbs.)
¼ to 2	¼ to 2	3/8	730
2-1/2 to 5	2-1/2 to 3	½	1350
6	4 to 5	5/8	2160
8 to 12	6	¾	3230
14	8 to 12	7/8	4480
16	14 to 16	1	5900
18 to 20	18 to 20	1-1/4	9500
22 to 42	22 to 42	1-1/2	13,800

Rods may be reduced one size for double rod hangers with 3/8” minimum diameter, or when other paragraphs require a minimum of 2 hangers per section provided the minimum diameter of 3/8” in maintained.

b. Based on Anvil Fig. 146.

3. Supports:
   a. Pipe Saddle; MSS Type 38: Cast iron saddle, black steel lock nut nipple, cast iron reducer all with galvanized finish. Suitable for standard field cut and threaded galvanized steel pipe. Cast iron floor flange. Based on Anvil Fig. 264 Saddle, Fig. 63 Floor Flange.
   b. Pipe Saddle Cold Piping: MSS Type 40. Single bonded unit consisting of a galvanized metal shield and a molded section of rigid polyurethane foam insulation. Rigid urethane foam shall have a density of 4 pounds per cubic foot, a thermal conductivity of 0.13 Btu.in/sq.ft./hr ^{o}F at 75^{o}F mean temperature. Insulation thickness to be equal to thickness specified for pipe being supported.
   c. Adjustable Pipe Roll and Base; MSS Type 46: Cast iron base plate steel stand and roll, adjusting screws with galvanized finish. Based on Anvil Fig. 274.
   d. Welded Steel Bracket; MSS Type 32: Welded carbon steel rate for 1500 lbs., with galvanized finish. Rating is contingent on rod and bolt size. Based on Anvil Fig. 195.
   e. Riser Clamps; MSS Type 8: Carbon steel, galvanized finish for black steel or galvanized pipe, plastic coated for cold steel, copper, glass or brass pipe rated for a minimum of 220 lbs. at 3/4" size. Based on Anvil Fig. 261.
4. Accessories:
   a. Protective Shields; MSS Type 40: Carbon steel, galvanized minimum of 12" length sized for required insulation. Based on Anvil Fig. 167.
   b. Protective Saddles; MSS Type 39: Carbon steel plate, minimum of 12" length, sized for required insulation. Based on Anvil Fig. 160 thru 165.

c. Steel Turnbuckle; MSS Type 13: Forged steel, galvanized finish with locknuts. Rated at a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 230.
d. Steel Clevis; MSS Type 14: Forged steel, galvanized finish with steel pin and cotter pin. Rated for a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 299.
e. Weldless Eye Nut; MSS Type 17: Forged steel, galvanized finish. Rated for a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 290 or 290L.

C. Pipe Sleeves:
1. Wall: Schedule 40 carbon steel pipe sized to accommodate pipe and insulation. If sleeves are field cut coat cut edges with cold galvanizing spray, ZRC or equivalent.
2. Floor or Exterior Walls below Grade: Schedule 40 steel pipe with anchor and water stop hot dip galvanized after fabrication. Sized to accommodate pipe (pipe insulation if required). Sleeve length will be sized to allow a minimum of 1/2" extension below floor or exterior side of a wall below grade and 1-1/2" extension above floor and 1/2" extension on interior side of an exterior wall below grade.
3. Based on Thunderline Corp. Link Seal Wall Sleeve.

D. Pipe Seals: Composition Plastic Pressure Plates, zinc coated bolts, nuts and metal parts, composition rubber sealing element designed for long term stability rated for temperatures of 40□F to +250□F. Based on Thunderline Corp. Link Seal LS Series.
E. Duct Hangers and Supports: Fabrication and application of duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Latest Edition, as applicable.
F. Duct Sleeves: Sleeves shall be provided for ducts penetrating concrete and masonry walls, stud framed fire rated walls, and poured- in-place concrete floors and roofs. Sleeves shall be sized to accommodate duct and insulation.
G. Fabricated Steel Supports:
1. Field or shop fabricated. See details on drawings.
2. If not detailed on drawings the contractor is to provide suitable supports as required.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Where applicable install in accordance with the manufacturers written installation instructions.
B. Where supports are in contact with copper pipe provide copper plated support or wrap pipe with sheet lead.
C. Where supports are in contact with glass, aluminum or brass pipe provide plastic coating on supports, or wrap pipe with sheet plastic.
D. General interior supports, including attachments and pipe supports that are plain steel shall be cleaned of all rust, primed, and painted black within one week of installation. The schedule shall be fully coordinated with the Owner and all programming including by this contractor. At substantial completion all supports shall be free of rust and in a “like new condition”.

E. Hangers and supports, including attachments & pipe support exposed to weather or located in utility tunnels or accessible utility trenches or subject to spillage shall be hot dip galvanized after fabrication. At substantial completion all supports shall be free of rust and in a “like new condition”.
F. Fabricated steel supports exposed to weather (including pipe supports) or located in utility tunnels and accessible utility trenches or subject to spillage shall be hot dipped galvanized after fabrication, primed and painted black within one week of installation. Cut, welded, drilled, or otherwise damaged surfaces of galvanized coating shall be repaired in accordance with Section 23 02 00. At substantial completion all supports shall be free of rust and in a “like new condition”.

3.2 INSTALLATION

A. Inserts, Shells and Upper Attachments:
   1. Inserts:
      a. Contractor shall have inserts at site and dimensioned location drawings ready at the beginning of the involved concrete work.
      b. Install inserts by securing to concrete forms and inserting reinforcing rod thru the opening provided in the insert in accordance with shop drawings.
      c. Provide necessary supervision while concrete is being poured to correct any misalignment caused by the concrete.
   2. Shells: Size shell length to assure a minimum of 1" solid concrete remaining from shell end to concrete face.
   3. Upper Attachment:
      a. Select proper attachment for building construction.
      b. For plain steel devices, prime with black paint prior to installation.
      c. Adjust attachment location for proper alignment and no more than 4 deg. offset from a perpendicular alignment.
      d. If proper alignment cannot be achieved from the existing building structure provide a trapeze type support size to handle the design load with a minimum safety factor of 5.
B. Pipe Hanger, Rods, Supports and Accessories:
   1. Select proper hanger for piping systems.
   2. The location of hangers and supports shall be coordinated with the structural work to ensure that the structural members will support the intended load.
   3. Provide hex head nut on rod at top and bottom of clevis hanger yoke, and at each rod connection to intermediate and upper attachment. Rod nuts shall be securely locked in place.
   4. Hanger rods shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing.
   5. Hangers shall be fabricated to permit adequate adjustment after erection while still supporting the load. Turnbuckles shall be provided where required for vertical adjustment of the piping.
   6. For vibration isolation hanger intermediate attachment requirements for isolated equipment refer to Section 23 05 48.

7. Supports for vertical piping shall be located at each floor or at intervals of not more than 15 feet and at intervals of not more than 8 feet from end of risers. Where supports are provided on intermediate floors spaced 15 feet or less between floors, no additional supports are required other than those specified for end of risers.
8. A hanger or support shall be provided adjacent to each piece of equipment to ensure that none of the pipe weight is supported from the equipment.
9. The maximum spacing between pipe supports for straight runs shall be in accordance with the following chart. If any deviation from the table exists within the manufacturers written installation instructions, whichever spacing reflecting the smaller centerline to centerline dimension shall be used.
   MAXIMUM HORIZONTAL PIPE HANGER AND SUPPORT SPACING TABLE
   a. Steel Pipe (Schedule 40 & 80):
      Up to 1": 7 ft. on center
      1-1/4" and larger: 10 ft. on center
   b. Copper Pipe (Types L, K and M):
      Up to 1" size: 5 ft. on center
      1-1/4" and larger: 7 ft. on center
   c. Ductile Iron and Cast Iron: Two hangers per section length.
   d. Polyvinyl Chloride (PVC):
      Up to 1-1/2": 3 ft. on center
      2" and larger: 4 ft. on center
10. Hanger centerline spacing shall be reduced by 50% in areas of concentrated valves and/or fittings, also no more than a maximum distance of 12 inches from valves, fittings and/or couplings, or 24 inches from a change in direction.
11. Parallel piping may be supported by trapeze hangers consisting of steel angle, channel, or beam suspended by steel rods attached to upper structure. Piping may be supported above, or suspended below, the angle, channel, or beam.
12. Provide protective shields on all cold and dual temperature piping required to be insulated (see specification Section 23 07 00: Insulation for extent of insulation).
13. Provide protective saddles sized to match insulation thickness on all hot piping required to be insulated (see specification Section 23 07 00: Insulation for extent of insulation). Fill void between saddle and pipe with insulation as specified.
14. Provide turnbuckles on all hangers which require leveling or aligning.
15. Provide steel clevis where detailed and/or required.
16. Provide weldless eye nuts on hanger terminations where disassembly or swing may be required. Use in combination with steel clevis.

C. Pipe Sleeves:
   1. Secure sleeves to forms for concrete construction. Ensure sleeves are not disengaged or misaligned by concrete placement operations.
   2. Provide temporary cap for open end of sleeves to prevent entrance of concrete.
   3. Provide temporary internal bracing where required to prevent distortion of sheet metal sleeves by concrete placement operations.
   4. Sleeves shall not be installed in structural members, except where indicated or approved.
   5. Furnish sleeves to masonry contractor in advance of masonry work. Furnish dimensioned drawings indicating exact location of sleeves.

6. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface, except as indicated otherwise.
7. Sleeves passing through floors in wet areas, such as areas containing plumbing fixtures or floor drains, shall extend a minimum of 4 inches above the finished floor. Sleeves in wet areas shall be enclosed with 4 inch concrete curb.
8. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance all around between the pipe and inside of sleeve, or between jacket over insulation and sleeve.
9. Provide membrane clamping devices on sleeves for waterproof floors.
10. Sleeves are not required in existing structures where openings through existing concrete floors, walls, or roof are core drilled.

D. Pipe Seals:
1. Provide pipe seals for all pipe sleeves used in:
   a. External walls.
   b. Floor slabs on grade.
   c. Upper floors where spillage may occur.

E. Duct Hanger and Supports: Installation of duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Latest Edition, as applicable.

F. Duct Sleeves:
1. Secure sleeves to forms for concrete construction. Ensure sleeves are not disengaged or misaligned by concrete placement operations.
2. Provide temporary cap for open end of sleeves to prevent entrance of concrete.
3. Provide temporary internal bracing where required to prevent distortion of sheet metal sleeves by concrete placement operations.
4. Sleeves shall not be installed in structural members, except where indicated or approved.
5. Furnish sleeves to masonry contractor in advance of masonry work. Furnish dimensioned drawings indicating exact location of sleeves.
6. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface, except as indicated otherwise.
7. Sleeves passing through floors in wet areas, such as areas containing plumbing fixtures or floor drains, shall extend a minimum of 4 inches above the finished floor. Sleeves in wet areas shall be enclosed with 4-inch concrete curb.
8. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance all around between the duct and inside of sleeve, or between jacket over insulation and sleeve.
9. Provide membrane clamping devices on sleeves for waterproof floors.
10. Duct sleeves shall be secured to opening and have a flange turned back to wall to cover any irregularities in the opening provided for the sleeve.

G. Fabricated Steel Supports: Steel for supports shall be saw cut, with sharp edges ground smooth. After fabrication remove all foreign material, including welding slag and spatter, and leave ready for painting or galvanizing, as applicable.

END OF SECTION

SECTION 23 05 48
VIBRATION & SEISMIC CONTROLS FOR HVAC SYSTEMS

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Vibration isolators.
B. Bases.
C. Grooved-Joint Flexible pipe connectors.
D. Braided Flexible pipe connectors.
E. Neoprene Flexible Pipe Connectors.
F. Mass Loaded Vinyl Fabric.

1.3 QUALITY ASSURANCE

A. The vibration isolation materials manufacturer shall be responsible for the proper selection of spring rates to accomplish the specified minimum static deflections for all spring and pad type isolators based on the weight distribution of equipment to be isolated.
B. The vibration isolation materials manufacturer shall be responsible for the structural design of steel beam bases and concrete inertia bases to support mechanical equipment scheduled to receive a supplementary base.
C. Vibration isolation shop drawings shall show isolator locations, and load on each isolator, deflection, compressed spring height, solid spring height, spring diameters and color coding.
D. Where grooved-joint flexible pipe connectors are specified, manufacturer shall design the isolation system and include drawings showing all supports, restraints, etc. as required to ensure performance.

1.4 SUBMITTALS

A. Submit a schedule indicating make, model, type and deflection for each system or weight range.
B. Product data and shop drawings, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
C. Submit in accordance with Division 1 requirements.
D. Submit manufacturer's certification of installation quality.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Vibration Isolators:
   1. Amber/Booth Company
   2. Mason Industries, Inc.
   3. Peabody Noise Control, Inc. - Kinetics.
   4. Vibration Mountings and Controls, Inc.

B. Bases:
   1. Amber/Booth Company
   2. Mason Industries, Inc.
   3. Peabody Noise Control, Inc. - Kinetics.
   4. Vibration Mountings and Controls, Inc.

C. Grooved-Joint Flexible Pipe Connectors:
   1. Central Sprink
   2. Grinnell (Gruv-Lok)
   3. Tyler Pipe (Gustin-Bacon)
   4. Unisource Manufacturing Inc.
   5. Victaulic Co. of America

D. Braided Flexible Pipe Connectors:
   1. Flexonics
   2. Keflex, Inc.
   3. Mason Industries, Inc.
   4. Metraflex Co.
   5. Proco Products, Inc.
   6. Southeastern Hose
   7. Unisource Manufacturing Inc.
   8. Wheatley Gaso, Inc.

E. Neoprene Flexible Pipe Connectors:
   1. Flexonics
   2. Keflex, Inc.
   3. Mason Industries, Inc.
   4. Mercer Rubber Company.
   5. Metraflex Co.
   6. Proco Products, Inc.
   7. Unisource Manufacturing Inc.
   8. Wheatley Gaso, Inc.

F. Mass-Loaded Vinyl Fabric:
   1. Peabody Kinetics, Inc.
   2. United Process, Inc.

2.2 MATERIALS

A. Vibration Isolators:

1. Type A: Double Deflection Neoprene Mount: Double deflection neoprene mountings shall have a minimum static deflection of 0.35". All metal surfaces shall be neoprene covered to avoid corrosion and have friction pads both top and bottom, so they need not be bolted to the floor. Bolt holes shall be provided for these areas where bolting is required. On equipment such as small vent sets and close coupled pumps, steel rails shall be used above the mountings to compensate for the overhang. Based on Mason Type ND.
2. Type B: Spring Type Mount: Spring type isolators shall be free standing and laterally stable without any housing and complete with 1/4" neoprene acoustical friction pads between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Based on Mason Type SLF.
3. Type C: Restrained Spring Type Mount: Spring type isolators shall be laterally stable with housing and complete with 1/4" neoprene acoustical friction pads between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. A housing shall be used that includes vertical limit stops to prevent spring extension when weight is removed. The installed and operating heights shall be the same. A minimum clearance of 1/2" shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operations. Mountings used out of doors shall be hot dipped galvanized. Based on Mason Model SLR.
4. Type D: Vibration Hangers: Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing thru a 30o arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Based on Mason Model 30N.
5. Type E: Horizontal Thrust Restraints: The horizontal thrust restraint shall consist of a spring element in series with a neoprene pad. The spring diameter shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. The spring element shall be contained within a steel frame and designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4" movement at start and stop. The assembly shall be furnished with one rod and angle brackets for attachment to both the equipment and ductwork or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrically on either side of the unit. Based on Mason Model WB.

6. Type F: Neoprene Isolation Pads: Neoprene isolation pads shall be single rib or crossed, double rib neoprene in-shear pads, in combination with steel shims when required, having minimum static deflections as tabulated. All neoprene pads shall be true neoprene in-shear using alternately higher and lower ribs to provide effective vibration isolation, and shall be molded using 2500 PSI tensile strength, oil resistant, compounds with no color additives. Pads shall be 45 or 65 durometer and designed to permit 60 or 120 psi loading, respectively, at maximum rated deflections. Neoprene in-shear isolation pads shall be provided to meet tabulated minimum operating static deflections without exceeding published maximum static deflections. Use single or, crossed, double rib or laminated composites of both as required. When two pads of ribbed material are laminated, they shall be separated by, and bonded to, a galvanized steel shim plate. Based on Kinetics NPS, NPD, NGS or NGD.

B. Bases:
   1. Type 1: Structural Steel Base: All perimeter members shall be beams with a minimum depth equal to 1/10th of the longest dimensions of the base. Beam depth need not exceed 14" provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of one inch. Based on Mason Model WF.
   2. Type 2: Inertia Bases:
      a. The base shall consist of rectangular structural beam or channel concrete forms for floating foundations. Bases for split case pumps shall be large enough to provide support for suction and discharge base ells. The base depth need not exceed 12" unless specifically recommended by the base manufacturer for mass or rigidity. In general, bases shall be a minimum of 1/12th of the longest dimension of the base, but not less than 6". Forms shall include minimum concrete reinforcement consisting of half inch bars or angles welded in place on 6" centers running both ways in a layer 1-1/2" above the bottom, or additional steel as is required by the structural conditions. Forms shall be furnished with steel members to hold anchor bolt sleeves when the anchor bolts fall in concrete locations. Height saving brackets shall be employed in all mounting locations to maintain a 1" clearance below the base.
      b. Inertia bases for pumps shall be large enough to support removable metal insulation cover and suction diffusers where they are used.
      c. Based on Mason Type K.
   3. Type 3: Curb Mounted Equipment Base: Curb mounted rooftop equipment shall be mounted on vibration isolation bases that fit over the roof curb and under the isolated equipment. The extruded aluminum top member shall overlap the bottom member to provide water runoff independent of the seal. The aluminum members shall house cadmium plated springs having a 1-1/2" minimum deflection with 50% additional travel to solid. Spring diameters shall be no less than 0.8 of the spring heights at rated load. Wind resistance shall be provided by means of resilient snubbers in the corners with a minimum clearance of 1/4" so as not to interfere with the spring action except in high winds. The weather seal shall consist of continuous closed cell sponge materials both above and below the base and a waterproof flexible ductlike EPDM connection joining the outside perimeter of the aluminum members. Foam or other contact seals are unacceptable at the spring cavity closure. Caulking shall be kept to a minimum.

Submittals shall include spring deflections, spring diameters, compressed spring height and solid spring height as well as seal and wind resistance details. Based on Mason Type RSC.

C. Flexible Pipe Connectors:
   1. Grooved-joint flexible pipe connectors shall consist of a minimum of three flexible pipe couplings. Coupling shall contain a resilient elastomeric gasket conforming to the internal cavity of the coupling housing and providing a pressure responsive seal against the pipe to create a permanent leak tight seal. Assembly shall permit expansion, contraction and deflection and shall dampen noise and vibration.
   2. Braided flexible pipe connectors constructed of stainless steel annular corrugated metal surrounded with a woven braid of high tensile stainless steel. Units capable of absorbing pump vibration and noise accept thermal expansion and reduce piping stress due to minor misalignment and pressure variations. Sizes 1/2" through 2" to have carbon steel male pipe thread connections. Sizes 2-1/2" and larger to have carbon steel plate flanges with ASA #150 bolt hole patterns. Sizes through 8" to be suitable for 150 psig working pressure at 200-deg F. Based on Keflex KSSPC.
   3. Flexible neoprene connectors shall be used on all equipment as indicated on the drawings or on the equipment schedule. They shall be manufactured of multiple ply's of nylon tire cord fabric and neoprene both molded and cured in hydraulic rubber presses. No steel wire or rings shall be used as pressure reinforcement. Straight connectors shall have two spheres. Connectors up to and including 1-1/2" diameter may have threaded ends. Connectors 2" and larger shall be manufactured with floating galvanized flanges recessed to lock the connector's raised face neoprene flanges. Hoses shall be installed on the equipment side of the shut-off valves. Connectors shall be rated a minimum of 150 psi at 220oF. Flanged equipment shall be directly connected to neoprene elbows in the size range 2-1/2" through 12" if the piping makes a 90o turn at the equipment. All straight through connections shall be made with twin-spheres properly pre-extended as recommended by the manufacturer to prevent additional elongation under pressure. 12" and larger sizes operating above 100 psi shall employ control cables with end fittings isolated by means of 1/2" thick bridge bearing neoprene washer bushings designed for a maximum of 1000 psi. Based on Mason Flex.

D. Mass-Loaded Vinyl Fabric: Mass loaded vinyl shall achieve the noise transmission loss and meet the physical requirements and flammability rating specified. It shall have a continuous operating temperature range from -40 to +220-deg F and shall be resistant to oils, weak acids, alkalis, and weathering. Sound control materials shall be Kinetics Noise Control Type KNM- 100AL mass-loaded vinyl fabric or equal reinforced fabric coated with vinyl and loaded with high-density, completely encapsulated inert fillers. The product shall not contain asbestos. Material shall have a density of 1 lb. per sq.ft., with the following noise transmission loss (dB) frequency (Hz):

125	250	500	1K	2K	4K	STC
15	19	21	28	33	37	27

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. All floor mounted equipment shall be installed on a housekeeping pad, in addition to any isolation or inertia base requirement as specified in Section 15050 - Basic Materials and Methods.
B. Installation of all vibration isolation materials and supplemental equipment bases specified in this section of the specifications shall be accomplished following the manufacturers written instructions.
C. On completion of installation of all isolation materials and before startup of isolated equipment all debris shall be cleared from areas surrounding and from beneath all isolated equipment, leaving equipment free to move on the isolation supports.
D. No rigid connections between equipment and building structure shall be made that degrades the noise and vibration isolation system herein specified. Electrical conduit connections to isolated equipment shall be looped to allow free motion of isolated equipment.
E. Adjust all isolators for uniform support.
F. Readjust all isolators after system start-up to assure constant support.

3.2 INSPECTION

A. The Contractor shall notify the local representative of the vibration isolation materials manufacturer prior to installing any vibration isolation devices. The Contractor shall seek the representative's guidance in any installation procedures he is unfamiliar with.
B. The local representative of the vibration isolation materials manufacturer shall conduct periodic inspections of the installation of materials herein specified and shall report in writing to the Contractor any deviations from good installation practice observed.
C. On completion of installation of all noise and vibration isolation devices herein specified, the local representative of the isolation materials manufacturer shall inspect the complete system and report in writing any installation errors, improperly selected isolation devices, or other fault in the system that could affect the performance of the system.
D. The installing Contractor shall submit a report to the Owner's Representative including the manufacturer's representative's final report indicating all isolation reported as properly installed or requiring correction and include a report by the Contractor on steps taken to properly complete the isolation work.

3.3 VIBRATION ISOLATION SCHEDULE:

A. Ductwork (Main supply and return within and up to 50' of Mechanical Rooms):
   1. Base type: None required.
   2. Isolator Type: "D"
   3. Deflection: .75"
B. Fans, Belted Vent Sets, Roof:
   1. Base type: "1"
   2. Isolator Type: "C"
   3. Deflection: .75"

4. Accessories: Flexible duct connectors (Section 23 33 00).

C. Terminal Boxes (Required on all units that are not provided with factory mounted internal isolation):
   1. Base type: None required.
   2. Isolator Type: "D"
   3. Deflection: .75"

D. Piping (Within and up to 50' outside of Mechanical Rooms):
   1. Base type: None required.
   2. Isolator Type: "A"
   3. Deflection: .75"
   4. Accessories: Flexible pipe connector at exit to room.

E. Packaged Air Handling Units:
   1. Base type: None required.
   2. Isolator Type: Internal spring type provided with AHU.
   3. Deflection: 2"
   4. Accessories: Flexible duct connectors (internal fan isolation and Section 23 33 00-flexible duct connectors).

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Contractor/CM shall use one of TAB vendors listed. Pricing shall be obtained from each vendor, one of whom shall be used by Contractor/CM, to perform TAB work for HVAC systems.
B. Contractor's/CM's bid shall include lowest responsive bid from Test and Balance firms indicated. No other firms shall be used without Owner's written approval.
C. Contractor/CM will coordinate and administer TAB vendor's work.
D. Scope of TAB work is indicated in Part 3 - Execution.

1.2 RELATED SECTIONS

A. Section 01 31 00 – Project Coordination.
B. Section 01 33 00 – Submittal Procedures.
C. Section 01 42 00 – References.
D. Section 01 45 00 – Quality Control.
E. Section 01 78 00 – Closeout Submittals.
F. Section 01 91 00 – Commissioning
G. Section 23 08 00 – Commissioning of HVAC.

1.3 REFERENCES

A. Comply with Section 01 42 00 – References for additional applicable references, abbreviations, definitions, and acronyms.
B. Florida Building, Mechanical and Plumbing Codes, 2020 (7th Edition).
C. Florida Fire Prevention Code, 2020 (7th Edition).
D. NEEB: Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.
E. AABC: National Standards for Total System Balance.
F. ASHRAE: ASHRAE Application Handbook; latest edition: Testing, Adjusting, Balancing.
G. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) - HVAC Systems Testing, Adjusting and Balancing (latest edition).

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittals.
B. Test and Balance contractors indicated herein to perform TAB work shall review Bid Documents and submit proposal to Contractor/Construction Manager at time of bidding indicated in Request for Proposals for Work.
C. Test and Balance vendor selected by Contractor/CM to perform TAB work for HVAC systems shall review and become familiar with project documents, review HVAC installation as work progresses and provide monthly progress reports to Owner indicating Contractor's/Construction Manager's HVAC work has been performed per Section 23 08 00 – Commissioning HVAC.

1.5 QUALIFICATIONS

A. Prequalified TAB Vendors:
   1. Perfect Balance, Inc., 50 S. US Hwy One, Suite 307, Jupiter, FL 33477; P. O. Box 1584; Tel: 561-575-4919; Fax: 561-746-0726; Website: www.perfectbalanceinc.com. Contact: Bill Halm.
   2. Precision Air Balance, Inc., P. O. Box 101712, Cape Coral, FL 33910-1712; Tel: 239- 574-2400; Fax: 239-574-2400; Fax: 239-574-2400. Website: www.precision-air- balance.com. Contact: Mark Rusnock.
   3. Bay To Bay Balancing, Inc., 933 Lee Rd., Suite 405, Orlando, FL 32810; Tel: 407- 704-8468; Fax: 407-704-8770; Email Address: Debbie@Bay2BAy.net.
   4. Robert Shorr, CPMM, 13201 Collecting Canal Rd., Loxahatchee, FL 33470; 2428 Fawn Run, Oviedo, FL 32765; Tel: 561-351-0245; Fax: 561-855-8105. Email Address: Robert@tabfirm.com.
B. No other Test and Balance vendors are permitted to bid.

1.6 SCOPE OF SERVICES

A. Scope of services shall include:
   1. Review project documents to verify that HVAC systems are designed so that TAB may be accomplished.
   2. Provide pre-TAB inspections of HVAC systems during construction to assure that systems are installed in conformance with project documents and approved shop drawings.
   3. Perform TAB of HVAC systems in accord with industry standard to assure correct air/water flow rates and energy efficient operation.
   4. Provide certified TAB report of HVAC systems in accord with this Section.
   5. Provide coordination of TAB activities between Design Mechanical Engineer, Mechanical Contractor, and Energy Management and Control System (EMCS) Contractor.
   6. Initiate conference calls and/or schedule meetings to resolve TAB issues and document solutions to TAB issues.
   7. If resolution is not possible or is not timely, schedule meeting(s) with appropriate parties and District staff (Project Manager).
   8. Within 15 calendar days after receipt of Construction Documents, TAB Contractor shall review and provide written design review report of deficiencies (errors, omissions, conflicts, etc.) that would preclude TAB.
   9. Schedule meeting(s) with Owner's Project Manager and Design Mechanical Engineer to resolve noted deficiencies.
   10. Report shall address each item in Paragraphs 2.3 through 2.7 by itemizing each area reviewed and results.
   11. Design Engineer shall incorporate resolution of reviewed items into Contract Documents prior to issuance to Contractor/Construction Manager.

PART 2 – PRODUCTS

2.1 Not Used.

PART 3 – EXECUTION

3.1 PRE-TAB INSPECTION

A. Coordinate inspection schedule with Mechanical Contractor and Owner's Commissioning HVAC Agent. Provide written inspection schedule. Note Commissioning inspection, Substantial Completion and Final Completion milestones on TAB schedule.
B. For each inspection, TAB vendor shall sign in and out either at District's field office or, if field office does not exist, at District Facilities offices located at 1050 East 10th St., Stuart, FL 34996.
C. Provide periodic inspections during construction and written pre-TAB punch lists within seven calendar days after each inspection. Frequency of inspections shall be determined by TAB vendor to provide adequate inspection coverage but shall not be less than monthly during HVAC system installation.
D. Inspection reports shall define area inspected and shall itemize TAB punch items.
E. Inspections shall include following areas:
   1. Comply with Section 23 08 00 – Commissioning HVAC.
2. Ductwork Systems (Outdoor, Supply, Return, Exhaust, Relief, etc.): Verify proper installation of duct fittings, balancing devices, access doors, turning vanes, transitions, flexible connections, etc.
3. Piping Systems (Chilled Water, Condenser Water, Make-up Water, etc.): Verify the proper installation of pipe fittings, balancing valves, Venturis, flexible connections, gage cocks, pressure gages, thermometers, etc.
4. HVAC Equipment: Verify that manufacturer, model number, power supply, motor horsepower, accessories, etc. are per approved shop drawings.
5. When shop drawings of different manufacturer than scheduled in project documents are approved, data per shop drawings shall be listed in TAB report as design data.
6. Verify that motor starter's overload protectors are correct for motor's rated load amperes.
7. Installation of HVAC Equipment: Verify that installation is per project documents and/or approved shop drawings.
8. Hydronic System Commissioning: Monitor cleaning, flushing, filling and chemical treatment.
9. Observe water samples being drawn and labeled. Advise Owner's Project Manager if system commissioning is acceptable.
10. Obtain copy of chemical treatment test report and provide same in TAB report.
11. Distribute inspection schedule per Distribution List in Para. 3.2.C.
12. Distribute pre-TAB punch lists per the Distribution List in Para. 3.2.B.
13. Obtain complete set of approved HVAC shop drawings, addenda, architect supplement instructions, change orders, etc. from the Mechanical Contractor,
14. TAB vendor is responsible for scheduling meetings with Mechanical Contractor to obtain construction schedules for pre-TAB inspections and to resolve TAB punch items.
15. Verify automatic temperature controls are operational, equipment and duct access panels are securely closed, isolation and balancing valves are operational, ceilings, plenums, windows, and doors are closed or sealed for testing.

3.2 DISTRIBUTION LIST

A. Design Review Reports shall be emailed to following:
   1. Design Mechanical Engineer.
   2. Building Department.
   3. Design Architect.
   4. Owner's Project Manager.
   5. Owner's Commissioning HVAC Agent.
B. Commissioning HVAC Equipment, Pre-TAB Inspection Schedule and TAB Work Schedule:
   1. Owner's Project Manager.
   2. Owner's TAB.
   3. Owner's Commissioning HVAC Agent. Information shall be used to verify Contractor's compliance with Contract Documents.
   4. Design Architect.
   5. Design Mechanical Engineer.
   6. Provide copy of schedules to General Contractor/CM.
   7. Provide copy of schedules to Mechanical Contractor.
C. TAB Inspection Punch Lists and TAB Work Punch Lists:
   1. Mechanical Contractor.
   2. Owner's Project Manager. This information shall be used to verify the compliance by the TAB vendor with the TAB Contract.
   3. Design Mechanical Engineer.
   4. Design Architect.
   5. General Contractor/CM.
D. TAB Report, Monthly Status Reports and Revised TAB Test Reports:
   1. Owner's Project Manager. Provide six (6) copies of Final TAB Report (one copy of other reports).
   2. Building Department.
   3. Design Architect.
   4. Design Mechanical Engineer.
   5. General Contractor/CM.
   6. Mechanical Contractor.

3.3 TAB WORK

A. Coordinate TAB work schedule with Mechanical Contractor and provide written TAB work schedule. Note Substantial Completion and Final Completion milestones on TAB schedule.
B. For each visit to project site, TAB vendor shall sign in and out either at District's field office or, if field office does not exist, at District's Facilities Administrative office.
C. Provide written punch lists summarizing non-complying items as soon as they are discovered, but at least weekly. Punch lists shall clearly delineate responsible party (Mechanical Contractor or Design Mechanical Engineer) for each punch item.
D. Punch items, relative to system performance, shall be documented by providing TAB test reports and plotting measured data on equipment performance curves. Punch items are responsibility of Design Mechanical Engineer if HVAC systems have been installed per project documents and approved shop drawings.

E. TAB vendor shall coordinate with responsible party (Mechanical Contractor or Design Mechanical Engineer) to resolve punch items. However, resolution that modifies the HVAC system design, operational modes or performance levels shall be approved, in writing, by Owner's Project Manager.
F. After written notification of punch list repairs by Mechanical Contractor, TAB vendor shall provide one re-TAB per item within contract. Additional TAB fees due to repeat TAB punch items and retesting are responsibility of Mechanical Contractor.
G. TAB vendor shall be responsible to clearly document additional fees and to provide documentation to Owner's Project Manager. Documentation that is unclear, inaccurate, or untimely will not be accepted.
H. Provide personnel on continuous basis in order to complete TAB work in timely manner.
I. Every effort shall be made to complete TAB work before District occupancy and/or Substantial Completion. After Owner's occupancy, access to site may be restricted. Work schedules shall be modified accordingly. Work after normal business hours shall be coordinated with Owner's Project Manager.
J. Immediately inform Owner's Project Manager of work progress, work schedules and potential problem areas, which may delay timely completion of TAB work.
K. Distribute TAB work schedule and punch lists per Distribution List in Para. 3.02.
L. TAB vendor is responsible for scheduling meetings with appropriate parties to obtain construction schedules for TAB work and to resolve TAB punch items.
M. Data for non-complying systems shall be provided so that affected parties are working with same information to outstanding punch items.
N. Coordinate with Mechanical Contractor and Design Mechanical Engineer in order to resolve TAB punch items and provide written monthly status report.
O. Provide revised TAB test reports for incorporation into TAB report within 15 calendar days after outstanding punch items have been resolved.
P. Punch items shall be resolved, and TAB report shall be completed prior to Final Completion.
Q. Distribute TAB report, monthly status reports and revised TAB test reports per the Distribution List in Para.3.02.

3.4 VERIFICATION OF MEASUREMENTS

A. Owner shall have option of requesting verification of measurements in TAB report. Measurement verification shall involve 10% or less of measurements in TAB report.
B. Owner shall select measurements to be verified and TAB Contractor shall retest, in presence of the Owner's Project Manager, those measurements.
C. To pass measurement verification, at least 90% of those measurements shall be within acceptable tolerance of Design value.
D. Measurements that are out-of-tolerance shall be re-balanced to within acceptable tolerances.
E. If measurement verification fails, TAB Contractor shall rebalance systems at no additional cost to District. Measurement verification shall be repeated with another set of measurements that shall be selected by Owner.
F. TAB Contractor shall provide revised TAB test reports for the re-balanced systems within 15 calendar days of measurement verification. Distribute revised TAB test reports according to Distribution Lists in Para. 3.2.

3.5 TAB REPORT REQUIREMENTS

A. Publish TAB report within 15 calendar days after Substantial Completion. Publishing of TAB report shall not be delayed for unresolved punch items.
B. Distribute TAB report, monthly status reports and revised TAB test reports per Distribution List in Para. 3.2.
B. Provide reports in hard cover, letter size, 3-ring binders with identification on front and binder. Include set of reduced HVAC floor plans with air outlets and equipment identified to correspond with test reports. Number pages, i.e., Page X of XX.
C. Provide report per following format:
    1. Title Page.
    2. Certification Page.
    3. Table of Contents.
    4. Summary of Non-complying Systems (ALL ITEMS).
        a) Itemize outstanding TAB punch items.
        b) Itemize out-of-tolerance parameters from each test report. (NO EXCEPTIONS).
    5. Instrument Calibration Report.
    6. Test reports for each building.
    7. Test reports for the central cooling/heating plant.
    8. Test reports for the chemical treatment of the hydronic systems.
    9. Reduced set of HVAC floor plans (NO EXCEPTIONS).
D. Central Station Air Handler Units (AHU).
    1. Air handler unit CFM may be determined either by totaling individual CFMs from supply air grilles or by supply air duct traverse.
    2. If design CFM (within -5%) cannot be achieved, air handler unit CFM shall be verified by supply air duct traverse; return air duct traverse is not acceptable.
    3. When duct traverse is utilized, provide Duct Traverse Report in TAB Report and note traverse locations on reduced set of HVAC floor plans.
    4. Adjust fan RPM until either design CFM (-5%/+10%) is obtained or motor is at rated FLA. Do not use motor service factor.
    5. Plot TAB data on manufacturer's fan performance curve. Include fan performance curve in TAB report. The following information shall be provided:
        a) Plot design point
        b) Label data point DESIGN POINT.
        c) Plot measured CFM and RPM. Label data point OPERATING POINT.
        d) Plot system resistance curve.
    6. If design CFM (-5%/+10%) cannot be obtained, provide specific recommendations in order to obtain design CFM.
    7. Provide measured static pressure data at the following locations:
        a) Filter inlet pressure.
        b) Filter delta pressure.
        c) Coil (cooling/heating/reheat) delta pressure.
        d) Fan suction pressure.

e) Fan discharge pressure. Determine value from fan performance curve based on CFM and RPM; measured values are not reliable.
f) Provide Air Handler Unit Test Report.
g) Provide Coil Test Report. Plot actual data on psychrometric chart and include psychrometric chart in TAB report. Provided following data:
(1) Plot outdoor air DB/WB temperature. Label data point (OA).
(2) Plot return air DB/WB temperature. Label data point (RA).
(3) Plot coil-entering air DB/WB temperature. Label data point (CEA).
(4) Plot coil-leaving air DB/WB temperature. Label data point (CLA). (5) For draw-thru AHUs, the location of coil leaving air temperatures is after the coil but before the fan.
(5) Measured data, when plotted on a psychrometric chart, shall represent consistent HVAC system processes. Inconsistent measured data shall be redone.
h) Provide Air Outlet Test Report. Note any outlet not within ± 10% of design CFM and outlet(s) with objectionable noise level.
i) Define area served using both drawing room number and actual room number.
j) For variable air volume systems, provide Variable Air Volume Box Test Report.

8. Provide test reports and data in following order:
a) Air Handler Unit Test Report.
b) Fan Performance Curve.
c) Coil Test Report.
d) Psychrometric Chart.
e) Air Outlet Test Report.
f) Variable Air Volume Box Test Report.
g) Duct Traverse Reports.

3.6 FANS (EXHAUST)

A. Provide test reports in following order:
1. Fan Test Report.
2. Air Outlet Test Report: Provide for fans with multiple supply and/or exhaust grilles. Note outlet(s) with objectionable noise level.

B. Adjust fan RPM until either design CFM (-5%/+10%) is obtained or motor is at rated FLA. Do not use motor service factor.
C. If design CFM (-5%/+10%) cannot be obtained, provide fan suction and discharge static pressures to determine external static pressure.
D. If design CFM (-5%/+10%) cannot be obtained, provide specific recommendations in order to obtain design CFM.

3.7 PUMPS (PRIMARY CHILLED WATER)

A. Determine pump head using pump flange gage taps in order for TAB data to correlate with the pump performance curve.
B. Determine GPM using venturi. Provide venturi diameter and differential head.
C. Adjust system-balancing valves (coils and pump discharge) until either design GPM (-5%/+10%) is obtained or motor is at rated FLA. Do not use motor service factor.

D. Plot TAB data on manufacturer's pump performance curve. Include performance curve in TAB report. Provide following information:
   1. Plot valve shut head.
   2. Plot valve open head and GPM. Verify motor will not overload.
   3. Plot impeller curve.
   4. Plot final operating head and GPM. Label data point OPERATING POINT.
   5. Plot design head and GPM. Label data point DESIGN POINT.
   6. Plot system-operating curve.
E. If design GPM (-5%/+10%) cannot be obtained, provide specific recommendations in order to obtain design GPM.
F. Provide test reports and data in the following order:
   1. Pump Test Report.
   2. Pump Performance Curve.
G. Water Coils: Adjust individual coils to within ± 10% of design GPM, as long as total system water flow is within -5%/+10% of design GPM.
H. Noise
   1. Provide Acoustical Test Report (8.10.X) for those areas that, during TAB work, appear to have an objectionable noise level.
   2. Plot octave band acoustical data on NC curves in order to identify problem frequencies and to quantify the level of attenuation required.
   3. For student occupied areas, NC levels shall be NC35 or less.
I. Venturis: Provide calibration charts (GPM versus differential head loss) in TAB report.
J. Balancing Valves and Combination Balancing/Shutoff Valves
   1. Valves used to set GPM shall have adjustable memory stops.
   2. Permanently mark the final position of each memory stop.
K. Volume Dampers.
   1. Dampers used to set CFM shall have locking quadrants.
   2. Permanently mark the final position of each locking quadrant.
   3. For externally insulated ducts, all volume dampers shall have 2" high standoffs for locking quadrants.

3.8 REPORT FORMS

A. Each test report shall bear name of person who recorded data, date when data was recorded, and licensed professional seal of supervisor.
B. Test reports shall be computer generated and shall provide all data listed, as well as any required data not listed.
C. Title Page shall include following information:
   1. Date.
   2. Project's name and address.
   3. Project number (SBMC).
   4. Architect's name and address.
   5. Design Mechanical Engineer's name and address.
   6. General Contractor's name and address.
   7. Mechanical Contractor's name and address.
   8. TAB Contractor's name, address and phone number.
D. Certification Page
   1. Project's name and address.
   2. Certification statement.

3. TAB Contractor's name.
4. TAB Supervisor's name.
5. Certification number.
6. Date.
7. Seal and signature of TAB Supervisor.

E. Instrument Calibration Report
   1. Instrument.
   2. Manufacturer.
   3. Model number.
   4. Serial number.
   5. Range.
   6. Calibration date.

F. Central Station Air Handler Unit Test Report
   1. Air Handler Unit Data.
      a. Drawing Unit Symbol and Number.
      b. Manufacturer, model number and serial Number.
      c. Wheel type: Forward curve (FC), airfoil (AF), backward incline (BI).
      d. Wheel diameter (IN).
      e. Fan arrangement: Draw thru (DT), blow thru (BT).
      f. Fan discharge: Upblast front (UBF), upblast rear (UBR), top horizontal (TH), bottom horizontal (BH).
      g. Number of fan belts, manufacturer, and size.
      h. Number of filters, type, and size.
      i. Note if the filter pull strip and spacers are installed. If there are obvious leak paths around filters, AHU is not acceptable until leaks are repaired.
   2. Motor Data.
      a. Manufacturer.
      b. Frame size.
      c. Nameplate HP, volts, amps, phase, RPM, and service factor.
      d. Starter size and overload element capacity in amps.
   3. Performance Data (Design and Actual).
      a. Supply air CFM.
      b. Outside air CFM.
      c. Fan RPM.
      d. Motor volts T1-T2, T2-T3, T3-T1.
      e. Motor FLA T1, T1, T3.
      f. Fan total static pressure, IN WC.
      g. Fan suction static pressure, IN WC (Actual).
      h. Fan discharge static pressure, IN WC (Actual). Refer to Article 8.2, A.5.e.
      i. Filter static pressure loss, IN WC.
      j. Cooling coil static pressure loss, IN WC.
      k. Heating coil static pressure loss, IN WC.
      l. Reheat coil static pressure loss, IN WC.
      m. AHU casing static pressure loss, IN WC.
      n. External static pressure loss, IN WC.
      o. Inlet guide vane position at design CFM (Actual).
      p. Variable speed drive output at design CFM (Actual).
      q. Note any abnormal vibration.

G. Coil Test Report.
   1. Coil Data.
      a. AHU Drawing Unit Symbol and Number.
      b. Number of rows and fins per foot.
      c. Coil CFM.
      d. Face area, SF.
      e. Face velocity, FPM.
   2. Air-side Performance Data (Design and Actual).
      a. Outside air CFM.
      b. Outside air DB and WB temperatures, °F.
      c. Return air CFM.
      d. Return air DB and WB temperatures, °F.
      e. Coil CFM.
      f. Coil entering air DB and WB temperatures, °F.
      g. Coil leaving air DB and WB temperatures, °F.
      h. Calculate coil capacity, BTUH (=4.5*CFM*DH).
   3. Water-side Performance Data (Design and Actual).
      a. Coil GPM.
      b. Coil entering water temperature, °F.
      c. Coil leaving water temperature, °F.
      d. Coil head loss, FT (=2.31*PSID).
      e. Venturi diameter, IN (Actual).
      f. Venturi differential head, IN WC (Actual).
      g. Calculate coil capacity, BTUH (=500*GPM*DT).

H. Fan (Exhaust)Test Report.
   1. Fan Data.
      a) Drawing Unit Symbol and Number.
      b) Manufacturer, model number and serial number.
      c) Type: Ceiling, inline, roof, wall.
      d) Wheel type: Forward curve (FC), airfoil (AF), backward incline (BI).
      e) Wheel diameter, IN.
      f) Number of belts, manufacturer, and size.
   2. Motor Data.
      a) Manufacturer.
      b) Frame size.
      c) Nameplate HP, volts, amps, phase, RPM, and service factor.
      d) Starter size and overload element capacity, amps.
   3. Performance Data (Design and Actual).
      a) CFM.
      b) Fan RPM.
      c) Fan suction static pressure, IN WC (Actual).
      d) Fan discharge static pressure, IN WC (Actual).
      e) Fan total static pressure, IN WC.
      f) Motor volts T1-T2, T2-T3, T3-T1.
      g) Motor FLA T1, T2, T3.
      h) Note any abnormal vibration.

E. Air Outlet Test Report.
   1. Outlet Data.
      a) Drawing Unit Symbol and Number.
      b) Manufacturer.

c) Drawing and actual room numbers (both room numbers).
d) Type: Ceiling diffuser (CD), sidewall grille (SWG), exhaust grille (EG), return grille (RG), transfer grille (TG), etc.
e) Size, IN.

2. Performance Data.
a) Design CFM.
b) Actual CFM.
c) Note all outlets that are not balanced within ±10% of design. (Actual CFM- Design CFM)/ Design CFM) *100.
d) Note outlets with an objectionable noise level greater than 35 db in classrooms.

F. Duct Heater Test Report.
1. Unit Data.
a) Drawing Unit Symbol and Number.
b) Manufacturer, model number and serial number.
c) Design KW, volts, amps, phase, and number of steps.
2. Performance Data (Actual).
a) Volts T1-T2, T2-T3, T3-T1.
b) Amps T1, T2, T3.

G. Unit Ventilator/Fan Coil Unit Test Report.
1. Unit Data.
a) Drawing Unit Symbol and Number.
b) Manufacturer, model number and serial number.
c) Control valve: 2-way or 3-way, 2-position or modulating.
d) Fan motor nameplate HP, volts, amps, phase, RPM, and service factor.
e) Electric heater KW, volts, amps, phase, and number of steps.
2. Performance Data (Design and Actual).
a) Outside air CFM.
b) Fan motor volts T1-T2, T2-T3, T3-T1.
c) Fan motor FLA T1, T2, T3.
d) Coil GPM.
e) Coil entering water temperature, °F.
f) Coil leaving water temperature, °F.
g) Venturi size, IN (Actual).
h) Venturi differential head, IN WC (Actual).
i) Heater volts T1-T2, T2-T3, T3-T1.
j) Heater amps T1, T2, T3.

H. Pump Test Report.
1. Pump Data.
a) Drawing Unit Symbol and Number.
b) Manufacturer, model number and serial number.
c) Design GPM, head, RPM, and impeller diameter.
d) Required NPSH.
e) Seal type.
2. Motor Data.
a) Manufacturer.
b) Frame size.
c) Nameplate HP, volts, amps, phase, RPM, and service factor.
d) Starter size and overload element capacity, amps.

3. Performance Data.
    a) Valve shut differential head, FT.
    b) Actual impeller diameter, IN.
    c) Valve open differential head FT. Verify motor will not overload.
    d) Valve open GPM.
    e) Final suction pressure, PSIG.
    f) Final discharge pressure, PSIG.
    g) Final pump head, FT (=2.31*PSIG).
    h) Final pump GPM.
    i) Motor volts T1-T2, T2-T3, T3-T1.
    j) Motor amps T1, T2, T3.
    k) Note any abnormal vibration.

I. Duct Traverse Test Report.
1. Duct Data.
    a) System/Branch.
    b) Size, IN.
    c) Area, SF.
    d) Design airflow, CFM.
    e) Design velocity, FPM.
2. Traverse Data.
    a) Duct static pressure, IN WC.
    b) Air temperature, °F.
    c) Traverse position, IN.
    d) Traverse velocity pressure, IN WC.
    e) Traverse velocity, FPM.
    f) Average duct velocity, FPM.
    g) Measured airflow, CFM.

J. Variable Air Volume Box Test Report.
1. Box Data.
    a) Drawing Unit Symbol and Number.
    b) Manufacturer, model number and serial number.
    c) Fan HP, volts, amps, and phase.
    d) Heater KW, volts, amps, phase, and number of steps.
2. Performance Data (Design and Actual).
    a) Cooling CFM: Primary maximum/minimum.
    b) Heating CFM: Primary minimum/secondary/total.
    c) Heater volts T1-T2, T2-T3, T3-T1.
    d) Heater amps T1, T2, T3.
    e) Fan volts T1-T2.
    f) Fan amps T1.

K. Condensing Unit Test Report.
1. Unit Data.
    a) Drawing Unit Symbol and Number.
    b) Manufacturer, model number and serial number.
    c) Number of compressors/circuits.
2. Compressor Data.
    a) Ambient temperature, °F.
    b) Compressor volts T1-T2, T2-T3, T3-T1.
    c) Compressor amps T1, T2, T3.

3. Condenser Fan Data.
   a) Number of fans.
   b) Fan HP, volts, amps, phase, and RPM.

END OF SECTION

SECTION 23 07 00
HVAC INSULATION

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Duct Systems Insulation.
B. Piping Systems Insulation.
C. Equipment Insulation.
D. Underground Pipe Insulation.
E. Cold Pipe Hanger Support Blocks.
F. Accessories.

1.3 QUALITY ASSURANCE

A. All products within the conditioned air stream or active plenums shall comply with the NFPA 90A Flame/Smoke rating of 25/50 and comply with UL 181 erosion limitations. Fire hazard ratings shall be as determined by NFPA-255, "Method of Test of Surface Burning Characteristics of Building Materials" - ASTM E84 or UL 723.
B. All adhesives, cements, finishes, jackets, etc., shall be UL listed or labeled for use as applied to insulation and designed specifically for use in the installation.
C. All insulation shall be installed in accordance with National Commercial & Industrial Insulation Standards (NCIA).
D. Kitchen hood exhaust duct fireproofing system shall have specific acceptance by ICBO, and SBCCI. Material shall be non-hazardous and contain no asbestos or toxic materials. Suitable for 2-hour fire rating.

1.4 SUBMITTALS

A. Submit schedule indicating type of insulation, thickness, vapor barrier or coating by system and size.
B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
C. Submit details of insulated removable covers using the actual equipment dimensions, concrete base sizes and piping arrangements.
D. Submit in accordance with Division 1 requirements.

1.5 GENERAL REQUIREMENTS

A. Factory-applied insulation is specified under the applicable equipment Section of these specifications. It is listed here for reference only.

B. Acoustical duct liner is specified under Section 23 31 01 - Shop Fabricated Ductwork. It is listed here for reference only.
C. Packages and standard containers of materials shall be delivered unopened to job site and shall have the manufacturer's label attached giving a complete description of the material.

1.6 DEFINITIONS

A. The term "exposed" means exposed to view in finished spaces, in equipment rooms, in fan rooms, in closets, in utility corridors, in tunnels, on roof, in storage rooms, and in other spaces as indicated.
B. The term "concealed" means concealed from view, and includes all spaces not defined as exposed.
C. The term "unconditioned" space shall mean all places where the temperature surrounding the pipe or duct has not been conditioned consistent with conditioned spaces, and shall include mechanical equipment rooms, non-active ceiling plenums, and non-accessible chases. This term shall also include conditioned spaces where the humidity levels are allowed to rise above 65% RH.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fiberglass Insulation:
   1. Owens-Corning Fiberglas
   2. Knauf Fiberglass
   3. CertainTeed
   4. Johns Manville
B. Closed Cell Elastomeric Insulation:
   1. Armacell LLC
   2. Johns Manville
   3. Rubatex
C. Foamglass Insulation:
   1. Pittsburgh Corning
   2. Cell-U-Foam Corp.

2.2 DUCT INSULATION AND FIREPROOFING REQUIREMENTS

A. Refer to the drawings for insulation size and type requirements. Please contact the engineer prior to bid with any questions regarding the insulation requirements.

2.3 PIPE INSULATION REQUIREMENTS

A. Refer to Section 23 02 00 for PVC jacket color specifications requirements on all piping exposed or concealed.

2.4 MATERIALS

A. Duct Insulation: Blanket Fiberglass: Flexible fibrous glass, flame retardant factory laminated foil-skrim-kraft (FSK) vapor barrier, 2" stapling flange, maximum vapor permeance of .02 perm/in., minimum density of 1.5 lb/cf, maximum conductivity per 1" thickness of .28 at 75°F mean temperature. Based on Knauf Duct Wrap.

B. Pipe Insulation (to 450-deg F):
   1. Rigid Fiberglass: Resin bonded fibrous glass, flame retardant, factory applied all service jacket vapor barrier with self-sealing pressure sensitive lap joints, molded to accommodate pipe, maximum vapor permeance of .02 perm/in. and a puncture resistance of 50 units, minimum density 4.0 lb/cf, maximum conductivity per 1" thickness of .23 at 75°F, .29 at 200°F and .43 at 400°F mean temperature. Based on Knauf Pipe Insulation.
   2. Closed Cell Elastomeric (Small Pipe Sizes up to 5 Inches): Flexible, elastomeric, closed cellular, tubular molded to accommodate piping, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non-absorbent, ozone resistant, minimum density of 4 lb/cf, maximum conductivity per 1" thickness of .27 at 75°F mean temperature. Based on Armacell LLC AP Armaflex and Self-seal Armaflex 2000.
   3. Closed Cell Elastomeric (Large Pipe Sizes, 6" and Larger): Sheet type, flexible, elastomeric, closed cellular, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non-absorbent, ozone resistant, minimum density of 4 lb/cf, maximum conductivity per 1" thickness of 2.7 at 75°F mean temperature. Based on Armacell LLC Armaflex II.
   4. Foamglas: Rigid, preformed sections of 100% rigid cellular glass dimensionally complying with ASTM C585 standards, non-absorptive of moisture after immersion, water vapor permeability 0.00 perm/in. impervious to common acids (except hydrofluoric),
      non-combustible, 100 PSI compressive strength when capped with hot asphalt, 8.5 #/cu.ft. density, thermal conductivity 0.33 BTU-In./Hr./Sq.Ft./F @ 50°F. Based on Pittsburgh Corning Foamglas.

C. Equipment Insulation:
   1. Closed Cell Elastomeric Sheet type, flexible, elastomeric, closed cellular, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non-absorbent, ozone resistant, minimum density of 6 lb/cf, maximum conductivity per 1" thickness of .27 at 75°F mean temperature. Based on Armacell LLC Armaflex II.
   2. Foamglas: Sections of 100% rigid cellular glass, non-absorptive of moisture after immersion, water vapor permeability 0.00 perm/in., impervious to common acids (except hydrofluoric), non-combustible, 100 PSI compressive strength when capped with hot asphalt, 8.5 #/cu.ft. density, thermal conductivity 0.32 BTU-In/Hr./Sq.Ft./F @ 50°F. Based on Pittsburgh Corning Foamglas.

D. Insulation Accessories: Aluminum Pipe Jacket and Fitting Covers: Jacket shall be 0.016" thick (26 gauge) embossed aluminum, sized to provide a 2" (min.) lap joint both longitudinally and circumferentially, with 3/4" min. wide x 0.015" min. (30 gauge) thick draw bands. Fitting covers shall be aluminum, 0.025" (22 gauge), min., thickness.

E. Cold Pipe Hanger Support Blocks: Lightweight, rigid, closed cell material having 100 lb/sq.in. compressive strength when capped with hot asphalt according to ASTM C240. Based on Pittsburgh Corning Foamglas.
F. Accessories:
   1. Aluminum Pipe Jacket and Fitting Covers: Jacket .016" thick (28 ga.) embossed aluminum sized to provide a minimum 2" lap joint both longitudinal and circumferentially, minimum 3/4-inch x .015-inch thick (30 ga) draw bands. Covers .024 inch thick.
   2. PVC pipe jacket and fitting covers used with insulation for pipe, elbows, tees, couplings, 25/50 flame/smoke ratings, suitable for temperatures to 500°F.
   3. Glass Cloth Pipe, Duct and Equipment Jacket: Glass lagging cloth, 8 oz/sy treated weight. Secure with elastomeric insulating adhesive on elastomeric insulation, for fiberglass insulation use appropriate mastic finish as recommended by the insulation manufacturer with the perm rating of the mastic equal to or less than that of the insulation it is sealing.
   4. Corner angles shall be minimum 28-gauge, 1 inch by 1 inch aluminum adhered to 2-inch by 2-inch heavy kraft paper.
   5. Glass tape shall be a minimum density of 1.6 ounces per square yard, 4 inch wide with a 10 x 10 thread count per inch of width. Glass cloth shall be untreated.
   6. Staples shall be outward clinching type, Type 304 or 316 stainless steel in accord with ASTM A 167 or Monel® coated.
   7. Wire shall be soft annealed galvanized, or copper, 16 gauge, or nickel copper alloy.
   8. Closed cell elastomeric insulated finish shall be a white water based flexible, acrylic latex enamel equal to WB Armaflex finish.
   9. Insulation Tape: Closed cell elastomeric insulation: 2" wide x 1/8" thick.
   10. Elastomeric Insulation Adhesive: Air drying contact adhesive for securing sheets to flat or curved metal surfaces and joining seams and butt joints of elastomeric insulation. Suitable for temperatures to 180□F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method.
   11. Vapor Barrier Mastic: Air drying flexible water-based mastic used for applying a vapor barrier joint with glass cloth at insulation joints. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Maximum Perm rating of 0.08, Childers Products Company, Inc. CP-35 Chil Therm® WB, Foster Products Corp. Product Data 30-80 Foster Vapor Safe® Coating, Marathon Industries, Inc. 590 LO-PERM, Richard's Paint Manufacturing CO., Inc. VBM-4, Vimasco Corp. 749 Vapor-Blok, or equal.
   12. Acrylic Latex Finish and Sealers:
      a. Elastomeric Insulations: Air drying flexible water-based finish used for finishing flexible elastomeric insulation. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Armacell LLC WB Armaflex finish.

b. Foamglass Insulation: Air drying flexible water-based sealer used for applying a vapor barrier seal over microscopic cracks that develop in the insulation. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Maximum Perm rating of 0.08, Childers Products Company, Inc. CP-35 Chil Therm® WB, Foster Products Corp. Product Data 30-80 Foster Vapor Safe® Coating, Marathon Industries, Inc. 590 LO-PERM, Richard's Paint Manufacturing CO., Inc. VBM-4, Vimasco Corp. 749 Vapor-Blok, or equal.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install all insulation in strict accordance with the manufacturers written installation instructions.
B. Provide a PVC jacket on all exposed rain leader piping, including but not limited to the Gym.
C. All insulation work shall be performed by skilled mechanics regularly engaged in the insulation trade.
D. Properly coordinate the insulation work with the other trades so that installation is performed with a minimum of conflict.
E. Insulation shall not be applied on any piping or duct system requiring testing until testing is completed and approved by Engineer.
F. Insulation shall not be applied until all systems are clean, dry, free of dirt, dust, or grease.
G. The finished installation shall present a neat and acceptable appearance which includes but is not limited to: all jackets smooth, all vapor barriers sealed properly, no evidence of "ballooning" of the jackets, or sagging insulation, all valves, dampers, gauges, unions, etc. accessible. The Engineer shall be the final judge of acceptance of workmanship.
H. All equipment nameplates on hot equipment shall be left uncovered. All equipment nameplates on cold equipment shall have a removable section sized to expose the nameplate. This section shall be clearly marked "NAMEPLATE".
I. If proper maintenance procedures require access to the insulated equipment removable panels, sections or covers shall be provided to accomplish this. These access devices shall be constructed in a manner to assure easy access and sturdy construction. The contractor shall assume the responsibility to coordinate all equipment requiring insulation to be either factory or field insulated.
J. Insulation and accessories shall be applied only at suitable application temperature and conditions as recommended by the manufacturer. Do not apply insulation to any surface while it is wet.
K. Insulation shall be protected from moisture and weather during storage and installation.
L. Insulation which has sustained moisture damage, torn jackets, or other damage due to improper storage or other reasons shall not be used. If evidence of this is sighted the Owner's representative reserves the right to require the insulating contractor to remove any and/or all insulation until the Engineer is satisfied that there is no longer any inferior insulation installed on this project.

M. Insulation, fabric, and jacketing shall be protected from damage during construction. Damage by the insulator shall be repaired without cost to the Owner. Damage by others shall be reported in writing to the contractor.
N. The insulation subcontractor is responsible for proper material storage at the work site.
O. Work performed prior to receipt of approved documents or submittals, which later proves to be incorrect or inappropriate, shall be promptly replaced by the contractor without cost to the purchaser.
P. Insulation shall not be installed until adequate access and clearances at control mechanisms, dampers, sleeves, columns, and walls have been provided.
Q. All insulation at handholes, access doors or other openings, and adjacent to flanges and valves shall be neatly finished where exposed to view.
R. All materials, accessories and methods of installation and fabrication are subject to the Owner's Representatives inspection and approval during any phase of the work.
S. The insulation subcontractor shall prevent the accumulation of insulation debris in the buildings and on the premises of the Owner.
T. The insulation subcontractor shall be responsible for his own safety program at the work site and shall provide instruction on safe practices for his workers assigned to the project. All employees are subject to the work rules at the job site.
U. The insulation subcontractor shall familiarize himself with the progress and execution of the job and notify the proper parties of interferences and any problems with the proper installation of his materials.

3.2 INSTALLATION

A. Duct Insulation:
    1. General:
        a. Insulate or internally line all flexible duct connectors equal to or greater than adjacent insulation thickness.
        b. The tops of all diffusers shall be insulated same as connecting ductwork to prevent condensation.
        c. Duct insulation at fire dampers shall be extended over supporting angle iron and sealed to wall.
    2. Blanket Fiberglass Insulation:
        a. Insulation shall be tightly wrapped on the ductwork with all circumferential joints butted and longitudinal joints lapped 2 inches and stapled. Joints shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth. Additionally, secure insulation to bottom of rectangular ducts over 24 inches wide with weld pins at no more than 18-inches on center.
        b. Insulation shall be butted with facing overlapping all joints shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2-inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth. Breaks, punctures, pin penetrations in facing shall be sealed with vapor barrier tape and vapor barrier adhesive.

3. Rigid Fiberglass Insulation:
    a. Use boards in largest possible size to minimize seams. Do not use "scraps".
    b. Shall be installed in all non-public exposed areas up to 10’-0” above finished floor.
    c. Provide corner angles where insulation is subject to harm.
    d. All fasteners shall be non-corroding.
    e. The insulation shall be applied by use of cup head weld pins. Such fasteners shall be spaced in accordance with NCIA recommendations, where NCIA standards do not address exact dimensions, cup head weld pins shall be spaced on 12" centers. Pin caps shall be covered with a round vapor seal patch that matches the jacket on the ASJ board. On cold ducts, these shall be coated so as to not cause condensation.
    f. Ducts having sharp bends shall have the insulation scored as required to conform to the curved surfaces to provide a neat and acceptable appearance when finished.
    g. Insulation edges and joints shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth.
    h. Generally, rigid fiberglass material will only be used in finished or exposed areas, and it is intended that the finish present a neat and uniform appearance as to color and workmanship.
    i. In finished areas, molded glass fiber insulation shall be used to insulate round ducts where commercially available sizes can be used.
    j. Fittings on round ducts in finished areas shall be covered with pre-molded fiberglass fitting insulators equal to Insul-Coustic where sizes are available. For sizes where pre-molded fittings are not available use miter-cut segments of molded pipe insulation, wired in place, with all joints sealed with adhesive and smoothed out with a coat of insulating cement.
    k. On cold ducts, the fittings shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth. Hot ducts shall be finished in a similar manner, except the mastic need not be of the vapor barrier type.

B. Pipe Insulation:
1. General:
    a. All locations where the insulated surface is supported by hangers, the insulation shall be protected by shields or saddles properly skimmed to maintain a smooth outer sur- face, and proper insulation thickness. Chilled water piping, 3" and over shall have a section of Foamglas insulation installed between the pipe and shield. 3 and 4" to be 12" long, 5" and 6" to be 18" long and 8" and over, 24" long. If the possibility exists that the hanger may conduct the temperature of the conveyed medium and thus cause condensation or personal injury due to high temperature, the hanger shall also be insulated. Joints between Foamglas and pipe insulation shall be properly sealed.

b. All devices connected to or in line with the piping system shall be insulated greater than or equal to the connecting piping. This includes but is not limited to valves, air separators, expansion tanks, control valves, control devices, gauge connections, thermometer stems, chemical feed equipment, piping flexible connectors, etc. This is particularly important on ice water and refrigerant lines.
c. The insulation at threaded unions in steam and hot water piping shall be tapered and terminated with cement and glass lagging cloth and lagging adhesives.
d. Insulate exterior surfaces of all anchors and guides for chilled water and dual temperature piping systems.
e. A complete moisture and vapor barrier shall be installed wherever insulation is penetrated by hangers or other projections through insulation and in contact with cold surfaces for which a vapor seal is specified.
f. Cover fittings, flanges, unions, valves, anchors, and accessories with pre-molded or segmented insulation of the same thickness and material as the adjoining pipe insulation. Where nesting size insulation is used overlap pipe insulation 2 inches or one pipe diameter. Fill voids with insulating cement and trowel smooth. Elbows shall have not less than 3 segments per elbow. Secure insulation with wire or tape until finish is applied. Blanket inserts in lieu of pre-molded or segmented insulation is not allowed. Cover fittings with preformed PVC fitting covers.
g. Wrap all pressure gauge taps, thermometer wells and all other penetrations through insulation with closed cell insulation tape so as to prevent condensation.
h. Seal all raw edges of insulation.
i. For piping supported by hangers outdoors, apply a rain shield to prevent water entry.

2. Rigid Fiberglass:
   a. Provide PVC fitting covers for all fittings.
   b. Align all jacket seams.
   c. Assure all vapor barriers are properly sealed.
   d. Provide PVC jacket over all exposed insulation in the equipment room.
   e. All corner angles below 6’-10” shall have padded insulation and be marked with yellow stripes.
3. Closed Cell Elastomeric:
   a. All joints shall be sealed with adhesives.
   b. Where the thickness is to be obtained by use of two layers of insulation, install with staggered joints.
   c. Finish:
      1) Concealed Indoors: No additional finish.
      2) Exposed Indoors: Provide PVC jacket over all insulation.
      3) Concealed Indoors: Provide PVC jacket over fittings fabricated from insulation sections or sheet.
      4) Outdoors: Provide aluminum pipe jacket.
4. Foamglas:
   a. All joints, both longitudinal and circumferential shall be sealed with a vapor barrier mastic.

b. Thickness shown for refrigeration pipe to be obtained by use of two layers of insulation with staggered joints.
c. Finish:
1) Exposed Indoors: Provide PVC jacket over all insulation that shall be sealed with an acrylic latex finish.
2) Concealed: Provide PVC jacket over fittings fabricated from insulation sections or sheet. Provide ASJ over all other.
3) Exposed Outdoors: Provide acrylic latex finish and aluminum pipe jacket.

C. Equipment Insulation:
1. Vessel and Large Pipe Insulation:
a. Insulation shall be of the same material as the piping which serves it, and it shall be layered to obtain the required thickness. Maximum of 1-1/2" thick per layer.
b. All joints shall be staggered to avoid thermal gaps.
c. Sheet size shall be as large as possible to minimize seams. Do not use "scraps".
d. Securing shall be by welded studs and/or non-corrosive banding wire. Do not weld brackets, clips or other devices to ASME coded pressure vessels or piping. Insulation pins or studs shall be as specified and installed in accordance with NCIA standards.
e. Finish shall be with PVC jacket or galvanized steel mesh wire and a finish coat of insulating cement minimum of 1/4" thick. After cement has cured apply glass lagging cloth and proper coating as directed by manufacturer. All corners shall have metal corner beads and provide acrylic latex finish.
2. Removable Covers:
a. Equipment specified to have removable covers shall have insulation as specified in Paragraph 2.4, fastened to the inside surfaces of a 20-gauge galvanized sheet metal equipment cover.
b. The covers shall be of a sectionalized design and shall be custom fitted around each piece of equipment. For ease of removal, joints between sections shall coincide with the splits or joints in the equipment. Joints between sections of the cover shall be held together with quick-connect trunk latches and shall be gasketed to form a vapor-tite seal cover (for the passage of pipes, etc.) shall be provided with closed cell elastomeric collars to ensure a tight fit.
c. The box shall be fitted around each piece of equipment and split for removal to coincide with the split in the casing. The sections of the box shall be held together with quick disconnect trunk latches. Joints between box sections shall be gasketed to form a vapor seal. Void spaces in the box shall be packed with flexible fiberglass insulation. Openings around pump casing shall be provided with closed cell elastomeric collar to ensure tight fit.
d. Provide acrylic latex finish.
e. Coordinate the piping of the drain, vent, gauge, and control lines to exit through the base or back section of the removable cover. The insulation of these pipes shall be totally independent of the removable cover.
3. Chilled Water Compression Tank and Filtering Systems: Surfaces shall be insulated with 1-inch-thick closed cell elastomeric insulation board or pipe insulation, as applicable. Finish as specified for vessel and large pipe insulation.

D. Cold Pipe Hanger Support Blocks:

1. Provide on all chilled fluid systems pipe hangers and supports.
2. Apply Pittcote 404 acrylic latex mastic filler over insulation and on ends.
3. Apply Pittseal 444 butyl joint and penetration sealant at joint between Foamglas and adjacent insulation.
4. Provide vapor barrier system to match the vapor barrier on the adjacent system.
5. Provide 20 gauge (min.) galvanized shield between the insulation and the hanger or support.

E. PVC Jacket:
1. Provide PVC sheet jacket over all exposed, indoor piping or insulation.
2. Provide PVC pipe jacket over all exposed, indoor Foamglas, or elastomeric pipe insulation.
3. Provide PVC fitting covers over all fittings fabricated from insulation sections or sheet material.
4. PVC pipe jacket shall be applied with special attention given to achieving positive seal at all longitudinal and circumferential joints using a welding solvent on the longitudinal joint as recommended by the manufacturer. Slip joints to have 4" minimum lap and no welding solvent.

F. Glass Cloth Jacket:
1. Provide where specified.
2. Provide acrylic latex finish.

G. Flexible Acrylic Latex:
1. Apply two coats to glass cloth jacket, concealed Foamglas, and closed cell elastomeric insulation.
2. Refer to Division 9 for color to be used. If no instructions are given, provide a white finish.

3.3 MISCELLANEOUS ITEMS

A. General: Provide insulation of any portion of a system or piece of equipment not previously discussed where ambient operating conditions will allow condensation to occur or whose surface temperature exceeds 115-deg F. Insulation materials and method shall be as directed by the Designer.
B. Final Inspection: At final inspection, the finished surfaces of all exposed insulation shall be clean and without stains or blemishes. Repair and clean the insulation surfaces and, if necessary, to obtain a new appearance, shall coat discolored surfaces with off-white latex water-base semi-gloss paint or lagging adhesive, without a change in the contract price.

END OF SECTION

SECTION 23 09 00
HVAC INSTRUMENTATION AND CONTROL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Provide all required devices to tie into the existing EMS system to integrate into the system.
B. Complete system of control and interlock wiring including wiring specified in Section 23 05 18 - Control Wiring and Section 23 09 93 - Sequence of Operation.
C. Interface with Product Integrated Controls specified in other sections of the specifications.
D. This section also includes Web Based Open Protocol DDC building network controllers and Equipment controllers that are open protocol utilizing BACnet protocol for the purpose of controlling HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory wired controls, lighting in new and existing facilities.
E. Access to the controls shall be through an owner provided IP address with use of a user ID and password. Contractor to provide a web server as part of the contract.

1.3 QUALITY ASSURANCE

A. The installation of the building control system devices shall be by the manufacturer of the controls or his local authorized agent who has a minimum of five (5) years of representation.
B. All electrical components 25 V and above shall be U.L. listed or labeled.
C. All equipment or piping used in the conditioned air stream, spaces or return air plenums shall comply with NFPA 90A Flame/Smoke/Fuel contribution rating of 25/50/0 and all applicable local building codes or requirements.
D. All wiring shall conform to the National Electrical Code (NEC).
E. All smoke dampers shall be rated in accordance with UL 555S.

1.4 DEFINITIONS

A. Control Wiring: All wiring, 120 VAC or low voltage other than power wiring, required for the proper operation of the mechanical system.
B. Power Wiring: All line voltage wiring to the mechanical equipment. Note: Where line voltage serves a control circuit such as power to a transformer, power to a DDC control panel, power for a line voltage thermostat, or damper this shall be considered control wiring.

1.5 SUBMITTALS

A. Submit in accordance with Division 1 Requirements.
B. Provide complete catalog data and installation instructions for each control component. Include damper and valve sizing details.
C. Control system submittal shall contain the following graphics and documentation for each system being controlled:
    1. Communications bus schematic showing all panel locations and hardware requirements.
    2. Schematic wiring diagrams in ladder form for each system including power source.
    3. Schematic diagram with detail of all hardware, components used, location of instruments, bulbs, dampers, valves, and other components. The chart shall include control chart including control symbols, quantity, manufacturer's part number, tech sheet reference (include in submittal) and description of part.
    4. Each DDC field panel shall be detailed in the submittal to identify termination boards within each panel and terminal of their respective field points. Each termination point shall define the point name and point description by each terminal with the field panel. Point names and descriptors shall be consistent throughout the submittal on the schematics, wiring diagrams, equipment list, etc.
    5. Submit the system architecture or configuration complete with all processors, terminals, other peripheral devices, modems, etc., with interconnecting diagrams.
    6. A report shall be included in the submittal to include every point in the entire system. The report shall include the programmed data for each point:
        a. Point Name
        b. Point Type (analog, digital, etc.)
        c. Point Descriptor
        d. Physical Address (enclose legend)
        e. Alarm (yes or no)
        f. Print Alarm (yes or no)
        g. High Limit
        h. Low Limit
        i. Totalized (yes or no)
        j. Hours or Minutes Totalized
        k. Engineering Unit of Point
    7. A flow chart form of sequence of operation in abbreviated English language.
    8. English language sequence of operation defining flow chart with control company programmed inputs to reflect English language sequence. Each sequence task shall be followed by the control company coded program. One list of coded programmed inputs at the end of each sequence of operation shall be acceptable.
D. For each Direct Digital Control (DDC) panel provide:
    1. Point List identifying each input and output by point name, point type, hardware description, wiring terminations, mounting arrangements and software features.
    2. Complete English language description of all software.
    3. Flow diagram and complete details program.

1.6 CONTROL SYSTEM GENERAL REQUIREMENTS

A. The control system shall be of the electronic microprocessor type employing Direct Digital Control (DDC) Open Protocol technology (BACnet) technology for all control sequences unless specifically stated otherwise in the Sequence of Operation portion of this specification.
B. All DDC controllers shall be connected via a communications bus to an operator's panel. The operator's panel may be located on the face of one of the DDC controllers, or at an alternate location as approved by the Engineers. In addition, a portable operator's panel may be connected to the system at any DDC controller location.
C. All DDC controllers shall be connected to a global information handler, which shall send and receive information of the existing global nature throughout the system.
D. Provisions shall be made to allow additional DDC controllers to be added at any point on the communications bus for future expansion.
E. Field Installed Devices (FID) shall be capable of stand-alone operation, as well as interfacing with the networked Building Control System. These controllers shall be based on BACnet Protocols. No other protocols for this section will be acceptable.
F. Valve and damper operators shall be of the electronic type.
G. The existing Building Control System is made up of HVAC equipment with factory installed microprocessor-based Product Integrated Controls (PIC), distributed microprocessor-based Field Installed Devices (FID), input/output modules and necessary software set up for expansion under the original.
H. The Product Integrated Controls (PIC) shall be factory installed controls capable of stand-alone operation. The controller shall be specifically designed to operate and monitor the functions of the HVAC equipment on which it is installed. The PIC shall be capable of interfacing onto the network.

1.7 INTENT OF DRAWINGS AND SPECIFICATIONS

A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment, and workmanship and to provide a tie into the existing building control system. The ultimate goal of the MCSD for this campus and project is to have a fully integrated BACnet EMS system.
B. The drawings are diagrammatic intending to show a workable general arrangement and location of system components and are not necessarily complete or rigid in all details.
C. No deviation in the specified sequence of operation, as specified on drawings, will be allowed without written approval from the Engineer.

1.8 OPERATION AND MAINTENANCE MANUALS AND INSTRUCTIONS FOR OWNER

A. Operation and maintenance manuals shall be provided as outlined in Division 1 Requirements. The manuals shall include all data which was a part of the original submittal with as- built wiring diagrams, parts lists and operating and maintenance instruction manuals.
B. Refer to training hours table and scope in section 23 05 00 for job owner training conducted by a technician or technicians fully qualified to conduct such training shall be provided. Instruction or Training shall include, but not be limited to:

1. Instructions in the manufacturers recommended maintenance and operating procedures.
2. Instructions in the detailed sequence of operation of the mechanical equipment controls.
3. Instructions in reading and using the control wiring diagrams.
4. Instructions in control setpoint adjustment as relating to each specific system provided under this section.
5. Performance testing as described in Part 3.

1.9 COOPERATION WITH OTHER CONTRACTORS

A. The Building Control Sub-Contractor shall coordinate with other trades to assure a complete and operational Building Control System.
B. This contractor shall furnish to the air balance contractor (Section 23 05 93) a notebook PC computer for terminal box set-up. At the completion of the balancing, the terminal shall be turned over to the owner.

1.10 MATERIALS, STORAGE AND HANDLING

A. All components shipped to the job-site and stored on-site shall be stored in a clean, dry storage location.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/REPRESENTATIVES

A. Siemens
B. Johnson Controls
C. Trane
D. Automated Logic
E. Engineer-approved Equal

2.2 EQUIPMENT

A. Direct Digital Control (DDC) Controllers:
   1. Direct Digital Control (DDC) Controllers shall be field programmable microprocessor based, electronic controllers incorporating direct digital control technology. The DDC controllers shall be capable of performing their assigned control and energy management functions as standalone units or as part of a comprehensive Building Management System. The controllers shall be capable of performing energy management functions including, but not limited to supply air and water reset, duty cycling, morning cool-down and warm-up, solar compensation, unoccupied setback, and real-time scheduling.
   2. The controllers shall have built-in, non-volatile, real-time calendar clocks capable of generating real and elapsed time signals in years, months, days of the week, hours, minutes, and seconds, as well as elapsed time in days, hours, minutes, and seconds. The controller shall be provided with a minimum of 72 hour back-up capability protect against loss of time in the calendar clock and the programmed software and provide surge protection on the head end terminal.

3. The controllers shall be capable of interfacing with a standard twisted pair communication channel for local operation and shall be protected with software security code keys to prevent unauthorized access. Where practical, controllers shall be fully distributed and dedicated to an individual piece of equipment or system. When input/output requirements exceed the capacity of a controller, additional controllers shall be connected serially in a daisy chain configuration to allow for the use of a single RS485 interface channel for multiple controllers. Global level controllers shall allow full Internet Protocol (IP) communications through a static IP connection through a 10/100 megabit per second Ethernet protocol.
4. The controllers shall be programmed for the sequences of operation defined hereinafter. The execution of these sequences shall be fully automatic and without operator intervention. The controllers shall sense all of their inputs, test for multiple input programmed conditions and execute appropriate action on valves, dampers, pumps, fans and other equipment. The programmed conditions may include any combination of inputs, outputs, time, and the mathematical operations (addition, subtraction, greater than, less than, square root, or absolute value). Program changes shall be entered into the controllers without interruption of the system operation.
5. The controllers shall be completely field programmable from a standard portable programming unit, a CRT terminal or from a remote location through a telephone modem. The program logic shall allow changes without interruption of the system operation.
6. The controllers shall be programmed to examine their inputs for emergency conditions and to automatically initiating the actuation of the appropriate alarm mode.
7. The operator, through a terminal, shall be capable of overriding the programmed control sequence to manually operate the outputs for system checkout. All sequences of operation shall be demonstrated through this simulation technique. The controllers shall be stepped through their sequence to verify system operation. During the maintenance routine, the controllers shall be capable of selectively disabling inputs and outputs without affecting the operations of the remaining inputs and outputs. The controller’s status shall be accessible through the ASCII channel. Upon appropriate commands, the controller shall read out time, analog input values, output status, program line number being processed, disabled inputs, disabled outputs, and sequencing program logic. Through the ASCII channel, the controllers shall be capable of printing a data history log for maintenance and troubleshooting of the system.
8. The controllers shall have a minimum of four levels of access available for terminal operation of the unit. The number of functions allowed an operator shall be determined by the level of password that is correctly entered into the controller.
9. The executive operating system provided with the controllers shall provide for all the functions described herein. The executive system shall provide English error messages to the user when any command or date is entered that cannot be understood by the microprocessor. An editing system shall also be provided for program entry. A program and variable trace routine shall also be provided to allow for easier program testing and debugging.

10. Digital Controllers used to control terminal equipment, such as variable volume boxes, shall be designed as individual control units. All variables shall be capable of being viewed and changed from the operator's panel, or the portable operator's console.
11. Digital Controllers used to control variable air volume (VAV) boxes shall include:
    a. Pressure independent air volume controller capable of controlling air volume within 5% of design air volume from minimum to maximum flow and at all points in between regardless of changes in system static pressure. Air volume maximum and minimum to be factory set and field re-adjustable. Controller shall be capable of 3 set positions: Off, Minimum and Maximum with VAV control from the min. to max. position. Minimum air volume shall be accurately controlled as low as 100 FPM based on inlet duct size. Maximum and minimum air volumes as scheduled on the drawings. If special multi-point velocity sensor is required to meet the specification, this supplier to furnish and coordinate installation with terminal supplier.
    b. 24 VAC damper actuators. NC control operation as specified.
    c. Digital output for fan control.
    d. Digital outputs for each step of electric heat control.
    e. Temperature sensor.
    f. A factory calibrated damper assembly and multi-point velocity sensor is specified to be provided with VAV terminals under Section 23 36 00 – Air Terminal Units. Provide 24V power source and wiring to terminal controller on VAV units which do not have a fan under this division, and in addition, a 24V, 40VA control transformer will be supplied on fan powered units by the terminal manufacturer. This supplier shall coordinate all requirements with the terminal supplier.

B. Input-Output Devices:
    1. Temperature Sensors:
        a. Temperature sensors shall be provided for space, duct, fluid, and outside air sensing which are compatible with the digital controllers. All temperature sensors shall be accurate to .36-deg F over a range of -30 to 220-deg F and shall have a demonstrated stability of .04-deg F over a 10 year period.
        b. Temperature sensors shall be 10K resistor style.
        c. All sensors in water lines to be installed in wells. If a permanent thermometer is not located at sensing point, a second well will be installed adjacent for temperature verification purposes.
        d. All sensors for cooling or heating coil leaving air temperatures shall be serpentine type across entire coil surface area. Sensing tube type is not acceptable.
        e. Room temperature sensors in public spaces (Auditoriums and Gymnasiums) shall have concealed setpoint adjustment with blank covers.
        f. Room temperature sensors in private offices and classrooms shall have user accessible setpoint adjustment with setpoint indication and space temperature indication with adjustable minimum and maximum setpoints capability with digital read outs.
    2. Humidity Sensors:
        a. Electronic Humidity Transmitters: Electronic humidity transmitters shall produce a linear 4-20 ma signal over a range of 0 to 100% RH. Accuracy shall be 2% of full scale.
        b. Single point calibration.

c. Shall be either VAISALA HMD-60U for duct applications and VAISALA HMW-60U for wall mounted applications or Veris.
d. Room Humidity sensors shall be integral to the room temperature sensor so that there is only one sensor per room.

3. Pressure Sensors:
   a. Electronic static and differential pressure transmitters shall be stainless steel diaphragm type, with a variable capacitance electrode to produce a linear signal over the appropriate input range. Input ranges shall be available from 0.1 in. H_2O to 7.5 in. H_2O and transmitters shall be selected for 150% of the design pressure. Both zero and span shall be field adjustable. Accuracy shall be □1% of full scale over the selected range, wherever differential pressure transmitters are subject to damage by disconnecting pressure lines, provide three valve manifolds for disconnection and testing. Based on Setra Model C239.
4. Valves and Operators:
   a. Isolation Type Valves:
      1) 2" and smaller: Ball style, sized for minimum pressure drop.
      2) 2-1/2" and larger: Butterfly style, sized for minimum pressure drop.
   b. Control Valves:
      1) Valves shall be provided with equal percentage modulating plugs, renewable composition disk especially compounded for hot or cold water service to assure tight seating. Three-way valves shall be furnished with modulating type plug assemblies and shall have one seat machined integral with the body and the other three-way valve end.
      2) Valves shall be sized as indicated or as required to guarantee sufficient size to meet the heating or cooling requirements with specified pressure drops. Water valves shall be sized for 2 psig minimum and 5 psig maximum pressure drop. Valves 2 inches and smaller shall be screwed and valves 2-1/2 inches and larger shall be flanged.
   c. Valve operators:
      1) Shall be gear driven electronic. Operators shall be of sufficient size to ensure smooth positive, operation and tight shut-off against system pressure.
      2) Electronic operators shall be of the positive gear driven type using a brushless DC motor with built-in mechanical stops and electronic current limiting circuit to prevent burn-out. The drive motor shall be microprocessor controlled and capable of accepting a 4-20 mA, 0-10 V DC, 0-20 V Dc phasecut, on-off, or floating tri-state control signal as required. Based on Belimo Aircontrols (USA), Inc.
      3) Preheat coil valves and valves on the primary and secondary heating water circuits shall have spring returns. The water valves shall be designed to go to the open position on power or other failure.
      4) The source of power for valve operation, electronic shall be the responsibility of the BCS Contractor.
5. Butterfly Valves and Operators:
   a. Isolation valves and control valves 4" and over may be butterfly type.
   b. Valves to have 416 stainless steel stem, full lug, cast iron or ductile iron body to permit removal of downstream piping, long neck body extended to allow for a minimum of 2" insulation, aluminum bronze or stainless-steel disc, bubble tight EPDM seat, infinite position throttling, Class 150, 20 F to 220 F range.

c. Where three way valves are shown, factory furnished T-assemblies with mounted valves and cross linkage may be used.
d. Valves to have gear driven electronic operators. Operators to be of sufficient size to ensure smooth, positive operation and tight shut-off against system pressure. Preheat coil valves and valves on the primary and secondary heating water circuits shall have spring returns. The water valves shall be designed to go to the open position on power or other failure.
    1) Shall be gear driven electronic. Operators shall be of sufficient size to ensure smooth positive, operation and tight shut-off against system pressure.
    2) Electronic operators shall be of the positive gear driven type using a brushless DC motor with built-in mechanical stops and electronic current limiting circuit to prevent burn-out. The drive motor shall be microprocessor controlled and capable of accepting a 4-20 mA, 0-10 V DC, 0-20 V Dc phasecut, on-off, or floating tri-state control signal as required. Based on Belimo Aircontrols (USA), Inc.
    3) Preheat coil valves and valves on the primary and secondary heating water circuits shall have spring returns. The water valves shall be designed to go to the open position on power or other failure.
    4) The source of power for valve operation, electronic shall be the responsibility of the BCS Contractor.
e. The source of power for valve operation, electronic shall be the responsibility of the BCS Contractor.
f. Based on Keystone Fig. AR2.

6. Dampers and Operators:
    a. Provide outdoor air control dampers with the following features:
    b. Frame: aluminum channel with corner braces.
    c. Blade: 6" maximum width, opposed blade, aluminum airfoil.
    d. Axles: ½" hex axle stainless steel shaft, secured tight to the blade; non-stick, non- corrosive, molded synthetic bearings.
    e. Control Shaft: 6" x ½" diameter, galvanized steel control shaft with outboard support bearing.
    f. Actuator Bracket: Concealed in damper frame, galvanized steel.
    g. Seals: edge and jam seals.
    h. Leakage Rates: Maximum leakage rates shall not exceed the following values when tested at 1" WG pressure differential per AMCA Publication 500.

Damper Width	Leakage Rate
12"	65 CFM/SF
24"	50 CFM/SF
36"	40 CFM/SF
48"	40 CFM/SF

    i. Performance specifications are based on Ruskin CD50. Other products satisfying the specifications are acceptable.

j. Electronic operators shall be of the positive gear driven type using a brushless DC motor with built-in mechanical stops and electronic current limiting circuit to prevent burn-out. The drive motor shall be microprocessor controlled and capable of accepting a 4-20 mA, 0-10 V DC, 0-20 V DC phasecut, on-off, or floating tri-state control signal as required. Based on Belimo Air Controls (USA), Inc., Invensys DuraDrive and Tamco.
k. Actuators for outdoor air and exhaust air dampers shall have spring return, and the dampers shall be designed to go to the closed position on power or other failure.

7. Smoke Detectors:
   a. Smoke detectors (SD) will be furnished and installed by Division 26 – Electrical and Division 23 – Mechanical. (Refer to Specification Section 23 33 00). Detectors will be required in all air handling systems greater than 2000 CFM. Detectors will be required in both supply and return ducts of air handling units or on multi-story buildings in the return at each floor. The detectors shall be wired to shut-down the fans and indicate status to the DDC controls. In the case of an engineered smoke control system, they shall be wired to control as specified and shall be interlocked with the fire alarm system.
8. High limit thermostats (FS) shall be provided for each exhaust fan and shall be of the manual reset type. Thermostats shall be UL listed and shall be wired to shut down their respective fans should the temperature in the duct rise above 125-deg F (adj.).
9. Low limit thermostats (FR) shall be provided as indicated and shall be wired to shut down their respective unit should the temperature at any point on its sensing element fall below 35-deg F (adj.). Thermostats shall require manual reset. Provide 1 foot of sensing element for each 2 sq. ft. of duct cross section.
10. Panels:
    a. All relays and similar devices shall be mounted within Control Panels. Quantity and location of control panels shall be dictated by the controls contractor's system architecture.
    b. Control panels shall be dust tight and furnished with hinged locking doors. Provide an engraved nameplate on the face of the panel clearly describing its function. All devices located within the panel shall be clearly labeled. All wiring within the panel shall be in accordance with NEMA, UL standard, NEC and local codes. Details and proposed mounting location of each panel shall be submitted prior to construction.
       All panels shall be factory prewired and pre-piped to terminal strips prior to arrival at job site. The wiring shall be installed orderly and easily identifiable.
    c. Provide wiring diagram mounted inside door with plastic protective covering.
11. Relays:
    a. All relays shall be plugged in, interchangeable, mounted on a circuit board and wired to numbered terminal strips.
    b. Start/stop relay modules shall provide either momentary or maintained switching action as appropriate for the motor being started.
12. Differential Pressure Switches: Binary differential pressure sensors shall be used to indicate pump and fan operation and for indicating high pressure drop across filters. These sensors shall be of the diaphragm type and shall be adjustable and furnished in ranges compatible with their service.

13. Current Sensing Relays:
    a. Solid state switch which operates when current level sensed by internal current transformer exceeds the threshold value set by the adjusting device. Internal circuits totally powered by induction from line being monitored.
    b. Current range and switching characteristics as required for intended duty.
14. Line Voltage Electric Thermostats:
    a. Where mechanical equipment such as certain exhaust fans or unit heaters are indicated to be controlled directly from a space thermostat, provide a thermostat of either the heating or cooling type depending upon the application.
    b. All line voltage thermostats shall be rated to carry 125% of the load of the controlled device.
15. Thermostat/Temperature Sensor Guard:
    a. Wire guard with steel base.
    b. Cast aluminum guard with steel base.
    c. Clear plastic guard with solid base and tumbler type key lock.
    d. Contractor to verify the location of these guards with engineer and Owners representative.
16. Air Flow Measuring Station: Duct and plenum mounted airflow measurement devices. The following is the only acceptable manufacturer:
    a. Tek-air's Vortek VT-5000
    b. Alternatives requesting acceptance as "equals" less than 60 days prior to bid date or products submitted in non-conformance with the requirements of this specification will not be considered.
    c. For any product to be considered for substitution a written section-by-section detailed exceptions/compliance document shall be submitted to the Engineer before any approval will be considered.
    d. Any product offered as an equal shall make a working demo available for a side by side evaluation in the specifying engineer's office.
    e. The working demo must be able to demonstrate airflow measurement throughout the entire specified range (50 - 5000 FPM), repeatability, response time and specification compliance. Providing a working demo in and of itself does not constitute its approval.
    f. Provide airflow/temperature measurement devices (ATMD) where indicated on the plans or as recommended by an authorized representative. Fan inlet measurement devices shall not be used unless specifically indicated on the plans.
    g. Each ATMD shall consist of one or more sensor probes and a single, remotely mounted, microprocessor-based transmitter capable of independently processing up to 16 independently wired sensor assemblies.
    h. Each sensor node shall contain two individually wired, hermetically sealed bead-in- glass thermistors.
        1) Thermistors shall be mounted in the sensor node using a marine-grade, waterproof epoxy. Thermistor leads shall be protected and not exposed to the environment. Thermistor leads shall not be fastened to the thermistor semiconductor substrate by weld or solder connections.

2) The airflow rate of each sensor assembly shall be equally weighted and averaged by the transmitter prior to output. All integrated circuitry shall be temperature rated as 'industrial-grade'. Submissions containing 'commercial-grade' integrated circuitry are not acceptable.
3) The temperature of each sensor assembly shall be velocity weighted and averaged by the transmitter prior to output.
4) Each transmitter shall have a 16-character alpha-numeric display capable of displaying airflow, temperature, system status, configuration settings and diagnostics.
5) Devices using chip-in-glass or diode-case chip thermistors are not acceptable.
6) Devices using less than two thermistors in each sensor assembly are not acceptable.
7) Devices having electronic circuitry mounted in or at the sensor probe are not acceptable.
8) Pitot tubes and arrays are not acceptable.
9) Vortex shedding devices are not acceptable.
10) Duct and Plenum Probes
    a) Probes shall be constructed of extruded, gold anodized, 6063 aluminum tubes or optionally of Type 316 stainless steel tubes. All internal wires within the tube shall be Kynar coated. PVC insulated conductors are not acceptable.
    b) The number of individual sensor nodes provided for each location shall be as follows:

Duct or Plenum Area (ft^2)	Total # Nodes / Location	Duct or Plenum Area (m^2)
<= 1	1 or 2	<= 0.093
>1 to <2	4	>0.093 to < 0.372
2 to < 4	6	0.372 to < 0.743
4 to < 8	8	0.743 to < 1.115
8 to <16	12	1.115 to < 1.486
>=16	16	>= 1.486

    c) Sensor probe design shall be capable of providing up to 8 sensor nodes per probe.
    d) The minimum operating airflow range shall be 0 to 5,000 FPM (25.4 m/s) unless otherwise indicated on the plans.
    e) Each ducted sensor probe shall have an integral, U.L. Listed, plenum rated cable. Cable jackets and conductor insulation shall be FEP, Teflon-FEP or Neoflon-FEP. Cables shall include a terminal plug for connection to the remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated. PVC jacketed cables or PVC insulated conductors are not acceptable with ducted sensor probes.

17. Carbon Dioxide Monitor - Controller:

a. CO2 sensing cell shall consist of a nondispersive infrared carbon dioxide gas cell that uses a pulse source and has no free air optical path. Output shall be linearized 4-20 mA for use with 24 VDC input. The unit shall be specifically designed for a wall application. Unit shall have span adjustment. The unit shall have no moving parts.
b. Minimum Requirements:
    1. Range: 0-2,000 ppm
    2. Accuracy: 3% of full scale
    3. Repeatability: 1% of full scale
    4. Zero Drift at Constant Temperatures: 100 ppm per 24 hours (random not cumulative)
    5. Max. allowable Drift in 1 year: 20 ppm
c. Unit shall not require calibration for a period of 1 year or more.
d. Unit shall have a 5 year warranty.
e. Approved Manufactures:
    1. System Integrator's brand named product.
    2. Valtronics
    3. Telaire
    4. Veris

18. Indoor Air Quality (IAQ) Sensor and Controller:
    a. Sensor to be located in return air duct. Sensor to supply a frequency modulated output signal superimposed on the DC supply as the contamination level in the air changes.
    b. The signal to be processed in the controller and compared to the setpoint. An increasing contamination concentration will cause the sensor to respond with an increasing output which will result in a proportional output from the controller.
    c. Sensor to carbon monoxide, carbon dioxide, formaldehyde and hydrocarbons which make up common indoor air pollution. The sensor shall respond to carbon dioxide and be capable of controlling to a limit as low as 500 PPM.
19. Photoelectric Sensor: Reflex type units containing the source and detector in the same enclosure using a remote reflector. An infrared light beam shall be emitted with a range of approximately 30 feet. Sensors shall be similar to Redington series 97 and 98. Installation may require recessing into mounting surface - coordinate with Architect and receive the Architect's approval prior to mounting sensors or reflector.
20. Control Air Tubing:
    a. Copper hard drawn or annealed.
    b. Fittings: Copper or brass, sweat or flare compression type.
    c. Non-metallic FR Polytubing. Tubing shall be suitable for use in return air plenums.
21. Programmable Lighting Panels:
    a. Programmable lighting panels shall contain up to 42 individual circuits as required. Each circuit shall contain a properly sized breaker and lighting contactor initiator. Lighting contactor initiator shall receive a signal from the Building Automation System to provide individual control for each lighting circuit.
    b. Refer to the electrical drawings and schedules for additional information and requirements.

c. Programmable lighting panels are to be furnished by this contractor. Installations and power wiring are by Division 26.

22. Smoke dampers shall be as specified in Section 23 33 00 – Air Duct Accessories.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and requirements. All necessary interconnections, services and adjustments required for a complete tie-in to the existing operable system shall be provided by this contractor.

B. The contractor shall review all contract drawings and specifications, including addenda and referenced material and shall visit the job site, if applicable in order to become informed prior to bidding as to existing conditions and limitations of the project. The contractor shall bring exceptions and inconsistencies in drawings, specifications, addenda, referenced material, other contract documents and site conditions to the attention of the engineer.

C. The location of material, equipment and devices shown on the drawings are approximate and are subject to such revisions as may be necessary or desirable at the time that the work is being installed. The contractor shall install the work in relation to existing conditions. Should project conditions require rearrangement, or if equipment or accessories can be installed to better advantage in a different manner, prepare and submit five copies of shop drawings indicating the proposed rearrangement for the Engineer's review.

D. Chilled Water Systems: Furnish a test well for installation under Section 23 05 19, adjacent to each temperature sensor where a fixed thermometer is not provided.

E. Control Wiring:
   1. All wiring incidental to the building control system, including electrical interlocks shall be included in this section and provided as part of the building control system.
   2. All control wiring shall be run in conduit where required by code or where the possibility of harm or permanent damage exists. In addition, all wiring installed below 8 feet or below suspended ceilings shall be installed in conduit.
   3. Any wiring not installed in conduit shall be multi-conductor cable, with individual wires color codes for ease of installation and troubleshooting. All wiring installed above a plenum ceiling shall be Teflon coated and rated for plenum service.
   4. All wiring shall be concealed wherever possible and installed in a neat and workmanlike manner. All wiring and conduit shall be run parallel or perpendicular to the building structure. All cables shall be supported at frequent intervals and attached to supports by the use of nylon tie-wraps.
   5. Control wiring shall conform to the requirements of Section 23 05 18 – Control Wiring and all applicable section of Division 26.

F. Terminal Controls: Unless provided by the terminal manufacturer, Direct Digital Controllers controlling VAV boxes, damper operators and velocity transmitters shall be shipped to the VAV box manufacturer for factory installation. Provide the box manufacturer with complete wiring and piping diagrams and detailed installation instructions. Box manufacturer shall furnish and install 24 volt transformer.

G. System Start-up and Check-out:
   1. The manufacturer shall provide a control technician for the start-up, check-out of all input and outputs, implement and check the software function and submit report on check-out of each system.

2. Demonstrate to the Owner that all functions are operating as per final approved sequences.
3. The manufacturer shall provide a control technician for the training of the Owner's operators as detailed in Division 1 Requirements.

H. System Acceptance & Trend Log Submittal:
1. After completion of the installation, check-out and control loop tuning, and trend logs shall be submitted, as listed below, to demonstrate the satisfactory performance of the system and to serve as a data base for the owner's future use.
2. The trend logs shall be organized in spread sheet format and presented in both tabular and graphical form. A disc or tape copy of each final accepted trend log set shall also be provided. Trend logs shall be as follows:
3. Control Stability Trend Logs:
   a. Each digital or analog output to valves, dampers, adjustable frequency drives and other control devices shall be included.
   b. Scan time shall be at five second intervals for a duration of ten minutes.
   c. Start of the sets shall be immediately after change from one mode to another, i.e., unoccupied to occupied, no economizer to economizer, off to on, etc. Only one log will be required for each output as long as it addresses all controlled elements.
   d. Where control of a piece of equipment is by factory furnished packaged controls, then the controlled temperature which is monitored shall be included. For instance, where a chiller is controlled by its own control system and control is from leaving chilled water temperature, then leaving chilled water temperature shall be included in the log set.

3.2 EQUIPMENT ADDITIONAL REQUIREMENTS

A. Smoke Detectors:
1. Smoke detectors will be furnished and installed under Division 26. Power wiring, alarm circuit and supervisory circuit will be provided under Division 26. Control wiring to auxiliary contacts required to shut-down fans (hard wired) and alarm BCS shall be provided by this Section.
2. All detectors shall function properly, equipment shall shut down and dampers must be tested for operation prior to building occupancy with design air flow to ensure operation under normal conditions. Provide a letter to the Owners Representative certifying that these tests have been conducted.
3. When an engineered smoke control system is specified, the smoke detectors shall function as specified.

B. Air Flow Measuring Stations:
1. Install air flow measuring stations on the inlet bells of the fan as specified. 120V AC power wiring and control wiring will be provided under this section.
2. For airflow measuring stations that cannot be mounted on the inlet bells of the fan, furnish air flow measuring stations for installation under Section 23 33 00 - Air Duct Accessories wiring will be provided under this section.
3. Coordinate location, duct size and confirm that there is proper space for access before releasing for fabrication. Coordinate installation requirements with sheet metal sub-contractor as specified in Section 23 33 00 - Air Duct Accessories.

C. Dampers:

1. Unless specifically stated otherwise, the outside air, return air and relief air dampers for all air handling units shall be provided under this section of the specifications. Where damper sizes are not shown on drawings, size outdoor air and relief air dampers at 1500 ft/min. and return air dampers at 2000 ft/min. face velocity. Discharge dampers shall be furnished on systems over 5000 CFM. Where so indicated, provide separate minimum and maximum O.A. damper.
2. Return air, relief air and discharge dampers to be smoke rated on systems over 15,000 CFM and arranged to close in response to smoke detector or function as specified in an engineered smoke control system.
3. Turn dampers over to sheet metal contractor for installation as specified in Section 23 33 00 - Air Duct Accessories.

D. Line Voltage Thermostats: (Used only for exhaust fans only, not for classrooms HVAC Systems). Provide and wire including necessary outlet box, conduit box and all interconnecting wiring.
E. Room Temperature Sensors:
   1. General:
      a. Provide a room temperature sensor in each location shown on the drawings.
      b. Each room temperature sensor shall be wired to a local control device that shall maintain the established setpoints within the space in response to time, mode and temperature inputs.
      c. Each sensor shall have a digital display and an override button.
   2. Room Temperature Sensor Mounting:
      a. In classrooms and offices, each room sensor shall be installed immediately inside door, next to the light switch with its center approximately 4'-0" above the floor. Each room sensor mounted on an exterior wall of the building with an insulating block of wood or other approved material.
      b. In public spaces and other unsupervised areas, locate temperature sensors with its center approximately 7'-0" above the floor.
      c. Devices with exposed setpoint adjustment, override switches, or any other operable feature shall be installed at a height in compliance with ADA for the location intended.
F. Thermostat/Temperature Sensor Guard: For schools, install in all public spaces and other unsupervised areas (Lockable Lexan covers). Not required in offices or classrooms unless called for on the drawings.
G. Carbon Dioxide Monitor - Controller: Install in the space or duct as shown on the drawings.
H. Indoor Air Quality Sensor:
   1. Install in return airstream as shown.
   2. Set IAQ controller at 100% control point. With ASHRAE recommended O.A. CFM as listed in the schedule or provided by the engineer and the building normal occupancy, trend the output signal for 30 days. At the end of the 30 day period, set the IAQ controller at a setpoint equal to the "lowest air quality signal" (poorest air quality). Controller shall then operate to modulate the O.A. damper from the "highest minimum O.A." quantity to the "lowest minimum O.A." to hold the setpoint. (The "lowest air quality signal" is that output which meets ASHRAE Standard 62 with normal occupancy. Reducing the O.A. below this is permissible due to lower occupancy or less contaminants.

3.3 SOFTWARE ENHANCEMENTS

A. After the system has operated properly for 90 days following start-up of the final component of the heating and air conditioning systems, an as-built copy of the software shall be transmitted to the owner for permanent record purposes. An allowance shall also be included for any software upgrading or enhancements to improve the system operation or as required for proper operation of the system during the first year of operation. Any changes to the software shall be immediately transmitted to the owner.

3.4 CALIBRATION AND TESTING

A. The Building Control Contractor shall calibrate all building controlled system equipment and verify operation before this system is placed on-line. All testing, calibrating, and adjusting shall be completed by the contractor prior to the start of the acceptance test; including all DDC control loops, interlocks, sequences, energy management programs, and alarms shall be tested, and proper operation verified.
B. The Product Integrated Controls shall be factory installed, configured, and tested for stand-alone operation. Specific configuration, such as setpoints and time schedules, shall be completed before the HVAC equipment on which it is installed and is placed in operation. All testing, calibrating, and adjusting of individual HVAC equipment PIC controls shall be done as a part of that individual unit start-up and acceptance. Only the PIC's network communications function shall be included with the automation (BCS) acceptance test.

3.5 ACCEPTANCE TEST

A. After start-up and calibration, the building controls sub-contractor shall submit to the engineer trend logs of all points on each system demonstrating stable and proper operation. The demonstration shall cover the following conditions:
   1. Cooling Only (O.A. Temperature > 70-deg F).
   2. Cooling and Heating (O.A. Temperature 55-deg F to 70-deg F).
   3. Heating Only (O.A. Temperature < 40-deg F).
B. The trend logs shall be as follows:
   1. 24-hour period at 15-minute intervals.
   2. 3 hour start-up period at 5 minute intervals.
   3. A total of two sets covering two days during each period are required.
C. After submission of the logs for any one of the periods, the engineer will review them for acceptability, and if acceptable, schedule a final walk-thru of the system for final acceptance and start of hardware warranty.
D. During the hardware warranty period, the controls sub-contractor shall submit trend data covering the other two periods. Any adjustments or modifications to get acceptable results in each period shall be considered to be part of the warranty obligation.

3.6 SEQUENCE OF OPERATION

A. See drawings for sequence of operation.

END OF SECTION

SECTION 23 09 93
SEQUENCE OF OPERATION FOR HVAC CONTROLS

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Provide all labor, material, documentation, and services required for the tie-in and implementation of the new air handlers and VAV's into the existing EMS system.
B. Module expansion shall be provided if required to allow for the additional control points.

1.3 RELATED WORK

A. Section 23 09 00 – Instrumentation and Control for HVAC

1.4 APPLICABLE PROVISION

A. Were modulation of a valve or damper is referred to then it shall mean the direct digital control of the valve or damper based on a control algorithm resident in the BCS software at the remote field panel. Unless noted otherwise the control algorithm shall be PID control. Optimum loop response shall be ensured by the use of a built in automatic loop tuner.
B. An Operator having the required level of password access shall be able to modify the existing Operator changeable or definable parameter(s) on-line from an I/O device such that the monitoring and control functions of the BCS shall not be affected during the period of the change. The mechanism by which the change is made shall be simple and shall be adequately described in the Operator's manuals. Where setpoints for control parameters such as setpoint or changeover temperatures, humidities, or times are referred to in this Section they shall be Operator changeable on-line.
C. Where the sequences refer to the start/stop of a system this shall be initiated either by an Operator manually entered command or automatically by a software routine such as "Optimum Stop/Start", "Power Demand Control", "Programmed Stop/Start", etc. or via an interlock in the sequences of operation to other equipment or event(s).
D. When the motor controller is equipped with a HOA the motors shall only be controlled by the BCS when the HOA switch is in the auto position.
E. Firestats, freezestats, smoke and fire detectors and interlocked dampers shall be wired to shutdown motors when the HOA switch is in both the hand and auto positions. It shall not be possible for the BCS to override these or any other safety devices or any fire alarm system control functions, except in the case of an engineered smoke control system in which case freeze protection safeties shall be overridden.

F. Refer to the Point Definition Sheets and System Schematics, which form part of these Contract Documents, to facilitate the interpretation of the sequences of operation as defined herein.
G. Provide additional I/O points, whether or not such points are indicated in the Point Definition Sheets, if they are required in order to attain the requirements of the Contract Documents.
H. Where fans and dampers are to be interlocked, provide hardwire interlocks between the motor terminal strip and damper such that the damper shall be driven open when the motor is required to start. Motor start-up shall not occur until the damper end switch indicates the damper is in the full-open position.
I. Where fans and dampers are hardwire interlocked, the interlocks shall apply in both the "hand" and "auto" positions of the HOA switch at the motor controller.
J. Where electric heat coil control calls for the electric heating coil to be staged/cycled on and off to maintain the required temperature set point, the control algorithm shall incorporate a deadband, changeable by the Operator, which shall prevent the too frequent on/off cycling of the heating coil.
K. Where electric heating coils are controlled by the BCS, the BCS shall not override any safety interlocks.
L. Where there are fans not identified within the sequence of operation, point definition sheets or schematic drawings that provide supply and/or exhaust air that are not controlled via a thermostat, they shall be hardwire interlocked to the controlling device. The supply fans shall be hardwire interlocked with their associated exhaust fan (if applicable) to operate simultaneously. The dampers shall be hardwire interlocked with the fans via end switches such that the fans cannot operate when the damper is not fully open. The damper status shall not be monitored by the BCS. If the supply or exhaust fan serves a riser with multiple dampers, the end switches of the riser dampers shall be wired in parallel as a group then wired in series with the fan's associated damper end switch to prevent the fan from operating unless both the fan's damper is open and at least one of the riser dampers are open.
M. The point list is provided for convenience and is not intended to be all inclusive. All points required to provide the Sequence of Operation shall be included as if listed. All points required by specification section 23 09 00 not listed in 23 09 93 will be required.
N. All wiring required to provide the Sequence of Operation shall be included.

1.5 ABBREVIATIONS

AFD	Adjustable Frequency Drive AUX Starter Auxiliary Contact
AI	Analog Input
AO	Analog Output
CFM	Air Flow in CFM from Air Monitor CSR Current Sensing Relay
D	Damper Operation
DI	Digital Input
DO	Digital Output
DP	Differential Pressure ES End Switch
Fa	Failure Alarm
FR	Freezestat
FS	Flow Switch
H	Humidity Sensor
Ha	High Static Pressure Alarm IAQ Indoor Air Quality

IGV	Inlet Guide Vanes
La	Low Static Pressure Alarm
Ma	Maintenance Alarm
Pd	Discharge Static Pressure
Pdd	Downduct Static Pressure
Pds	Discharge Static Pressure Safety
Ps	Suction Static Pressure
Pss	Suction Static Pressure Safety
R	Relay
Sa	Safety Alarm/Shut-down
SD	Smoke Detector
DP	Static Pressure Sensor
SR	Damper Smoke Rated
SS	Start-Stop
T	Temperature Sensor
Ta	Temperature Alarm
V	Valve Operator
VP	Virtual Point
X	Hardwired

PART 2 – PRODUCTS

(Not Applicable)

PART 3 – EXECUTION

3.1 SEQUENCE OF OPERATION – Refer to drawings for sequence of operations for equipment on this project.

END OF SECTION

SECTION 23 21 13
HYDRONIC PIPING

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Chilled Water (CHWS+R) and Condenser Water (CWS+R) Piping.
B. Equipment Drain (D) Piping.
C. A/C Unit Condensate Drain (CD) Piping.
D. Refrigerant (RS/RL/RHG) Piping.

1.3 DEFINITIONS

A. The pipe sizes given in this document are nominal.

1.4 QUALITY ASSURANCE

A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products and shall be of the manufacturer's most recent design that is in regular production.
B. Each item provided under this section shall meet the requirements for that item as installed and used, in accordance with the following standards:
   1. Metallic Piping Systems employing mechanical joints and grooved-end pipe - ASME/ANSI B-31.9
   2. All other metallic piping - ASME/ANSI B31.1.
   3. Refrigeration Piping - ASME/ANSI B31.5
   4. Polypropylene Piping – ASTM F 2389-07/ANSI 14.
C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.
D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.
E. Source Limitations: Unless specifically noted otherwise, provide products of the same manufacturer for each type of unit specified.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.

B. The work and materials listed in this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.
   1. American National Standards Institute (ANSI) Standards
   2. American Petroleum Institute (API) Specification
   3. American Society of Mechanical Engineers (ASME) Publications
   4. American Society for Testing and Materials (ASTM) Publications
   5. American Welding Society (AWS) Publication
   6. American Water Works Association (AWWA) Standards
   7. Cast Iron Soil Pipe Institute (CISPI) Standards
   8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications
   9. National Fire Protection Association (NFPA) Standards
   10. National Sanitation Foundation (NSF) Testing Laboratory Standards.
   11. Plastic Pipe Institute (PPI) Manual.
   12. Underwriters Laboratories (UL)

1.6 SUBMITTALS

A. All submittals shall be made in accordance with Division 1 requirements.
B. Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, pipe fittings, valves, and joints. Include the basic designation of the publication applicable for each type of material and method.
C. Submit current welder qualifications for all welders proposed for this project. Welding certificates shall be for the company performing the welding at this project as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.
D. Submit certified welding inspection reports as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Chilled Water and Condenser Water Piping.
   1. Pipe and Piping Products:
      a) Pipe shall be manufactured from a PP-R resin (Fusiolen) meeting the short-term properties and long-term strength requirements of ASTM F 2389 or CSA B137.11. The pipe shall contain no rework or recycled materials except that generated in the manufacturer’s own plant from resin of the same specification from the same raw material. All pipes shall be made in an extrusion process. All pipes shall comply with the rated pressure requirements of ASTM F 2389 or CSA B137.11. All pipes shall be certified by NSF International as complying with NSF 14, and ASTM F2389 or CSA B137.11.
      b) Pipe shall be Aquatherm® or Blue Pipe ®, available from Aquatherm, NA. Piping specifications and ordering information are available at www.aquatherm.com.

2. Fittings:
   a) Fittings shall be manufactured from a PP-R resin (Fusiolen) meeting the short-term properties and long-term strength requirements of ASTM F 2389. The fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All fittings shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11.
   b) Fittings shall be Aquatherm® Green Pipe® or Blue Pipe® available from Aquatherm, NA. Fittings, specifications, and ordering information are available at www.aquatherm.com.
   c.) Fittings shall be installed according to the manufacturer's instructions.
3. Warranty:
   a) Manufacturer shall warrant pipe and fittings for 10-years to be free of defects in materials or manufacturing.
   1) Warranty shall cover labor and material costs of repairing and/or replacing defective material and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.
   2) Warranty shall be in effect only upon submission by the Contractor to the manufacturer, valid pressure/leak test documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.
4. Valves:
   a) Valves shall be manufactured in accordance with the manufacturer's specifications and shall comply with the performance requirements of ASTM F 2389 or CSA B137.11. The valves shall contain no rework or recycled thermoplastic materials except that generated in the manufacturer's own plant, from resin of the same specification from the same raw material.
   b) Valves shall be Aquatherm® available from Aquatherm, NA. Valve specifications and ordering information are available at www.aquatherm.com.
5. Smoke and Fire Ratings
   a) Where indicated on the drawings, that a plenum-rated piping system is needed, the pipe shall be wrapped and/or insulated with standard pipe insulation, field installed. The pipe wrap or insulation shall meet the requirements of CAN/ULC-S102.2-03 or ASTM E84. The system shall have a Flame Spread Classification of less than 25, and Smoke Development rating of less than 50.
6. UV Protection:
   a) Not required for externally insulated piping.
7. Thermal and Vapor Barrier
   a) Insulation materials furnished and installed hereunder should meet the minimum thickness requirements of American Society of Heating, Refrigeration, and Air Conditioning Engineers ASHRAE 90.1 (current edition), "Energy Efficient Design of New Buildings." However, if other factors such as condensation control or personnel protection are to be considered, the selection of the thickness of insulation should satisfy the controlling factor.
   b) Where standard pipe insulation is indicated on the drawings or in these specifications, the contractor shall provide a thermal and vapor barrier insulation. The insulation products shall be provided as indicated on the drawings or elsewhere in these specifications. The standard pipe insulation shall be UV resistant, CFC-free, non-porous, non-fibrous, and resist mold growth.

B. Equipment Drain (D) Piping.
System Design Pressure: 10 psig.
1. Piping, 1/4" thru 1: Type L Hard-drawn Copper Tubing: ASTM B88.
2. Piping, 1" thru 2": Schedule 40 carbon steel, seamless, galvanized; ASTM A-106, Grade B, Type S.
3. Piping, 2-1/2" thru 10": Schedule 40 carbon steel, seamless or electric resistance welded, galvanized; ASTM A-53, Grade B, Type S or ERW.
4. Pipe Fittings, 1/4" thru 1": Wrought Copper, ANSI B16.22.
5. Pipe Fittings, 1-1/2" and larger: 125 lb. rated galvanized malleable iron, threaded type; ASTM A-197.
6. Solder: Lead-free, per code.
7. Unions: 1/4" thru 1": Wrought Copper, Pressure Class 150, w/solder ends.
8. Unions: 1" thru 2": Malleable Iron, Pressure Class 150, w/ threaded ends, ANSI B 16.39.
   Note: Dielectric unions shall be used to connect copper to steel pipe and shall have metal connections on each end threaded to match the adjacent piping. Metal components shall be separated by a nylon insulator to prevent current flow between dissimilar metals. Unions shall be suitable for the system operating pressures and temperatures.
9. Flanges: 150 lb. forged carbon steel, threaded type, with raised face, bored to match the mating pipe I.D.; ANSI B16.3.
10. Bolting studs: ASTM A-193, Grade B7. Nuts shall be heavy duty hex type; ASTM A-194, Grade 2H.
11. Gaskets: Full faced style, 1/8" thick. Gasket material shall be Nitrile (NBR) sheet, ASTM F104, Line Call Out F712100A9B4E22K5M6; Based on Garlock Blue-Gard® Style 3300 or acceptable equivalent.
12. Mechanical joints, grooved-end type, may be used on 2-1/2" IPS and larger. See paragraph 2.2 "Mechanical Joint Systems", this section, for specifications.

C. A/C Unit Condensate Drain (D) Piping.
System Design Pressure: 10 psig.
(Where two materials are listed, either may be used.)
1. Drains in Return Air Plenums or other areas - Copper:
   a) Piping, 1/4" thru 4: Type L Hard-drawn Copper Tubing: ASTM B88.
   b) Pipe Fittings, 1/4" thru 4":
      1) Wrought Copper, ANSI B16.22.
      2) Mechanically formed tee fitting, as created by T-Drill, is an acceptable method of installation.
   c) Solder: Lead-free, per code.
   d) Brazing for Mechanically formed tee fittings: Brazing: Contractors Option:
      1) 5% silver, 6% phosphorus, balance copper, 1190°F melting point. AWS A5.8 number BCuP -3. J.W. Harris Stay-Silv® 5 or equal.
      2) 15% silver, 5% phosphorus, balance copper, 1190°F melting point. AWS 5.8 number BCuP-5. J.W. Harris Stay-Silv® 15 or equal.
      3) 6% silver, 6.1% phosphorus, balance copper, 1190°F melting point. QQ-B-654A number BCuP -5. J.W. Harris Dynaflow® 5 or equal
   e) Unions: 1/4" thru 4": Wrought Copper, Pressure Class 150, w/solder ends.

Note: Dielectric unions shall be used to connect copper to steel pipe and shall have metal connections on each end threaded to match the adjacent piping. Metal components shall be separated by a nylon insulator to prevent current flow between dissimilar metals. Unions shall be suitable for the system operating pressures and temperatures.

2. Drains in Return Air Plenums Area or other areas - Galvanized:
   a) Piping, 1" thru 2": Schedule 40 carbon steel, seamless, galvanized ASTM A-106, Grade B, Type S. Piping, 2-1/2" thru 4": Schedule 40 carbon steel, seamless or electric resistance welded, galvanized; ASTM A-53, Grade B, Type S or ERW.
   b) Pipe Fittings, 1" and larger: 125 lb. rated, galvanized malleable iron, threaded type; ASTM A-197.
   c) Flanges: 150 lb. forged carbon steel, threaded type, with raised face, bored to match the mating pipe I.D.; ASTM A-181, Grade 2, or ASTM A-105, Grade 2. Flanges shall have the manufacturer's trademark affixed in accordance with MSS SP-25.
   d) Bolting studs: ASTM A-193, Grade B7. Nuts shall be heavy duty hex type; ASTM A-194, Grade 2H.
   e) Gaskets: Full faced style, 1/8" thick. Gasket material shall be Nitrile (NBR) sheet, ASTM F104 Line Call Out F712100A9B4E22K5M6; Based on Garlock Blue-Gard® Style 3300 or acceptable equivalent.
   f) Mechanical joints, grooved-end type, may be used on 2-1/2" IPS and larger. See Mechanical Joint Systems", this section, for specifications.
3. Drains, Indoor, not in Return Air Plenums - PVC:
   a. Schedule 40 Polyvinyl Chloride (PVC), ASTM D1785.
   b. Schedule 40 PVC, socket-type, ASTM D2466. Joints shall be made with solvent cement, ASTM D2564.

D. Refrigerant (RS/RL/RHG) Piping.
System Design Pressure: 300 psig.
1. Piping carrying Refrigerants shall be either ACR copper, or carbon steel.
2. ACR Copper Refrigerant Piping:
   a. Piping, 3" and smaller: Type ACR hard-drawn copper tubing, ASTM B88, ANSI H23.1.
   b. Fittings, 3" and smaller, all types, wrought copper: ASTM B16.22, ANSI B16.22. All 90° elbows shall be the long radius type.
   c. Brazing: Contractors Option:
      1) 5% silver, 6% phosphorus, balance copper, 1190°F melting point. AWS A5.8 number BCuP -3. J.W. Harris Stay-Silv® 5 or equal.
      2) 15% silver, 5% phosphorus, balance copper, 1190°F melting point. AWS 5.8 number BCuP-5. J.W. Harris Stay-Silv® 15 or equal.
      3) 6% silver, 6.1% phosphorus, balance copper, 1190°F melting point. QQ-B-654A number BCuP -5. J.W. Harris Dynaflow® 5 or equal
   d. Unions used shall be specifically designed for refrigeration piping.

2.2 MECHANICAL JOINT SYSTEMS

A. General:
1. All couplings, fittings, and gaskets shall be the products of a single manufacturer.
2. Valve ends shall be compatible with the couplings used on the connecting piping.

3. All exposed piping shall be cleaned, removing all rust, primed, and painted black. At substantial completion, all exposed piping shall be free of rust and in a “like new condition”.

B. Pipe Wall Thickness (Schedule Number):
1. Where rolled groove joints are used, the pipe wall thickness may, in some cases, be decreased below that specified for the particular fluid system. In all cases, the minimum pipe wall thickness shall be in accordance with ANSI/ASME B31.9, Chapter II, using 150% of the system operating pressure as the design pressure.
2. Pipe having cut (machined) grooves shall have a nominal wall thickness of not less than the wall thickness specified for Schedule 40 pipe of the particular pipe size.
3. Non-metallic pipe shall not be joined with grooved-end pipe mechanical joints.

C. Couplings:
1. Mechanical joint couplings shall be of the external type, for use with cut or rolled-groove end pipes, fittings, and valves.
2. Couplings shall be self-centering and shall engage and lock-in-place the grooved-end pipes, fittings, and gaskets.
3. All couplings shall be of the rigid style. Flexible couplings shall not be used without the written approval of the Engineer.
4. Couplings shall be Ductile Iron, ASTM A536; or malleable iron, ASTM A47, and shall be designed for not less than 250 psig at 230 Deg. F.
5. The coupling assembly shall be held together by two or more track-head, oval-neck steel bolts, ASTM A183.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General:
1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.

6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
8. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.
10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways, and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
12. Piping found to have water hammer or other objectionable vibrations which cannot be eliminated by proper grading or other natural means, shall be braced, trapped, or hung with shock absorbing hangers and equipped with air chambers, mechanical shock absorbers, flexible pipe connections or otherwise silenced using approved means.
13. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut, or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
14. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
15. Avoid bushings. Reducing fittings shall be used wherever practical.

16. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
17. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.
18. Copper tubing and galvanized steel shall not be mixed in any one run of piping.
19. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
20. Threaded joints shall be made with tapered threads in accordance with ANSI B2.1 and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint is made up a maximum of 3 threads shall be visible.
21. Polypropylene pipe fittings and joints shall be fusion welded in accordance with manufacturer’s specifications and product standards.
22. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.
23. Connections between plastic and metallic pipe shall be made with transition fittings manufactured for the specific purpose.
24. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Hydronic HVAC Systems Additional Requirements:
   1. Provide a 3/4-inch drain valve and a capped hose nipple at each low point in each system, and where indicated.
   2. Provide, at each high point in each system, and where indicated, an automatic air vent with drain line routed to the local floor drain.
   3. Mechanically formed tee shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a tee having a height of not less than three times the thickness of the branch tube wall s as to comply with the American Welding Society lap joint weld. The device shall be fully adjustable as to insure proper tolerance and complete uniformity of the joint. The branch tube shall be notched to conform with the inner curve of the run tube and have two dimple/depth stops pressed into the branch tube (one ¼” atop the other). This is to insure penetration of the branch tube into the tee is of sufficient depth for brazing and that the branch tube does not obstruct the flow in the main line tube. Dimple/depth stops shall be in line with the run of the tube. The second dimple shall be ¼” above the first and shall serve as a visual point of inspection. All mechanical formed tee fittings shall be brazed in accordance with

the Copper Development Associations Copper Tube Handbook using BCuP series filler metal. *NOTE:* Soft soldered joints will not be permitted. Contractor assumes responsibility for joints being installed in accordance with code and manufacturers' recommendations.

4. On liquid systems, make branch connections to top of mains for up-feed arrangement, and to bottom of mains for down-feed arrangement, except where main and branch line are of equal size the branch connection may be made to the side of the main for both up-feed and down-feed applications.
5. Provide water seal in the condensate drain from each air handling or air conditioning unit. The depth of each seal shall be equal to the total static pressure rating of the unit to which the seal is connected. Water seals shall be constructed of two tees and an appropriate U bend with the open end of each tee plugged.
6. Slope piping 1 inch per 40 ft, in the direction of flow.

C. Refrigerant Systems Additional Requirements:
1. Installation shall be in accordance with ANSI B31.5 Refrigeration Piping, unless specified otherwise herein.
2. Brazing procedures and operators shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.
3. Refrigerant pipeline accessories that may be damaged by heat shall be disassembled prior to joint brazing. Reassemble accessories after joint brazing operations are completed.
4. Joints shall be made with solder-type fittings. The outside surface of the tube where engaged in the fitting, and the inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before brazing. Self-cleaning compounds are not allowed. Care shall be taken to prevent annealing of tube and fittings when making connections. Brazed joints shall be made with flux and the previously specified silver-brazing alloy. The brazing alloy shall be applied and drawn through the full fitting length. Excess brazing alloy shall be wiped from the joint before the brazing alloy hardens. Joints shall be made with heat applied uniformly around the entire circumference of the tube and fittings. Remove all excess flux for a clear visual inspection of all brazed connections.
5. Refrigerant piping installed below concrete slab- on-grade shall be installed in continuous runs without joints and shall be encased in PVC plastic conduit. Ends of conduit shall be sealed watertight.

3.2 WELDING, BRAZING, AND SOLDERING

A. Operator and Procedure Qualifications: All welding and/or brazing operators and all welding and brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.
B. Welding:

1. All pipe welding performed under this division of the specifications shall be examined in accordance with ANSI B31.1 requirement for each piping system. The pipe weld examination is hereby made a part of the work of this division of the specifications. An independent outside inspection firm, regularly performing this type of examination, shall be hired by the contractor or subcontractor performing the welding as part of the work of their contract. The examination shall be performed by a representative of the Inspection Company (hereafter called the Inspector) who is qualified and certified for each examination method required.
2. The Inspection Company performing the examination shall certify in writing that all pipe welds performed under this contract conform to the requirements of ANSI B31.1 for each piping system and to all other governing codes.
3. Before final acceptance of the welded piping, certified test reports shall be submitted for review. The reports shall include the following data: name and location of project, date of test, type of piping system, working pressure and temperature, standard used for testing and applicable test method, number and location of welds tested and names of persons performing test.
4. Welders and procedures for fire protection system piping qualified in accordance with NFPA No. 13.

C. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".

D. Soldering: Joints in copper tubing shall be made with solder-type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self-cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid, or a petroleum-based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. All joints to be wiped clean after soldering. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxyacetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

E. Piping Identification: All piping shall be marked in accordance with the provisions of Section 23 02 00 - BASIC MATERIALS AND METHODS FOR HVAC SYSTEMS.

3.3 TESTING OF PIPING SYSTEMS:

A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:
   1. General: Furnish everything required for the tests. Notify Architect/Engineer at least 48 hours before any testing is performed. Independent Agent/Owner shall verify pressure test and sign off. Report to be furnished to Architect/Engineer. Testing shall be performed at the completion of each phase of the project.
   2. HVAC related systems shall be tested with water at 1-1/2 times the system working pressure, but not less than 100 psig. Joints will be visually examined for leaks.

a. Initial Hydrostatic Test: Before insulation is applied to field connections, hydrostatically pressure test each pipe as a complete unity with fresh water to 150 psig or not less than 1.5 times systems pressure rating, whichever is greater. Pressure testing with air will not be permitted, unless approved prior to testing. Limit pressures rise to 100 psi per minute at beginning of test and pressure drop to 100 psi at conclusion of test. Remove air from system before start of tests. Pressure must hold for a minimum of four (4) hours with a 4-psi maximum drop. Examine system for leaks and porosity. Replace porous sections and repair leaks in accordance with pipe manufacturer's instructions, repeat tests until system is proven tight. During a 4-hour pressure holding period, valve off system and completely disconnect method of system pressurization.
b. Cycle Test: Pressure cycle test system at 150 psig or 1.5 times system pressure rating, whichever is greater, for 10 cycles. Each cycle shall consist of a one-minute period at 150 psig or 1.5 times system pressure rating and a 4-minute period when the pressure is dropped at least 40%. Examine system for leaks and porosity, repair leaks, replace porous pipe, and repeat test until system is proven tight.
c. Post Cycle Hydrostatic Test: Repeat initial hydrostatic test.
d. Operational Test: Operate complete system with water flowing through system. During 48 hours, cycle system 8 hours on and 8 hours off for 3 complete cycles. Examine system for leaks until system is proven tight.
e. Second Hydrostatic Test Series: After successful completion of operational testing, repeat first hydrostatic test series sequence. Examine pipe system for leaks and porosity. Repair leaks replace porous pipe, and repeat test until system is proven tight. After successful completion of the second hydrostatic test series, backfill trenches.
f. Final Hydrostatic Test: After completion of the final phase of construction, repeat the initial hydrostatic test on the entire piping system(s).

3. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.
4. Refrigerant Piping Systems shall be tested with dry carbon dioxide, or nitrogen, at 315 psig for the high side, and at 245 psig for the low side. If leaks are to be detected by use of an electronic halogen detector, or a halide torch, the system shall be pressurized with refrigerant gas prior to introduction of dry carbon dioxide or nitrogen into the system. Pre-charging of system with refrigerant gas is not necessary for soap bubble leak detection method.

B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 24 hours' notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.
C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed, and approval is granted.
D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.

E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems and blow out piping with compressed air to remove trapped water.
F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.
G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.
H. Disconnect pressure boosting apparatus, or vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.
I. During tests, isolate system components that have test pressures less than pressures specified for system tests.
J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

3.4 CLEANING OF PIPING SYSTEMS

A. HVAC Piping systems shall be thoroughly cleaned as described in Section 23 25 00 – HVAC Water Treatment.

END OF SECTION

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Single Wall Round Ductwork and Fittings.
B. Single Wall Round Snaplock Seam Galvanized Steel Ductwork and Fittings.
C. Double Wall Round Ductwork and Fittings.
D. Round Stainless-Steel Ductwork and Fittings.
E. Single Wall Round Flexible Ductwork.
F. Insulated Round Flexible Ductwork.

1.3 QUALITY ASSURANCE

A. All ductworks shall be fabricated within the guidelines established by the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) HVAC Duct Construction Standards - Metal and Flexible, latest edition.
B. All ductworks shall be fabricated to withstand the pressure and velocity required on this project.
C. All components, fasteners, sealants, adhesives, etc. in the conditioned air stream or exposed in active or non- active plenums shall conform to the NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems and Standard for Flame/Smoke/Fire Contribution of 25/50/0.
D. All ductworks shall conform to UL standard UL 181 Factory Made Air Duct Materials and Duct Connectors, latest edition. Applicable sections shall apply to shop fabricated ductwork.
E. After fabrication and installation of all shop fabricated ductwork the fabricator and installer, if not the same, shall certify in writing to the Owner's representative that all shop fabricated ductwork and installation of same meets or exceeds the quality standards established by SMACNA.

1.4 SUBMITTALS

A. Submission for acceptance is required.
B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
C. Submit in accordance with Division 1 requirements.

1.5 SHOP DRAWINGS

A. Shop Drawings: Provide shop drawings of ductwork as follows:
   1. Draw to a scale of not less than 1/4 inch to one foot on the same size sheets as the contract drawings.
   2. Show duct sizes.
   3. Show fitting details.
   4. Show lighting and ceiling diffusers.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Single Wall Round Ductwork and Fittings:
   1. Autoduct, Inc.
   2. Eastern Sheetmetal
   3. Hamlin Sheetmetal, Inc.
   4. Impulse Air.
   5. Lindab
   6. Semco Manufacturing, Inc.
   7. United McGill
B. Single Wall Round Snaplock Seam Galvanized Steel Ductwork and Fittings:
   1. Alco Manufacturing Company.
   2. Crown Products Company.
   3. Hughes.
C. Double Wall Round Ductwork and Fittings:
   1. Autoduct, Inc.
   2. Eastern Sheetmetal
   3. Hamlin Sheetmetal, Inc.
   4. Impulse Air.
   5. Lindab
   6. Semco Manufacturing, Inc.
   7. United McGill
D. Round Stainless-Steel Ductwork and Fittings:
   1. Autoduct, Inc.
   2. Eastern Sheetmetal
   3. Hamlin Sheetmetal, Inc.
   4. Impulse Air.
   5. Lindab
   6. Semco Manufacturing, Inc.
   7. United McGill
E. Single Wall Round Flexible Ductwork:
   1. ATCO Rubber Products, Inc.
   2. Flexmaster USA, Inc.
   3. Flexible Technologies - Thermaflex®
F. Insulated Round Flexible Ductwork:
   1. ATCO Rubber Products, Inc.
2. Flexmaster USA, Inc.

3. Flexible Technologies - Thermaflex®

2.2 FABRICATION

A. Single Wall Round Ductwork and Fittings:
   1. Materials: Hot rolled, continuously annealed, hot dipped galvanized steel minimum of G-90, 0.90 oz/sf coating, conforms to ASTM A653.
   2. Metal Gauges: Conform to the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) HVAC Duct Construction Standards - Metal and Flexible, latest edition. The following table shall establish a minimum guideline unless the manufacturer has U.L. Standard 181 test results that show that lighter gages (thinner wall thickness) with intermediate corrugations (ribs) allow the gage reduction:

Positive Internal Static Pressure in W.G.	0” – 2.0”		2.1” – 4.0”		4.1” – 10.0”	
Pipe Diameter	Spiral Pipe	Fittings	Spiral Pipe	Fittings	Spiral Pipe	Fittings
6” – 10”	28	26	28	24	28	24
12”	28	26	28	24	26	24
14”	28	26	26	24	26	24
16”	26	24	26	22	24	22
18” – 26”	26	24	24	22	24	22
27” – 36”	24	22	22	20	22	20
37” – 50”	22	20	20	20	20	20
51” – 60”	20	18	18	18	18	18
61” – 64”	18	16	18	16	18	16

   3. Duct Construction: Spiral wound, lock seam construction, slip joint or flanged connections as noted below under couplings.
   4. Fitting Construction:
      a. 90 Deg. and 45 Deg. Ells: Solid - welded seam construction for dust collector use, Solid - welded seam or spot welded and bonded for general use. Radiused ells to be full radiused unless otherwise noted, mitered ells to have single thickness, turning vanes, slip joint or flanged connections.
      b. Tees or Crosses: Solid - welded seam construction for dust collector use, Solid - welded seam or spot welded and bonded for general use. Tangential, unless otherwise noted or detailed, conical take off or reduction, slip joint or coupled ends. 180 Deg. or 45 Deg. as indicated.

c. Bellmouth: Solid - welded seam construction for dust collector use, Solid - welded seam or spot welded and bonded for general use. Spun metal, smooth converging bellmouth, round, gauge equal or greater than connecting duct.
d. Access Section:
   1) 7" Diameter and Less: Minimum 12" long flanged section, minimum four bolts per flange.
   2) 8" Diameter and Larger: Round or rectangular access cover, on welded raised section, pressure sensitive release suitable for manual release or emergency vacuum release, chain retainer, (see Para. 3.5: Schedules for Sizes).
e. Couplings:
   1) Joints 36" or less shall have 2" slip coupling.
   2) 38" or over shall be spiral mate.
f. Based on United McGill

B. Single Wall Round Snaplock Seam Galvanized Steel Ductwork and Fittings:
1. Materials: Hot rolled, continuously annealed, hot dipped galvanized steel minimum of G-90, 0.90 oz/sf coating, conforms to ASTM A653.
2. Metal Gauges: Minimum of 26 gauge, with remaining sizes conforming to the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) HVAC Duct Construction Standards Metal and Flexible, latest edition. The following table shall establish a minimum guideline:

Round Ducts:

Duct Diameter	Spiral Pipe	Fittings and Longitudinal Seam
Pipe 3" thru 14"	26	24
15" thru 26"	24	22
27" thru 30"	22	20

3. Duct Construction: Snaplock seam construction, slip joint or flanged connections.
4. Fitting Construction:
   a. 90 Deg. and 45 Deg. Ells: Adjustable ells to be full radiused unless otherwise noted, slip joint or flanged connections.
   b. Tees or Crosses: Adjustable, unless otherwise noted or detailed, conical take off or reduction, slip joint or coupled ends. 180 Deg. or 45 Deg. as indicated.

C. Double Wall Round Ductwork and Fittings:
1. Materials:
   a. Outer Duct: Hot rolled, continuously annealed hot dipped galvanized steel, minimum G- 90, 0.90 oz/sf (.001 inch thick/side) coating, conforms to ASTM 653.
   b. Liner: 1” thickness flexible fibrous glass minimum density 1.5 lb./cf., maximum conductivity per 1" thickness of .27 at 75□F mean temperature with a mylar coating.
   c. Inner Duct: Hot rolled continuously annealed, perforated hot dipped, galvanized steel, minimum G-90, 0.90 oz/sf (.001 inch thick/side) coating, conforms to ASTM 653.
2. Metal Gauges:

a. Outer Duct: Conform to the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) Duct Construction Standards, Metal and Flexible, latest edition. The following table shall establish a minimum guideline unless the manufacturer has U.L. Standard 181 test results that show that lighter gages (thinner wall thickness) with intermediate corrugations (ribs) allow the gage reduction:

Spiral Pipe Inside Dia.	Round Ducts: Shell	Perf. Liner	Longitudinal Shell	Fittings and Seam Pipe Perf. Liner
3" thru 8"	24	26 Non-Ribbed	24	24
9" thru 12"	24	28 Ribbed	24	24
13" thru 24"	22	28 Ribbed	22	24
25" thru 34"	20	28 Ribbed	20	24
35" thru 48"	20	28 Ribbed	20	22
49" thru 52"	18	28 Ribbed	18	22
53" thru 58"	18	26 Ribbed	18	22
59" thru 62"	16	26 Ribbed	16	22
63" thru 82"	16	22 Non-Ribbed	16	22

3. Duct Construction:
   a. Outer Duct: Spiral wound, lock seam construction, slip joint or flanged connections as noted below under couplings.
   b. Inner Duct: Spiral wound, lock seam construction, slip joint connections, mechanically bound to outer duct for vertical installation.
4. Fitting Construction:
   a. 90 Deg. and 45 Deg. Ells: Die formed or welded segmented construction, radiused ells to be full radiused unless otherwise noted, mitered ells to have single thickness turning vanes, liner and inner duct continuous.
   b. Tees or Crosses: Tangential unless otherwise noted, conical take off or reduction coupled ends, 180 Deg. or 45 Deg. as indicated.
   c. Bellmouth: Spun metal smooth converging bellmouth, round, single wall gauge equal to or greater than connecting duct.
   d. Access Section:
      1) 7" Diameter and Less: Flanged section, minimum four bolts per flange. Double wall section.
      2) 8" Diameter and Larger: Round or rectangular access cover, on welded raised sections, pressure sensitive release suitable for manual release or emergency vacuum release, chain retainer, (see Para. 3.5 - Schedules for Sizes).
   e. Couplings:
      1) Joints 36" or less shall have 2" slip coupling.
      2) 38" or over shall be spiral mate.
   f. Based on United McGill

D. Round Stainless-Steel Ductwork and Fittings:
   1. Materials: Exhaust duct shall be constructed of 304 or 316 stainless steel as scheduled with a 2B mill finish.

2. Metal Gauges: Conform to the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) Duct Construction Standards, Metal and Flexible, latest edition. The following table shall establish a minimum guideline unless the manufacturer has U.L. Standard 181 test results that show that lighter gages (thinner wall thickness) with intermediate corrugations (ribs) allow the gage reduction:

Negative Internal Static Pressure in W.G.	0" – 2.0"		2.1" – 6.0"		6.1" – 10.0"	
Pipe Diameter	Spiral Pipe	Fittings	Spiral Pipe	Fittings	Spiral Pipe	Fittings
9" – 15"	26	24	24	22	24	22
16" – 26"	24	22	22	20	20	18
28" - 36"	22	20	20	18	18	16
38" – 50"	20	18	18	16	18**	16
52" – 60"	18	16	16	14	18**	16*

* Companion angle rings required.
** Girth rings required 60" O.C.

3. Duct Construction: Round and oval ducts shall be of the spiral lockseam or all welded construction.
4. Fitting Construction: Fittings shall be factory fabricated with all seams continuously welded.
5. Fitting Type: Refer to Section 2.2.A.4.
6. Joints:
   a. Joints 36" or less shall have 2" slip coupling.
   b. 38" or over shall be spiral mate.

E. Uninsulated Round Flexible Ductwork:
1. High Pressure Application: Factory fabricated assembly of a trilaminate of aluminum foil, fiberglass, and polyester with a perm rating of .02 high tear strength and properties to resist temperature change, mildew, and age hardening. It shall be mechanically locked, without adhesives, into a formed aluminum helix on the ducts outside surface and be U.L. listed 181 Class 1 and comply with NFPA 90A and 90B. The material shall have a pressure rating of 12" w.g. positive pressure and -5" w.g. negative pressure through a temperature range of -20□F to +250□F. Based on Type NI-35 as manufactured by Flexmaster U.S.A., Inc., ATCO Rubber Products UPC #7 or Flexible Technologies – Thermaflex S-LP-10.

F. Insulated Round Flexible Ductwork:
1. High Pressure Application:

a. Factory fabricated assembly of a trilaminate of aluminum foil, fiberglass, and polyester with a perm rating of .02, high tear strength and properties to resist temperature change, mildew, and age hardening. It shall be mechanically locked, without adhesives, into a formed aluminum helix on the ducts outside surface and be U.L. listed 181 Class 1 and comply with NFPA 90A and 90B. The material shall have a pressure rating of 12" w.g. positive pressure and -5" w.g. negative pressure through a temperature range of -20□F to +250□F.
b. The duct material shall be factory wrapped in a blanket of fiberglass insulation with a C factor of .23 or less. The insulation shall be encased in a fire-retardant reinforced aluminum material vapor barrier with a perm rating of not over .05 grains per square ft. per hour per inch of mercury.
c. Based on Type 3M as manufactured by Flexmaster U.S.A., Inc., ATCO Rubber Products UPC #036 or Omni Air 1200, or Flexible Technologies – Thermaflex M- KF.

2. Low Pressure Application:
a. Factory fabricated assembly of a tri-laminate of aluminum foil, fiberglass, and polyester with a perm rating of .02, high tear strength and properties to resist temperature change, mildew, and age hardening. It shall be mechanically locked, without adhesives, into a formed aluminum helix on the ducts outside surface. It shall be U.L. listed 181 Class 1 and comply with NFPA 90A and 90B. The material shall have a pressure rating not less than 6" w.g. positive pressure and -3" w.g. negative pressure through a temperature range of -20□F to +250□F.
b. The duct material shall be factory wrapped in a blanket of fiberglass insulation with a C factor of .23 or less. The insulation shall be encased in a fire-retardant reinforced aluminum material vapor barrier with a perm rating of not over .05 grains per square ft. per hour per inch of mercury.
c. Based on Type 5M as manufactured by Flexmaster U.S.A., Inc., ATCO Rubber Products UPC #036 or Omni Air 1200, or Flexible Technologies – Thermaflex M- KF.

G. Ductwork, General: Each duct section shall have both ends covered with polyethylene or other suitable material to protect against the entrance of dirt, debris or water during shipment and storage prior to installation.
H. DUCT SEALANT: Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, used indoors or outdoors. Foster 32-19 Duct Fas, Childers CP-146 Chil Flex or Duro Dyne SAS.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS:

A. Install in strict accordance with the manufacturer's written installation instructions.
B. The drawings, due to their small scale, are diagrammatic in nature and are not necessarily complete in all details. For this reason, not all necessary offsets, rises or falls are shown. Coordinate the installation of the ductwork with all other trades and to provide all necessary offsets, etc. as required for completion of this project without any additional cost to the Owner, Architect or Engineer.
C. All ductworks shall be run parallel or perpendicular to building structure and seams or spirals shall be aligned whenever possible.

D. All sizes indicated on the drawings are inside clear dimensions.
E. All ductworks shall be properly sealed in a neat clean manner with all excess sealer wiped clean.
F. Coordinate the location of, provide the necessary access and install all devices provided in other specification sections within Division 23, including but not limited to fire, smoke and/or balancing dampers, access and mounting for control devices, air flow measuring stations, etc., as apply to this project.
G. All ducts passing through partitions or walls shall be properly and neatly sealed. If partition or wall carries a fire rating (fire damper indicated or if architectural plans indicate a rated wall) the duct shall be sleeved with the space between the sleeve and duct properly sealed with firestopping material (Refer to Division 7 for firestopping material). The sleeve shall be permanently affixed to the wall (see Section 23 05 29 - Supports, Hangers, Anchors and Sleeves for sleeve specification).
H. Coordinate the proper duct pressure classification with the system served and to provide the proper ductwork to withstand these pressures. (See Para. 3.5 Schedules: System Pressure Classification and Duct Material Schedule.)

3.2 CLEANING AND PROTECTION

A. During construction, ductwork shall be cleaned of dirt and debris internally section by section as it is installed. At end of each day, ductwork not finally connected to equipment shall be provided with a temporary closure of polyethylene film or other covering material that will prevent entrance of dust, debris, or water. Clean exterior surfaces of any material which might cause corrosion or if the duct is to be painted, it shall be cleaned suitable for painting. After substantial completion of the ductwork system the system shall be operated with filters in place to blow-out any remaining dust from the system. Protect all equipment and property from damage or fouling during this cleaning. All prefilters used during cleaning shall be replaced prior to turning the system over to the Owner.

3.3 LEAK TESTING

A. Duct Leakage Report: The Contractor shall make all the supply, return, outside air, and exhaust duct systems (limited to 1,500 cfm and greater) operationally air-tight, with no more than 2% leakage for duct systems rated at 2" w.c. pressure class, and 1% leakage for systems exceeding 2" w.c. pressure class. Leakage test to be performed by Contractor with all air device openings and fan connections sealed airtight. Test the systems prior to applying any insulation or concealing in soffits or chases. Use a portable fan capable of producing a static pressure equal or greater than the duct test pressure. This fan to have a flow measuring assembly consisting of a straight section of duct with an orifice plate, pressure taps, and a calibrated performance curve for determining leakage rates.
    1. Test each section equal to the external static pressure indicated for that fan or air handler with the portable fan assembly. After the fan achieves that steady state design pressure, record the air flow quantity across the orifice and the percent of design air flow. If the test fails, the Contractor shall reseal and retest at no additional cost to the Owner.

2. Repair all duct leaks that can be heard or felt, even if the system has passed the leakage test.
3. Submit duct leakage reports to the Balancer and the Engineer for their review and approval.
4. Refer to specification section 23 05 93 for more information.

3.4 INSTALLATION

A. General:
   1. Install generally as indicated.
   2. Conceal ductwork in finished spaces unless indicated otherwise.
   3. Do not install ductwork in or allow to enter or pass-through electrical rooms, elevator machine room, or spaces housing switchboards, panelboards, or distribution boards, except ductwork that serves electrical rooms, elevator machine rooms or spaces.
   4. Exercise special care to provide tight fitting well fabricated, well braced ductwork systems.
   5. Field assemble rectangular, round, or flat oval ductwork as follows:
      a. Use slip joints, couplings, etc. sealed with adhesive pre-applied to couplings or duct mate spiral mate or oval mate on duct sizes 1” and larger.
      b. Isolate dissimilar metals with elastomeric sealant tape or fiber gaskets and gaskets and washers for bolts.
   6. In high pressure ductwork (above 2" w.g.), do not use 2 pieces mitered 90-degree elbows with or without vanes unless approved by engineer.
   7. Make duct connections from hoods, openings, fans, and other devices.
B. Double Wall Round Ductwork and Fittings:
   1. Coordinate the liner and/or exterior insulation requirements to assure a continuous vapor barrier and uniform thermal resistance. See Para. 3.5 Schedules for liner/insulation thickness requirements.
   2. In unconditioned, non-accessible areas such as chases and dry wall ceiling the lined ducts shall also have an additional layer of duct wrap (See Section 23 07 00 -Insulation) at all joints to assure condensation control, wrap will extend a minimum of 6" on either side of joint.
C. Uninsulated Round Flexible Ductwork:
   1. Provide where indicated or required on return air duct connections only.
   2. Maximum length shall be 5'-0".
   3. Maximum turn or bend shall be no more than 90 Deg. Provide rigid elbows where 90 Deg. turns are indicated on the drawings.
   4. Flexible ductwork shall be cut to the proper length. Coiling or unnecessary offsets will not be permitted.
   5. Secure inner liner to terminal collar or duct coupling with duct sealer and sheet metal screws. Wrap with three wraps of duct tape following helix path.
   6. Rigid round ductwork may be substituted in lieu of flex unless the flex duct is used for vibration isolation or otherwise detailed.
D. Insulated Round Flexible Ductwork:
   1. Provide where indicated or required on supply air ducts.
   2. Coordinate the insulation requirements as to assure a continuous and consistent thermal resistance and vapor barrier.

3. Maximum length shall be 5'-0".
4. Maximum turn or bend shall be no more than 90 Deg. Provide rigid elbows where 90 Deg. turns are indicated on the drawings or more than one 90 Deg. turn is required.
5. Flexible ductwork shall be cut to the proper length. Coiling or unnecessary offsets will not be permitted.
6. Secure inner liner to terminal collar or duct coupling with duct sealer and sheet metal screws. Provide Stainless steel draw band to seal inner liner tight to connecting duct. Pull insulation over inner liner and fold vapor barrier over end of insulation. Secure with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth.
7. High pressure flexible duct to be provided upstream of all terminal boxes. Low pressure flexible duct may be used downstream of terminal box.
8. Rigid round ductwork may be substituted in lieu of flex unless the flex duct is used for vibration isolation or otherwise detailed. If omitted, external insulation must be provided per Section 23 07 00 - Insulation.

3.5 SCHEDULES

A. System Pressure Classification and Duct Material Schedule:

System I.D. No.	System	Section	Maximum Duct Pressure	Material
1.	Supply	AHU to Terminal	4" pos.	A
2.	Supply	Terminal to Diffuser	2" pos.	A
3.	Return	Terminal to AHU	2" neg.	A
4.	Emergency Exhaust	Exhaust Fan Schedule Legend:		

Duct Material:

A. Galvanized Steel
B. PVC Coated Galvanized Steel
C. 304 Stainless Steel

B. Access Door Schedule:
1. Round Duct:

	Duct Size	Access Door Size
a.	up to 7" dia.	12" long removable section
b.	8" to 12" dia.	8" x 12"
c.	13" to 18" dia.	12" x 12"
d.	19" dia. and up	14" x 20"

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Duct access doors.
B. Fire doors.
C. Fire dampers.
D. Smoke dampers.
E. Smoke/Fire dampers.
F. Backdraft dampers.
G. Volume dampers.
H. Prefabricated casing panels.
I. Flexible duct connectors.
J. Roof mounted air outlets and inlets.
K. Louver (Exhaust).
L. Louver (Outside Air Intake).
M. Hardware Cloth.
N. Aluminum Brick vent
O. Install miscellaneous control devices.

1.3 QUALITY ASSURANCE

A. All products provided for enhancement of Life Safety shall be UL listed and bear the appropriate label stating compliance.
B. All Products to have a Florida Product Approval Number, as required by the Florida Building Code.
C. All products located in the conditioned air stream or located in return air plenums shall conform to the NFPA 90A Flame/Smoke/Fuel Contribution of 25/50/0 and all other applicable requirements of NFPA 90A.
D. Smoke and Smoke/Fire dampers shall be provided with a 60 month from the date of shipment parts only warranty, including freight for all components, including damper operators.
E. Quality Assurance for Louvers:
    1. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
    2. Welding: Qualify procedures and personnel according to the following:
        a. AWS D1.2, "Structural Welding Code - Aluminum."
        b. AWS D1.6, "Structural Welding Code - Stainless Steel."

3. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.4 PERFORMANCE REQUIREMENTS FOR LOUVERS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers.
   1. Wind Loads: Determine in accordance with Florida Building Code (current edition).

1.5 SUBMITTALS

A. Submission for acceptance is required.
B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
C. Submit in accordance with Division 1 Requirements.
D. Submittals for Louvers:
   1. Product Data: For each type of product indicated.
   2. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.
      a. For installed louvers and vents indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Include summary of forces and loads on walls and jambs.
   3. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.
      a. Wind-Driven Rain.
      b. Air-Performance.

1.6 PROJECT CONDITIONS FOR LOUVERS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Duct Access Doors:
   1. Air Balance, Inc.

2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Nystrom
6. Prefco Products, Inc.
7. Ruskin Manufacturing, Co.
8. Safe Air Inc.

B. Fire Doors:
1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Nystrom
6. Prefco Products, Inc.
7. Ruskin Manufacturing, Co.
8. Safe Air Inc.

C. Fire Dampers:
1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Safe Air Inc.

D. Smoke Dampers:
1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Safe Air Inc./Dowco

E. Smoke/Fire Dampers:
1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Safe Air Inc./Dowco.

F. Backdraft Dampers:
1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Safe Air Inc./Dowco

G. Volume Dampers:
   1. Greenheck, Inc.
   2. Air Balance, Inc.
   3. Arrow United Industries, Inc.
   4. Cesco Products
   5. Nailor Industries, Inc.
   6. Prefco Products, Inc.
   7. Ruskin Manufacturing, Co.
   8. Safe Air Inc./ Dowco
H. Prefabricated Casing Panels:
   1. IAC
   2. Ruskin
   3. Semco
   4. United Sheetmetal
   5. Vibro Acoustics
I. Flexible Duct Connectors:
   1. Ductmate Industries, Inc.
   2. Duro-Dyne
   3. Elgen
   4. Ventfabric
J. Roof Mounted Air Outlets and Inlets:
   1. Air Balance, Inc.
   2. Cesco Products
   3. Greenheck, Inc.
   4. Leader, Inc.
   5. Loren Cook
   6. Ruskin Manufacturing Company
K. Louvers (Exhaust)- No Substitutions Accepted:
   1. Greenheck, Inc.
   2. Ruskin Company; Tomkins PLC.
   3. United Enertech
L. Louvers (Outside Air Intake)- No Substitutions Accepted:
   1. Greenheck, Inc.
   2. Ruskin Company; Tomkins PLC.
   3. United Enertech
M. Hardware Cloth:
   1. McNichols Co.
   2. or equal.
N. Aluminum Brick Vent
   1. Greenheck, Inc.
   2. Ruskin Manufacturing Company
   3. United

2.2 FABRICATION

A. Duct Access Doors:
   1. Low Pressure Ductwork:
      a. Rating up to 2" wg positive or negative.

b. Frame: Minimum 22-gauge galvanized steel or aluminum, minimum 5/8" knock over edge, neoprene gasket between frame and duct and frame and door.
c. Door: Minimum 24-gauge galvanized steel or aluminum, continuous hinge, and cam latches or minimum 2 cam latches, double wall construction, fiberglass insulated thickness to match ductwork.
d. Based on Ruskin Manufacturing Co. ADH24.

2. High Pressure Ductwork:
a. Rating: Up to 10" wg positive pressure.
b. Frame: Minimum 16-gauge galvanized steel with "Z" shaped reinforced corners, polyurethane gasket between frame and duct and frame and door.
c. Door: Minimum 16-gauge galvanized steel or aluminum, minimum 2 spring latches, double wall construction, fiberglass insulated with thickness to match ductwork.
d. Based on Ruskin Manufacturing Co. ADHP-3.

B. Fire Doors:
1. Rating: 3 hours (UL approved for installation in Class “A” wall construction).
2. Minimum 24-gauge galvanized steel frame suitable for connection to ductwork without transition, minimum 24-gauge galvanized steel curtain type blades located out of the airstream, thickness coordinated with wall construction. Where an active smoke control system exists (refer to Section 23 09 93) the damper shall be capable of closing in an airstream moving at a minimum of 2000 feet per minute and operating at 4" w.g. pressure (dynamic damper).
3. Sleeves: UL listed minimum gauge galvanized steel with welded construction corners. Roll formed sleeves will not be acceptable unless contractor guarantees in writing to seal voids in sleeve with UL approved sealer to limit air leakage. Length of sleeve shall be coordinated with the wall or floor.
4. Operation: Stainless steel constant force closure spring.
5. Link Setting: 160□F or 165□F
6. Based on Ruskin Manufacturing Co., IBD23 Style B (Static Systems).
7. Based on Ruskin Manufacturing Co., DIBD23 Style B (Active smoke control systems only).

C. Fire Dampers:
1. Rating: 1-1/2 hours (UL approved for installation in 2-hour walls).
2. Construction: Minimum 24-gauge galvanized steel frame suitable for connection to ductwork without transition, minimum 24-gauge galvanized steel curtain type blades located out of the airstream, thickness coordinated with wall construction. Where an active smoke control system exists (refer to Section 23 09 93) the damper shall be capable of closing in an airstream moving at a minimum of 2000 feet per minute and operating at 4" w.g. pressure (dynamic damper).
3. Sleeves: UL listed minimum gauge galvanized steel with welded construction corners. Roll formed sleeves will not be acceptable unless contractor guarantees in writing to seal voids in sleeve with UL approved sealer to limit air leakage. Length of sleeve shall be coordinated with the wall or floor.
4. Operation: Stainless steel constant force closure spring.
5. Link Setting: 160F or 165F.
6. Based on Ruskin Manufacturing Co. IBD2 Style B. (Static Systems).
7. Based on Ruskin Manufacturing Co., DIBD2 Style B. (Active smoke control systems only).

D. Smoke Dampers:
   1. Low and Medium Pressure Ductwork:
      a. UL labeled under UL 555S low leakage rated, no more than 10 CFM/SF @ 1" w.g. (UL Class II) after exposure to 1000□F for 1 hour (non-degradable). Classified for both horizontal and vertical mounting.
      b. Construction:
         1) Frame 16 galvanized steel.
         2) Damper Blades: 14-gauge true airfoil design constructed of galvanized steel of low leakage non-heat degradable design with friction free silicone rubber edge type for a smoke seal to 450□F incorporated into blade and frame shapes. Blade shall be suitable for installation in systems with a maximum velocity of 4,000 FPM and 8” w.g. pressure at closure.
      c. Damper operation by means of an electric actuator 120V AC, 24V AC or signal from smoke detector alarm circuit. Electric motor actuator to be UL listed with damper assembly for power open, spring closed operation with a maximum travel time of 15 seconds. Motor furnished with all connecting linkage and mounting hardware.
      d. Damper and actuator shall be provided with a 60-month warranty as described in Paragraph 1.3.C.
      e. Based on Ruskin Manufacturing Co., SD60-II.

E. Smoke/Fire Dampers:
   1. Low and Medium Pressure Ductwork:
      a. UL labeled under the following standards:
         1) UL 555 - 1-1/2 hr. fire endurance.
         2) UL 555S - Low leakage rated, no more than 10 CFM/SF @ 1" w.g. (UL Class II) after exposure to 1000□F for 1 hour (non-degradable).
         3) Classified for both horizontal and vertical mounting.
      b. Construction: Single damper designed and rated for combination smoke/fire duty.
         1) Frame: 16 ga. galvanized steel.
         2) Damper Blades: 14-gauge true airfoil design constructed of galvanized steel of low leakage non-heat degradable design with friction free inflatable silicone coated fiberglass material to maintain smoke leakage rating to a minimum of 450□F and galvanized steel for flame seal to 1900□F. Blade shall be suitable for installation in systems with a maximum velocity of 2,000 FPM and 4” w.g. pressure at closure.
         3) Duct sleeve provided by others.
      c. Operation:
         1) Smoke/fire damper operation by means of an integral resettable and re-useable UL listed electric-ambient temperature link, UL listed releasing device and mechanical lock assembly. Link activated by either electric, 120V AC or 24V AC signal from smoke detector alarm circuit or 350□F duct ambient temperature. Damper shall be capable of being reopened by remote signal when the duct temperature drops to 150□F. Electric motor actuator shall be UL listed with the damper assembly for power open/spring closed operation. Motor actuator shall be factory furnished with all connecting linkage and mounting hardware and shall be factory tested for proper operation.

2) Damper and actuator shall be provided with a 60-month warranty as described in Paragraph 1.3.C.

d. Based on Ruskin Manufacturing, Co., FSD60-2.

F. Backdraft Dampers:
1. Low Pressure Ductwork:
a. Rating: Up to 1" wg positive or negative.
b. Frame: Minimum 16 gauge (.064") galvanized steel or extruded aluminum.
c. Blades: Minimum 16 gauge (.064") galvanized steel or extruded aluminum parallel blade action, brass bearing, non-ferrous or de-iron pivot pins, gasketed blades.
d. Accessories: Counterbalance and weights suitable for assisting or retarding as indicated on the drawings.
e. Based on Ruskin Manufacturing, Co. CBD4.

G. Volume Dampers:
1. Provide volume dampers where indicated, in all branch ductwork and construct as follows:
a. Provide single blades to a maximum of 10-inch blade width.
b. Provide inside end synthetic bearings and locking quadrants with wing nuts.
c. Friction locks are not permitted.
d. Break damper blades on both edges for stiffness.
e. Provide multi-blades on dampers 12 inches and larger with inside pins and molded synthetic bearings, and 2 inches wide by 1/8-inch-thick structural galvanized channel frame.
f. Provide galvanized connecting bar with molded synthetic bearings on multi-blade dampers.
g. Provide standoff bracket for installation in externally insulated duct.
h. Based on Ruskin Manufacturing, Co. MD35 for rectangular ducts (MDSR25 for round ducts) with velocities up to 1500 feet per minute.
i. Based on Ruskin Manufacturing, Co. CD30AF1 for rectangular ducts (CDR82 for round ducts) with velocities over 1501 feet per minute.

H. Prefabricated Casing Panels:
1. Panel sections shall consist of an outer sheet of 18 gauge and an inner sheet of 22-gauge galvanized steel. Inside panel surfaces shall have 3/32-inch diameter perforations on 3/16-inch centers.
2. Panels shall be completely metal enclosed; shall be minimum (2) (4) inches thick; and the space between inner and outer surfaces shall be filled with acoustic material which will not settle, shed, or dust.
3. Housing shall be factory fabricated and field assembled with joining members serving to provide structural rigidity to 10 inches water pressure differential, either positive or negative. Structure shall be tested and rated for known structural deflection.
4. The joining members shall be fabricated from galvanized sheet steel, minimum 20 gauge, and shall be arranged to provide a pressure tight air seal against 10 inches pressure differential, either positive or negative. Use Sealing Mastic when joining parallel panels, roof to wall panels, joints and corner joints. Housing shall be fabricated to withstand floor and roof loads of 40 pounds per square foot plus any concentrated loads.
5. Assembly shall be secured against the separation forces of air pressure with cadmium plated metal fasteners.

6. The panel shall have minimum airborne sound transmission loss when tested according to ASTM E90-70.
   Transmission Loss in DB Octave

Band HZ	63	125	250	500	1K	2K	4K
Loss	30	16	24	35	45	52	58

7. The thermal conductivity of the panel shall not exceed 0.07 Btu/hr-square foot-degrees F.
8. Insulated access doors shall be provided. Doors shall be constructed of 20-gauge galvanized steel, adequately hinged. Doors shall open against the pressure force and be equipped with safety features such as latches operable from both sides of door and wire glass double pane windows not less than 6 inches x 6 inches square. Doors shall seat against neoprene gaskets. Doors shall have Ventfabrics No. 260 "Ventlok" latches.
9. All openings in the casing for ductwork connections shall be cut and framed at the factory by the panel manufacturer. All openings shall be sealed to prevent air leakage and condensation in accordance with the manufacturer's instructions.
10. All joints, corners, etc., in the panels and floor shall be so designed that no direct path for sound or air leakage can occur.
11. The casing manufacturer shall guarantee that the casings, doors and housings shall meet the acoustical, thermal and air pressure performance specified, when installed in accordance with the manufacturer's recommendations and as noted herein.

I. Flexible Duct Connectors (Required on all duct transitions from AHU to ductwork):
   1. Indoor Applications:
      a. Material: Heavy glass fabric double - Coated with neoprene, Minimum of 30 oz/sy, Resistant to abrasion and damage due to repeated flexing, waterproof and airtight, minimum 26-gauge galvanized steel or .032" aluminum edge a minimum of 2-1/2" wide each side. Coordinate the flex width with the schedule in 3.3 - Schedule.
      b. Rating:
         1) Temperature: -10□F to 200□F
         2) Pressure: 10" positive – 10" negative
      c. Based on Ventfabric and Ventglass.
   2. Outdoor Applications:
      a. Heavy glass fabric double - Coated with neoprene, Minimum of 30 oz/sy, resistant to abrasion and damage due to repeated flexing, waterproof, airtight and resistant to damage from direct sunlight, minimum 26-gauge galvanized steel or .032" aluminum edge at minimum of 2-1/2" wide each side. Coordinate the flex width with the schedule in 3.3 - Schedule.
      b. Rating:
         1) Temperature: -10□F to 250□F
         2) Pressure: 10" positive 10" negative
      c. Based on Ventfabrics Ventlon.

J. Louvers (Exhaust):
   1. Subject to compliance with requirements, provide either of the following unless a specific orientation is indicated:
   2. Horizontal Storm-Resistant Louver.
   3. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch (2.0 mm).

4. Performance Requirements:
   a. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 inches (75 mm) per hour and a wind speed of 29 mph (13 m/s) at a core-area intake velocity of 700-fpm (3.6-m/s).
   b. Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 600-fpm (3.0-m/s) free-area intake velocity.
   c. Free Area: Not less than 7.0 sq. ft. (0.65 sq. m) for 48-inch-(1220-mm-) wide by 48- inch-(1220-mm-) high louver.
5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
6. Acceptable Products – Horizontal:
   a. Greenheck EHH-501-X.
   b. Ruskin EME-520-MD.
   c. UEC SED-5.
   Must be Miami Dade NOA approved and also have a Florida Product Approval Number.
7. EHPA Acceptable Products – Vertical:
   a. Based on Ruskin Manufacturing, Co. EME6325D /CD-50 Miami Dade/Hurricane Tested & Missile Impact Tested and approved. (Vertical Blade). This louver shall be used on ALL EHPA Buildings as specified on the Architectural Drawings.

K. Louvers (Outside Air Intake):
1. Subject to compliance with requirements, provide either of the following unless a specific orientation is indicated:
   a. Horizontal Storm-Resistant Louver.
2. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch (2.0 mm).
3. Performance Requirements:
   a. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 inches (75 mm) per hour and a wind speed of 29 mph (13 m/s) at a core-area intake velocity of 700-fpm (3.6-m/s).
   b. Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 600- fpm (3.0-m/s) free-area intake velocity.
   c. Free Area: Not less than 7.0 sq.ft. (0.65 sq.m) for 48-inch-(1220-mm-) wide by 48- inch-(1220-mm-) high louver.
4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
5. Acceptable Products – Horizontal:
   a. Greenheck EHH-501-X.
   b. Ruskin EME-520-MD.
   c. UEC SED-5.
   Must be Miami Dade NOA approved and also have a Florida Product Approval Number.
6. EHPA Acceptable Products – Vertical:
   a. Based on Ruskin Manufacturing, Co. EME6325D /CD-50 Miami Dade/Hurricane Tested & Missile Impact Tested and approved. (Vertical Blade). This louver shall be used on ALL EHPA Buildings as specified on the Architectural Drawings.

L. Hardware Cloth: 4 mesh galvanized steel, plain weave with .035 wire.

M. Aluminum Brick Vent
   1. Extruded aluminum, 0.100” minimum wall thickness for frame and blades. Frame depth 4”.
   2. 8-1/8” W x 7-3/4”H with 1-1/2 flanged frame and aluminum mesh screen.
   3. Finish to be “Kynar 500” fluropolymer coating having dry thickness of approximately 1.2 mils when baked at 450□F. Color to be selected by Architect.
   4. Minimum free area shall be 39% of nominal size.
   5. Based on Ruskin Manufacturing, Co. BV100 or Greenheck Model BVF.

2.3 MATERIALS FOR LOUVERS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T5 or T-52.
B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.
D. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. 4 finish.
E. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat-head, hex-head, or Phillips pan-head screws for exposed fasteners, unless otherwise indicated.
F. Post installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION, GENERAL FOR LOUVERS

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
C. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern.
D. Maintain equal louver blade spacing to produce uniform appearance.
E. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
F. Frame Type: As indicated.
G. Include supports, anchorages, and accessories required for complete assembly.
H. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.

I. Provide subsills or extended sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.
J. Provide with optional wire mesh filter rack and filters.
K. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.5 LOUVER SCREENS

A. General: Provide screen at each exterior louver.
   1. Screen Location for Fixed Louvers: Interior face.
   2. Screening Type: Insect screening, unless otherwise indicated; bird screening where indicated.
B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.
C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
   1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
   2. Finish: Same finish as louver frames to which louver screens are attached.
   3. Type: Rewireable frames with a driven spline or insert for securing screen mesh.
D. Louver Screening for Aluminum Louvers:
   1. Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.
   2. Bird Screening: Aluminum, 1/2-inch- (12.7-mm-) square mesh, 0.063-inch (1.6-mm) wire.

2.6 CLOSURE ANGLES AND CLOSURE PLATES FOR LOUVERS

A. Fabricate from minimum 0.074-inch (2 mm) thick stainless steel or aluminum.
B. Provide continuous closure angles and closure plates on inside head, jambs, and sill of exterior wall louvers.
C. Secure angles and plates to louver frames with screws, and to masonry or concrete with fasteners as specified.
D. Provide minimum 0.032-inch (0.8 mm) thick stainless steel or aluminum sleeves in cavity walls and elsewhere as shown.

2.7 BLANK-OFF PANELS

A. Uninsulated, Blank-Off Panels:
   1. Aluminum sheet for aluminum louvers, not less than 0.050-inch (1.2-mm) nominal thickness, unless otherwise indicated.
   2. Panel Finish: Same finish applied to louvers.
   3. Attach blank-off panels to back of louver frames with clips or stainless-steel, sheet metal screws.
B. Insulated, Bland-off Panels: Laminated metal-faced panels consisting of insulating core surfaced on back and front with Metal sheets:
   1. Thickness: 2 Inch (50 mm).

2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch (0.8-mm) nominal thickness.
3. Insulating Core: Foamed-plastic rigid insulation board.
4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturers standard extruded-aluminum-channel frames, not less than 0.080-inch (2.0-mm) nominal thickness, with corners mitered and with same finish as panels.
5. Seal perimeter joints between panel faces and louver frames with 1/8-by-1-inch (3.2-by-25- mm) PVC compression gaskets.
6. Panel Finish: Same finish applied to louvers.
7. Attach blank-off panels to back of louver frames with clips or stainless steel, sheet metal screws.

2.8 ALUMINUM FINISHES

A. Finish louvers after assembly.
B. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers written instructions.
   1. Color and Gloss: As selected by School Board from manufacturers full range if not indicated as part of the Design Build Package.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install all products in strict accordance with the manufacturer's written installation instructions.
B. Coordinate the installation of products provided within other sections of Division 15 including but not limited to control dampers, airflow measuring stations, etc.

3.2 INSTALLATION

A. Duct Access Doors:
   1. Coordinate the proper class access door with the system requirements.
   2. Duct access doors shall be mounted so as to allow maximum access and/or door swing while also providing easy access from the floor or other personal accessible structures.
   3. Duct access doors shall be provided wherever required for proper maintenance of equipment, access to duct mounted control devices, or visual inspection and setting of dampers, etc. All doors, due to the small scale of the drawings, may not be shown, it is the contractor's responsibility to coordinate with all trades concerned to provide the necessary quantity and properly locate all doors.
B. Fire Doors:
   1. Fire doors shall be provided where indicated.
   2. Review the architectural drawings to determine the wall construction rating so as to provide the proper rated damper.

3. All fire doors shall be mounted within a 16-gauge steel sleeve permanently affixed to the wall by means of perimeter retaining angles.
4. The fire door shall be permanently attached to the sleeve. All voids around the sleeve and damper and sleeve and wall shall be properly fire stopped under Division 07 Section “Firestopping.”
5. Ductwork shall be attached to the fire door by means of a UL approved break away connection.
6. Access doors or access sections shall be provided at all fire door locations.

C. Fire Dampers:
1. Fire dampers shall be provided where indicated.
2. Review the architectural drawings to determine the wall construction rating so as to provide the proper rated damper.
3. All fire dampers shall be mounted within a UL approved thickness galvanized steel sleeve permanently affixed to the wall by means of perimeter retaining angles.
4. The fire damper shall be permanently attached to the sleeve. All voids around the sleeve and damper and sleeve and wall shall be properly fire stopped under Division 07 Section “Firestopping.”
5. Ductwork shall be attached to the fire damper by means of a UL approved break away connection.
6. Access doors or access sections shall be provided at all fire damper locations.

D. Smoke Dampers:
1. Provided where indicated. See combination smoke/fire damper for assemblies in fire rated barriers.
2. Review the architectural drawings to determine the wall construction rating so as to provide the proper rated damper.
3. Provide access doors or access sections at all damper locations.
4. Coordinate the provision of the smoke damper actuator with the automatic temperature control and fire alarm system and ensure adequate space for the mounting of the actuator during installation of the damper and ductwork.

E. Smoke/Fire Damper:
1. Provided where indicated. All smoke dampers in fire rated barriers to be combination type.
2. Review the architectural drawings to determine the wall construction rating so as to provide the proper rated damper.
3. All smoke/fire dampers shall be mounted within a UL approved thickness galvanized steel sleeve permanently affixed to the wall by means of perimeter retaining angles.
4. The smoke/fire damper shall be permanently attached to the sleeve. All voids around the sleeve and damper and sleeve and wall shall be properly fire stopped under Division 07 Section “Firestopping.”
5. Ductwork shall be attached to the smoke/fire damper by means of a UL approved break away connection.
6. Access doors or access sections shall be provided at all smoke/fire damper locations.
7. Coordinate the provision of the smoke damper actuator with the Building Control System and assure adequate space for the mounting of the actuator during installation of the smoke/fire damper and ductwork.

F. Backdraft Damper:

1. Securely attach backdraft damper to wall with a suitable sleeve and retaining angles and seal all voids between damper and wall.
2. Adjust damper to open or close under the design conditions.

G. Volume Dampers: Install at all branch take-offs.
H. Prefabricated Casing Panels:
1. Casing shall be constructed as detailed on drawings. All necessary structural steel bracing required but not shown shall be provided.
2. Casing shall be sealed airtight both positive and negative to □10 in. w.g.
3. Install in accordance with SMACNA duct construction standards for the pressure indicated.
4. Set access doors minimum 6 inches above floor as detailed on drawings. Arrange door swings so that fan static pressure holds door in closed position.
5. In casing sections subject to collection of water, where deep seal traps are shown, coordinate with other trades to be certain that traps are properly located.
6. All openings in casing shall be framed. All pipes shall be sleeved and area between pipe and sleeve sealed.

I. Flexible Duct Connectors:
1. Flexible duct connectors shall not be omitted where air handling units are provided with internally isolated fans and internal isolation.
2. Provide flexible duct connectors immediately adjacent to all in-line or ductwork connected fans and/or fan equipped units with or without internal vibration isolation.
3. Flexible duct connectors shall be properly selected and installed to ensure against collapsing under negative pressure and unacceptable ballooning under positive pressure. Leakage is not permissible. See width schedule in 3.3 - Schedules.

J. Roof Mounted Air Outlets and Inlets:
1. Install in accordance with manufacturers written installation instructions.
2. Coordinate installation requirements with roofing sub-contractor.

K. Hardware Cloth: Install over-all open-ended ducts. Provide sheet metal pocket over raw edges and secure with sheet metal screws through the metal edge cover.
L. Aluminum Brick Vent: Receive an unload louver and deliver to general contractor at jobsite for storage and installation by general contractor.
M. Install Miscellaneous Control Devices:
1. Install dampers furnished under Section 23 09 00. Provide necessary blank off sections where dampers are installed in factory fabricated mixing box openings.
2. Install air flow measuring stations furnished under Section 23 09 00. Coordinate size and location with proper access before approving release of units for fabrication and shipment.
3. Install duct smoke detectors provided under Division 26.

3.3 INSTALLATION FOR LOUVERS

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work and in accordance with manufacturer’s recommendations to meet requirements of article titled "Performance Requirements".
B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather-tight connection.
C. Form closely fitted joints with exposed connections accurately located and secured.

D. Install closure angles and closure plates.
E. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
F. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
H. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weather-tight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING FOR LOUVERS

A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

3.5 SCHEDULES

A. Access Door Schedule: Square or Rectangular Duct work:

Access Door Mounting

Surface Max. Dim.	Access Door Size
1. 6"	12" long Remove. Section
2. 7" to 8"	6" x 6"
3. 9" to 12"	8" x 8"
4. 13" to 18"	12" x 12"
5. 19" and up	16" x 16"
6. Special Situations	See Plans

B. Flexible Duct Connector Schedule: Indoor and Outdoor Material Width Schedule

Duct Size (Max. Dim.)	Pressure (Max.)	Width
1. 12" and less	positive	3"
2. 13" and up	positive	6"
3. 12" and less	negative	3"
4. 13" and up	negative	3"

END OF SECTION

SECTION 23 34 00
HVAC FANS

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. In-line centrifugal fans.

1.3 QUALITY ASSURANCE

A. All electrical components shall be UL listed or labeled.
B. All fans shall be AMCA certified.
C. All components in the conditioned air stream shall conform to the NFPA-90A Flame/Smoke/Fire Contribution Rating of 25/50/0.
D. All electrical devices shall conform to NEMA standards.
E. All Products to have a Florida Product Approval Number, as required by the Florida Building Code.
F. All wiring shall conform to the NEC.
G. Except where special motors are specified or required for the fan duty, all integral horsepower motors to be high efficiency type as specified in Section 23 05 13 - Motors.
H. The work shall include a one-year warranty from final completion. This warranty shall be by the Contractor to the Owner for any defective workmanship or material which has been furnished at no cost to the Owner for a period of one year from the date of final completion of System. Extended warranty shall be provided for systems installed during earlier phases of construction through to final completion of the final phase. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.
I. Starting of Mechanical Systems:
    1. Provide material and labor to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures.
    2. Provide labor to assist the Owner's Representative in acceptance review.
    3. Provide point by point system check-out. Submit results in tabulated form by system. Include this data as part of Operation and Maintenance Manuals.
    4. Provide information and assistance and cooperate with test, adjust, and balance services.
    5. Comply strictly with manufacturer's recommended procedures in starting up mechanical systems.
    6. Provide such periodic continuing adjustment services as necessary to ensure proper functioning of mechanical systems until acceptance and up to 1 full year after date of Owner acceptance.

1.4 SUBMITTALS

A. Submit dimension drawings, performance, and product data for acceptance. Include fan curves with the system design point plotted, and second point showing compliance with 110% of design static pressure as required by paragraph 3.1B. Also include fan efficiency and horsepower clearly indicated.
B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
C. Submit in accordance with Division 1 requirements.
D. Submit construction details and dimensional data including weights.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. In-line Centrifugal Fans:
   1. Acme Engineering and Manufacturing Corp.
   2. Greenheck Fan Corp.
   3. Loren Cook Co.
   4. Penn Ventilator Co., Inc.

2.2 CONSTRUCTION

A. In-line Centrifugal Fans:
   1. Heavy gauge aluminum housing with integral aluminum motor mounting base and straightening vanes heliarc mounted to housing at discharge end. Inlet and outlet flanges.
   2. Non-overloading, backwardly inclined aluminum air foil blower wheel with blades heliarc welded to the hub. Dynamically balanced. All wheels keyed to shaft.
   3. Belt drive or direct drive as scheduled with motor out of the airstream.
   4. Aluminum support bracket. Belt drive units to have locking strap and bolt to permit universal motor position. All motor shall be installed on the bottom of the unit for ease of maintenance.
   5. Grease lubricated anti-friction, self-aligning bearings having a minimum average life of 100,000 hours. Extended lubrication tubes.
   6. Belt drive units to have adjustable pitch belt drive designed for 140% of motor horsepower with a minimum of two oil resistant non-static belts. OSHA approved motor cover listed below.
   7. Direct drive units to be provided with adequate motor cooling passages.
   8. Motor Cover: The motor cover completely encloses the motor and drive assembly and also serves as an OSHA belt guard. The cover is constructed of 18-gauge galvanized steel & insulated. This shall be included on all fans with exterior mounted motors and will be factory mounted.
   9. Based on Loren Cook Type SQND/SQNB or Greenheck SQ/BSQ.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.
B. Provide fans capable of accommodating static pressure variations of plus 10 percent.
C. Provide matched belts and balanced variable sheaves for motors 15 hp and under, and fixed sheaves for 20 hp and over. Provide belt and sheave changes if required for proper air balancing.
D. Provide belt guards on belt driven fans.
E. Provide safety screen where inlet or outlet is exposed.
F. All fans to have back draft dampers.
G. Provide flexible connections on inlet and outlet of fans connected to ductwork as specified in Section 23 33 00 – Air Duct Accessories.

END OF SECTION

SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 – GENERAL

1.1 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. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Single Duct VAV Terminal Units.
B. Electric Heating Coils.

1.3 QUALITY ASSURANCE

A. All units shall be suitable for use in a return air plenum.
B. All components within the air stream shall conform to the NFPA 90A Standard for Flame/Smoke/Fire Contribution of 25/50/0.
C. All units shall be the product of a manufacturer regularly engaged in the production of terminal units and all supplied units shall be clearly described by means of published catalog data from the same manufacturer.
D. All units shall be capable of maintaining their minimum and maximum set points within a maximum of ±5%.
E. Fan powered box insulation and design suitable for 42□F primary air in 75□F, 60% RH ceiling plenum without condensation.
F. Fan powered boxes to be guaranteed to thoroughly mix 42□F primary air with 75□F recirculated air to produce a maximum of 1-1/2 F temperature differential at any place to the duct 4' downstream of the unit.
G. Include letter with submittal data stating that unit controls have been completely coordinated with controls contractor.
H. Terminal box manufacturer shall completely coordinate the controls provided on or required by the box with the control package provide under Section 23 09 00 – Instrumentation and Control for HVAC.
I. The work shall include a one-year warranty from final completion. This warranty shall be by the Contractor to the Owner for any defective workmanship or material which has been furnished at no cost to the Owner for a period of one year from the date of final completion of System. Extended warranty shall be provided for systems installed during earlier phases of construction through to final completion of the final phase. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.
J. Starting of Mechanical Systems:
    1. Provide material and labor to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures.
    2. Provide labor to assist the Owner's Representative in acceptance review.

3. Provide point by point system check-out. Submit results in tabulated form by system. Include this data as part of Operation and Maintenance Manuals.
4. Provide information and assistance and cooperate with test, adjust and balance services.
5. Comply strictly with manufacturer's recommended procedures in starting up mechanical systems.
6. Provide such periodic continuing adjustment services as necessary to ensure proper functioning of mechanical systems until acceptance and up to 1 full year after date of Owner acceptance.

K. Sound Power Data: Manufacturers shall submit sound power data for each comparable size terminal box listed. Sound levels at any speed, at any box, shall not exceed the listings below. The data taken as measured at a distance of one foot from any point on the fan powered box. Based on minimum inlet static pressure +0.5" w.g.

	125 Hz	**250 Hz**	**500 Hz**	**1K**	**2K**	**4K**
Discharge	73	69	67	64	64	61
Radiated	68	64	57	52	50	44

1.4 SUBMITTALS

A. Submit dimension drawings, performance, and product data for acceptance. Include listing of discharge and radiated sound power level for each of second thru sixth octave band for inlet pressures of 1-inch w.g. Include listing of control air requirements, if applicable.
B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
C. Refer to Division 1 for submittal requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Single Duct VAV Terminal Boxes:
   1. Trane
   2. Enviro-Tec.
   3. E.H. Price Company
   4. Krueger
   5. Nailor Industries, Inc.
   6. Titus
   7. Trane
   8. Metal*Aire

B. Electric Heating Coils:
   1. Enviro-Tec.
   2. E.H. Price Company
   3. Krueger
   4. Nailor Industries, Inc.

5. Titus
6. Metal*Aire

2.2 FABRICATION

A. Single Duct VAV Terminal Units:

1. Unit casing: galvanized steel, fully lined with 1 in. thick, 1-1/2 lb./cu. ft. density, nylon scrim reinforced foil skin vapor barrier insulation. Insulation shall be dual thermal/acoustical fiberglass insulation meeting NFPA 90A requirements and UL 181 erosion control requirements. All cut edges of insulation shall be sealed by a heavy adhesive seal to prevent fibrous material from entering the airstream. A special sheet metal picture frame bracket shall be used to enclose the liner of the discharge end to prevent the liner from dislodging under extremely high-pressure conditions and to prevent damage during installation. Casing shall have access doors or panels suitable for equipment service. Insulated damper with leakage not to exceed 2% of design flow at 3.0" w.g. All joints sealed with adhesive as required. Unit to have air inlet collar and flanged or slip and drive discharge connection.
2. Pressure Independent Air Volume Control Consisting of the Following:
   a. Factory calibrated damper assembly having maximum 4% leakage at 4.0" w.g.
   b. Multi-point velocity sensor.
   c. 24V, 40VA control transformer.
   d. Coordinate with DDC control package provided under Section 23 09 00 – Instrumentation and Control for HVAC.

B. Electric Heating Coil:

1. Tested with the fan terminal in accordance with UL and ETL standards. Meet all NEC requirements. UL Listed.
2. NEMA 1 electrical enclosure with single point connection for heater and fan. Wiring diagram with specific wiring for each unit included with unit.
3. Automatic reset thermal cutouts for each element, nickel chrome heating element, mercury disconnecting contactor for each step of control, line and control terminal blocks, interlocking, disconnect, main supply fuses, positive pressure air flow switch, 24 V control transformer. Coordinate with DDC control package provided under Section 23 09 00 – Instrumentation and Control for HVAC.
4. Galvanized steel casing with flanged or drive and slip connection.
5. Heating coil integral with terminal unit, and the heating coil shall be internally wired in such a manner that assures that a balanced electrical load will be provided across all three phases of the load at all times.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install in accordance with manufacturer's written installation instructions.
B. Support terminal box independent of ductwork.

C. Install terminal boxes to provide maximum clearance for electrical and maintenance access.
D. Coordinate the terminal box controls with the building control system contractor to ensure that all miscellaneous accessories required for proper operation are included and that the direct/reverse action normally closed/normally open functions are properly coordinated.
E. If terminal boxes are installed in areas where access to controls thru a lay-in or removable ceiling is not possible, coordinate the locations of access doors thru the ceiling.
F. Be sure minimum and maximum CFM settings agree with the requirements of the terminal unit schedule.
G. Provide rigid metal straight duct equal to four diameters on inlet of all terminals.
H. Provide transitions from duct size to terminal inlet or outlet size as required.
I. Provide flexible duct connection at outlet plus a minimum of 12" and a maximum of 36"of straight flexible duct upstream of rigid duct at inlet.

END OF SECTION

SECTION 23 37 13
GRILLES, REGISTERS AND DIFFUSERS

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Grilles.
B. Registers.
C. Diffusers.

1.3 QUALITY ASSURANCE

A. Manufacturer shall certify cataloged performance and ensure correct application of all air outlet types.
B. All components within the conditioned air stream or exposed in active or non-active plenums shall conform to the NFPA 90A standard for Flame/Smoke/Fire Contribution of 25/50/0.
C. Manufacturers shall fully comply with LEED IEQ Prerequisite 3 minimum acoustical performance.

1.4 SUBMITTALS

A. Submit schedule and product data for acceptance. Coordinate submittal by "G" number and include construction details, capacity ratings including airside pressure drops and NC levels.
B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
C. Submit in accordance with Division 1 requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Grilles:
   1. Titus
   2. Anemostat
   3. Krueger
   4. Metal*Aire Division of Metal Industries, Inc.
   5. Nailor
   6. Price
   7. Trox

B. Registers:
   1. Air Concepts
   2. Anemostat
   3. Krueger
   4. Metal*Aire Division of Metal Industries, Inc.
   5. Nailor
   6. Price
   7. Titus
   8. Trox

C. Diffusers:
   1. Anemostat
   2. Krueger
   3. Metal*Aire Division of Metal Industries, Inc.
   4. Nailor
   5. Price
   6. Titus
   7. Trox.

2.2 FABRICATION

A. Grilles:
   1. Sidewall or Ceiling Mounted Return/Exhaust Grille:
      a. Construction: Heavy gauge aluminum border. Size as indicated.
      b. Baked enamel finish.
      c. Based on Titus Model 272FL.
   2. Sidewall Double Deflection Supply Grille:
      a. Construction: Aluminum frame with aluminum shaped blades having long blades on front. Size as indicated.
      b. Baked enamel finish.
      c. Based on Titus Model 7DCA-AA.
   3. Ceiling Mounted Return Air Filter Grille:
      a. Construction: Heavy gauge aluminum border. Concealed hinged core with integral filter frame and start-up plus spare filter. Border suitable for use in ceiling specified in Contract Documents. Size as indicated.
      b. Baked enamel finish.
      c. Based on Titus Model 4FL.

B. Registers:
   1. Sidewall or Ceiling Mounted, Return Register (G-5 & G-6):
      a. Construction: Heavy gauge frame and horizontal bars. Bars set at 45-deg fixed deflection. Allen key operated opposed blade damper.
      b. Baked enamel finish.
      c. Based on Titus Model 350FL (aluminum) with/without Model AG-35AA opposed blade aluminum damper (refer to schedule and drawings for requirements).

C. Diffusers:
   1. Square Ceiling Diffuser (G-1):
      a. Construction: Surface or lay-in mounted, 3 cone diffusers. Round collar size as indicated. Aluminum construction only.

b. Baked enamel finish.
c. Based on Titus TMS-AA (aluminum).

PART 3 – EXECUTION

3.1 GENERAL

A. Install all devices in strict accordance with the manufacturer's written installation instructions.
B. Coordinate the proper grille style and frame style with the final approved ceiling construction and install grilles, registers, and diffusers in accordance with the requirements of the architectural reflected ceiling plan.
C. Due to the small scale of the drawings the contractor shall assume the responsibility to coordinate the air outlet and inlet locations with the reflected ceiling plans, lighting plans, sections and or details.
D. Any unlined or otherwise exposed parts beyond the grille, register or diffuser face exposed to sight shall be painted black.
E. Coordinate the color requirements for all grilles, registers, and diffusers with the Owner's Representative.
F. Insulate the back pans of all diffusers per the requirements of Specification Section 23 07 00.
G. Air distribution devices installed in lay-in ceilings shall have a 24”x24” extended panel.
H. Devices installed in sheetrock or other hard ceilings shall be surface mount type.

END OF SECTION

SECTION 23 41 00
PARTICULATE AIR FILTRATION

PART 1 – GENERAL

1.1 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. Refer to Division 1 for all requirements pertaining to General Provisions.

1.2 WORK INCLUDED

A. Extended Surface, Pleated, Panel Type Filters.
B. Filter Gauges

1.3 QUALITY ASSURANCE

A. High efficiency filter to be rated as per ASHRAE Standard 52-76 (atmospheric dust). The manufacturer shall guarantee filter performance to be as stated in their literature within tolerances conforming to Section 7.4 of ARI Standard 850-78. Representative filters shall have been tested by an independent, commercially operated test laboratory. The independent test laboratory report shall be available upon request to the specifying engineer and/or Owner.
B. Filter testing to be in accordance with UL Standard 900.

1.4 SUBMITTALS

A. Submission for acceptance is not required.
B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
C. Submit in accordance with Division 1 requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Extended Surface, Pleated, Panel Type Filters:
   1. American Air Filter
   2. Camfil-Farr
   3. Purolator Products Air Filtration Co.
   4. Flanders Filters, Inc.
B. Filter Gauges
   1. Dwyer Instruments, Inc.
   2. Approved Equal.

2.2 FABRICATION

A. Extended Surface, Pleated, Panel Type Filters:
   1. Extended surface pleated, cotton/synthetic fiber media, cardboard frame, wire support grid, dry type.
   2. Dry filtering principal.
   3. 2" thick, 30% minimum efficiency, UL Class 2 approved, maximum face velocity 500 FPM for construction filters and 2” thick, 90% minimum efficiency, UL Class 2 approved, maximum face velocity 500 FPM for post construction filters.
   4. Initial maximum air friction at 500 FPM equals .30 w.g. Air friction at change-out equals 1.00" w.g.
   5. Air filtration efficiency shall be MERV8 (construction phase) & MERV13 (post construction phase) and have 150 grams of dust holding capacity when tested in accordance with ASHRAE 52.2 & 52.1 respectively.
   6. Based on AAF PerfectPleat HC-M8 construction and AAF AMAir 1300 post construction occupancy.

B. Filter Gauges:
   1. Dry type gauge with appropriate pressure range for "final" pressure listed in schedule.
   2. Include static tips, compression fittings, 1/4" aluminum tubing and plastic vent valves.
   3. Based on Dwyer Magnehelic 2000 Series.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install filters and filter gauges in strict accordance with manufacturer’s recommendations. Provide separate gauge tap and valving so that pressure drop can be measured individually across final filters.
B. MERV8 construction filters to be removed from grilles and air handling units prior to occupancy and not replaced at the grilles. Final MERV13 filters shall be installed at the air handling units prior to occupancy and shall be replaced by the contractor after the commissioning process has been approved by the commissioning agent, owner, and engineer.
C. Contractor to pay particular attention to prevent air bypass through filter support system.
D. Do not operate fan systems without filters in place.
E. Provide six (6) extra sets of final MERV13 filters for all air handling units.

END OF SECTION

SECTION 23 70 00
AIR HANDLING UNITS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.2 SCOPE

A. Provide material, equipment, labor, and supervision necessary to install modularly constructed central station indoor and rooftop mounted outdoor air handling units.

1.3 STANDARDS

A. Units shall have certified ratings complying with ARI Standard 430, and be UL listed.
B. Units shall meet the design intent of ASHRAE Standard 62.
C. Coils shall have certified ratings in accordance with ARI Standard 410.

1.4 QUALIFICATIONS

A. Units shall be of the modular component type with self-supporting frames equal to:
   1. Temtrol (Basis of Design)
   2. Dunham-Bush
   3. Trane
   4. Carrier
   5. Engineered Air

1.5 SUBMITTALS

A. Submittal data shall consist of drawings showing unit dimensions, construction materials, fan performance curves, coil performance (capacity), damper leakage rates, horsepower, electrical characteristics, and installation instructions.
B. Manufacturers shall furnish for approval for each fan, certified sound power ratings with an octave band analysis and also the volume-pressure-horsepower characteristic curves from shut-off to free delivery.
C. Submit data on coils to include capacities, air and water flow rates, pressure and temperature drops, materials of construction and physical dimensions.
D. Where units other than that used as the basis of design are submitted, provide equipment room layout drawings at the time of ahu submittal to demonstrate coordination with the available space. Alternate equipment will not be reviewed without the layout drawings.

PART 2 – PRODUCTS

2.1 GENERAL

A. Units shall be factory built modular components and assembled with arrangements as indicated.
B. Units shall have capacities, arrangements, ratings, and performance as scheduled.
C. Unit modular components shall be catalogued products of the air handling unit manufacturer. Components which are not manufactured specifically by the air handling unit manufacturer (including face and bypass sections, filter sections) are not acceptable. Motors, drives, and dampers shall be factory mounted within modular components.

2.2 CASINGS

A. All casings including fan, coil, filter, and access sections (both outside and return air) shall be constructed of internally insulated double-wall sandwich construction with solid inner wall of the best quality galvanized steel reinforced for maximum rigidity with steel angle framework as required. Each unit shall consist of a fan section, coil section with drain pan and a filter section, and other sections as detailed on the drawings.
   1. Insulation shall be of the foam type with a minimum 'R' value of 12.5 ft^2 hour F/BTU
B. Belt guards shall totally enclose all moving parts.
C. The casing shall be designed for 1.5 times the design pressure equal to the negative of the maximum static pressure differential between the highest peak on the selected fan characteristic curve and ambient pressure or 8", whichever is less, with panel deflection of 0.005 percent of span. The casing shall be furnished with lifting lugs or other attachments to facilitate handling. Exterior wall panels shall be a minimum of 18-gauge galvanized steel with a 20-gauge solid galvanized steel, internal liner.
D. Casing shall have removable panels to provide access to internal components. Coils shall be removable without disassembly of unit. Double wall access doors shall be provided in the filter and fan sections of sufficient size to allow access to and cleaning of all interior components.
E. All unit access doors including fan, coil, access, and filter sections shall be double wall, fully gasketed with heavy duty steel hinges with fixed pins with a minimum of two heavy duty cam-lock type handles.
F. Drain pan shall be double wall stainless steel construction and provided under the complete fan and coil section for horizontal units and under the complete coil section for vertical units and other sections where water may collect. Drain pans shall be positively sloped in two directions to the drain connection. Drain pans shall be insulated with 1" insulation between the two pans.

2.3 FANS

A. All fans and shafts shall be manufactured by the unit manufacturer. Fan wheels shall be constructed of galvanized steel, double width, double inlet, centrifugal type. Fan type shall be of the type scheduled. Plug fans shall be single width/single inlet.

B. Internal bearings shall be provided with extended grease lines to unit exterior.
C. Fan housings shall be die-formed with streamlined inlets and side sheets. Bearings shall be grease lubricated ball bearings selected for an L-50 rating life of not less than 200,000 hours.
D. Fans shall be statically and dynamically balanced and factory run tested, in the unit. Fan performance shall be tested in accordance with ARI Standard 430-89 or AMCA 210 as appropriate. Excessive vibration shall be factory eliminated prior to shipment.
E. Fan shafts shall be solid and shall be designed such that they shall not exceed 75 percent of their first critical speed. Fan wheels shall be keyed to fan shafts.
F. Fan sections shall include an access door in the drive side of the fan.

2.4 COILS

A. Return Air Coils
   1. Coils shall be furnished for cooling and heating media as scheduled. Coils shall be fully contained within the unit casing. Scheduled coil face velocities shall not be exceeded, and the manufacturer shall certify that no moisture carryover will occur. Performance shall be certified in accordance with ARI 410.
   2. Coils shall be aluminum plate fin copper tube type. Fins shall have drawn, belled, collars bonded to the tubes by means of mechanical expansion of the tubes. Coil casings shall be stainless steel.
   3. Coil capacity and performance characteristics shall be as listed in schedule.
B. Outside Air Coils
   1. Coils shall be furnished for cooling and heating media as scheduled. Coils shall be fully contained within the unit casing. Scheduled coil face velocities shall not be exceeded, and the manufacturer shall certify that no moisture carryover will occur. Performance shall be certified in accordance with ARI 410.
   2. Coils shall be aluminum plate fin copper tube type. Fins shall have drawn, belled, collars bonded to the tubes by means of mechanical expansion of the tubes. Coil casings shall be stainless steel.
   3. Coil capacity and performance characteristics shall be as listed in schedule.
   4. Coils shall be coated with factory anti-corrosion coating on the coil.

2.5 MOTORS AND DRIVES

A. Motors shall be NEMA Standard, TEFC, premium energy efficient E+3, 1.15 service factor, normal torque, 40-deg C rise, of the horsepower rating and electrical characteristics as scheduled on drawings.
B. Drives shall be rated at 1.5 service factor of the motor horsepower rating. Drives shall be adjustable speed drives for adjustment within plus or minus 10 percent of specified RPM.
C. Motor shall be mounted on an adjustable mount, suitable for adjusting belt tension and drive alignment.
D. Furnish and install motor access doors to allow for maintenance and motor replacement.
E. Provide galvanized steel belt guard.
F. A drive replacement (belts and sheaves) shall be included in the base contract price.

2.6 INSULATION

A. Shall be provided between dual wall casings as specified under Paragraph 2.02.

2.7 FILTERS

A. Provide filter section, suitable for use with 4-inch-deep filters, with access door suitable for side loading. Filter section shall be of the configuration indicated on the drawings and be of the medium capacity angle type unless otherwise noted or indicated.
B. Filter section shall be coordinated with the commercially available filter sizes. Where filter filler panels are required, they shall be constructed of heavy gauge galvanized steel and be sized to seal properly between the adjacent filter and unit frame/access door. Provide gasketing to prevent filter bypass.
C. Filters shall be removable without the use of hand tools or special equipment.
D. 4-inch-thick filters shall be MERV-13.
E. Provide factory gauges for pressure differential of filters.

2.8 ISOLATORS

A. Internal isolation with a minimum of 2-inch deflection shall be provided for the fan and drive sections. Provide a neoprene pad between casing and housekeeping pad for indoor units.

PART 3 – EXECUTION

3.1 INSTALLATION

A. For indoor units, lay out exact location and furnish to General Contractor a dimensional drawing showing base sizes and locations. Coordinate pad height as required to provide the required condensate trap depth. Do not use shipping lugs to achieve necessary height unless approved by the Engineer.
B. Install units and make refrigerant piping and duct connections.
C. Extend condensate drain line from drain pan, through a trap, to the nearest floor/roof drain and elbow into drain. Contractor shall provide sufficient height between drain pan and condensate drain trap to allow drainage against negative fan pressure.
D. Install fire resistant flexible connectors in ducts at connections to units. Flexible connectors shall be in accordance with NFPA 90A.
E. Do not operate units for any purpose until ductwork is clean, filters are in place, bearings lubricated, and the fan has been test run under observation.
F. Release vibration isolation restraining bolts.

END OF SECTION

SECTION 23 81 26
DUCTLESS DX SPLIT SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.2 SCOPE

A. Provide material, equipment, labor, and supervision necessary to install ductless DX split systems.
B. Unit ratings, capacities, and characteristics shall be as scheduled on Drawings.

1.3 STANDARDS

A. Performance shall be in accordance with the applicable ARI 210/240 Standards. Unit shall be rated as a matched system.
B. Compressor motors, starters, wiring and control wiring shall all conform to NEMA, UL, NEC, and local utility requirements.

1.4 SECTION INCLUDES

A. Condensing unit package.
B. Air handling unit.
C. Charge of refrigerant and oil.
D. Controls and control connections.
E. Refrigerant piping connections.
F. Motor starters.
G. Electrical power connections.

1.5 SUBMITTALS

A. Submit shop drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Include schematic layouts showing condensing units, air handling units, cooling coils, refrigerant piping, and accessories required for complete system.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.
B. Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.

1.7 WARRANTY

A. Provide five-year extended compressor replacement warranty (parts only).

B. First Year Warranty: Include material coverage for refrigerant compressors, condenser coils, air handling unit, fans, controls electrical devices and related system components.

1.8 MANUFACTURERS

A. Provide products by one of the following:
1. Trane
2. Mitsubishi
3. Daikin

PART 2 – PRODUCTS

2.1 CONDENSING UNITS

A. Type:
   1. Units: Self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, and screens.
   2. Construction and Ratings: In accordance with ARI 210/240. Testing shall be in accordance with ASHRAE 14.
   3. Performance Ratings: Energy Efficiency Rating SEER not less than prescribed by ANSI/ASHRAE 90A, and the "Energy Efficiency Code for Building Construction", minimum of 13.0 SEER.
   4. See Schedule on Drawings for unit capacities, electrical characteristics, and performance criteria.
   5. Provide condensing unit with a holding charge of refrigerant and oil.
   6. Inverter type unit see schedule.
B. Casing
   1. House components in welded frame with steel panels with weather resistant, baked enamel finish.
   2. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors.
   3. Provide removable access doors or panels with piano hinges and quick fasteners.
C. Condenser Coils
   1. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig and dehydrate. Seal with holding charge of nitrogen or refrigerant.
D. FANS AND MOTORS
   1. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Equip with roller or ball bearings with grease fittings extended to outside of casing.
   2. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or 3 phases, with permanent lubricated ball bearings and built-in thermal overload protection.
   3. High efficiency motors as indicated.

E. Compressors
   1. Construction: Hermetic, scroll or reciprocating type with heat treated forged steel or cast-iron shafts, aluminum alloy connecting rods, automotive type pistons, rings to prevent gas leakage, suction, and discharge valves, and sealing surface immersed in oil.
   2. Mounting: Statically and dynamically balance rotating parts and mount on spring or rubber-in-shear vibration isolators. Internally isolate hermetic units on springs.
   3. Lubrication System: Reversible, positive displacement oil pump with oil charging valve, oil level sight glass, oil filter, and magnetic plug or strainer.
   4. Motor: Constant speed suction gas cooled with electronic sensor and winding over temperature protection, designed for across-the-line starting. Furnish with starter.
   5. Crankcase Heater: Evaporates refrigerant returning to crankcase during shut down. Energize heater continuously and when compressor is not operating.

2.2 AIR HANDLING UNIT

A. Type:
   1. Ductless, wall mounted, direct expansion fan coil units.
   2. Unit shall include evaporator coil, fan, fan motor, piping connections, drain pan, and integral controls.
   3. Unit shall include necessary factory provided wall mounting hardware.
B. Cabinet:
   1. Integral discharge grille and intake type, high-impact polystyrene.
   2. Fully insulated for acoustic and thermal protection.
C. Fans:
   1. Direct drive with motor driven vertical air sweep function.
   2. Open drip-proof permanently lubricated ball bearing motor with inherent overload protection. Motors shall be 3-speed.
D. Coil:
   1. Copper tube coil with aluminum fins and galvanized steel tube sheets.
   2. Drain pan shall be non-corrosive and include an integral trap.
E. Filters:
   1. Factory supplied and installed cleanable type.

2.3 CONTROLS

A. Controls shall consist of a microprocessor-based control system, which shall control space temperature, determine optimum fan speed, and run self-diagnostics. The temperature control range shall be from 64 degrees F to 84 degrees F. The unit shall have the following functions as a minimum:
   1. An automatic restart after power failure at the same operating conditions as at failure.
   2. A timer function to provide a minimum 24-hour timer cycle for system Auto/Start/Stop.
   3. Temperature-sensing controls shall sense return air temperature. Indoor air high discharge temperature shutdown shall be provided.
   4. Indoor coil freeze protection.
   5. Wireless infrared remote control to enter set points and operating conditions.
   6. Auto Stop features shall have integral setback control.
   7. Automatic airsweep control to provide on or off activation of airsweep louvers.

8. Dehumidification mode shall provide room air circulation when no cooling is required.
9. Fan only operation shall provide room air circulation when no cooing is required.
10. Diagnostics shall provide continuous checks of unit operation and warn of possible malfunctions. Error messages shall be displayed at the unit and at the remote controller.
11. Fan speed control shall be user-selectable: high, medium, low, or microprocessor automatic operation during all operating modes.
12. A time delay shall prevent compressor restart in less than 3-minutes.

PART 3 – EXECUTION

3.1 INSTALLATION

A. The Contractor shall install equipment in accordance with manufacturer's instructions.
B. Provide for connection to electrical service. Refer to Division 26.
C. Install units as indicated.
D. Provide connection to refrigeration piping system and evaporators. The Contractor shall provide and install the following for each refrigerant circuit:
   1. Suction and liquid line filter dryer replaceable core type.
   2. Liquid line sight glass and moisture indicator
   3. Insulated suction line.
   4. Suction and liquid line service valves and gage ports at condensing unit.
   5. Charging valves.
   6. Refrigerant and oil.
      Comply with ANSI/ASHRAE 15.

3.2 CONTRACTOR'S FIELD SERVICES

A. Prepare and start systems.
B. Supply initial charge of refrigerant and oil for each refrigerant circuit. Replace losses of refrigerant and oil.
C. Inspect and test for refrigerant leaks quarterly during first year of operation. Repair all leaks and replace losses of refrigerant and oil to meet manufacturer's specifications.

END OF SECTION

SECTION 26 01 00
OPERATION AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. O & M Manuals contain copies of all warranties, operation and maintenance instructions, and other pertinent information relative to the project that is used throughout the life of the facility. This section contains additional requirements for the preparation of Electrical and Systems Operation and Maintenance Manuals.

1.3 OPERATION AND MAINTENANCE MANUALS

A. General: Refer to Section 01 77 00 Closeout Procedures.
B. O & M Data:
   1. Manufacturers' operation and maintenance data is required for all items as called for in the specifications. O & M Manuals shall include manufacturer's name, model number(s), characteristics, manufacturer's agent, service agent, supplier, where and/or what item(s) are used for and description (i.e., surge suppression - switchboard MDPA).
   2. Include troubleshooting instructions, list of special tools required, theory of operation, manufacturer's care and cleaning, preventative maintenance instructions, wiring diagrams, and point-to-point schematics.
C. O & M Manuals to include, but are not limited to:
   1. Completed forms and information contained in Division 01 General Requirements, Section 01 77 00, and this section of the specifications. Reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Systems Schedule.
      a. Project Information Sheet (Exhibit A MCSD)
      b. O & M Cover Examples (Exhibits B/C MCSD)
      c. Spare Parts/Maintenance Stock Certification (Exhibit D MCSD)
      d. Check Out Memo
      e. Conductor Insulation Resistance Test Memo
      f. Ground Test Information
      g. Voltage and Amperage Readings (Tabulated Data)
      h. Progress and Record Drawing Certification
   2. Shop Drawings: Shop drawings shall be a copy of the final and accepted shop drawing submitted in accordance with Division 01 requirements.
   3. Product Data: Product data and/or catalog sheets shall be a copy of the final and accepted submittal submitted in accordance with Division 01 requirements. These shall be inserted in binder in proper order.

4. Warranties/Guarantees: Provide copies of warranties/guarantees in respective location in O & M binder, (Power and Lighting) (Systems). Original warranties/guarantees are to be incorporated as noted in Division 01 General Requirements.
5. Copies of electrical panel schedules and electrical panel directories included with the corresponding specification section.
6. Wiring diagrams, schematic, etc. inserted in proper order, for:
    a. Time clocks.
    b. Photocells.
    c. Control devices, motor controls.
    d. UPS systems.
    e. Transformers.
    f. Panelboards.
    g. Distribution panelboards.
    h. Switchboards.
    i. Each and every part of Divisions 27 and 28 sections of these Specifications
7. Division 26
    a. Section 26 05 19 – Building Wire and Cable
        i. Product data and/or catalog sheets on all products applicable to this project.
    b. Section 26 05 26 – Grounding and Bonding
        i. Product data and/or catalog sheets on all products applicable to this project.
        ii. Test results on each ground rod.
        iii. Ground Test Information Form
    c. Section 26 05 29 – Hangers and Supports
        i. Product data and/or catalog sheets on all products applicable to this project.
    d. Section 26 05 33 - Conduit
        i. Product data and/or catalog sheets on all products applicable to this project.
    e. Section 26 05 34 – Outlet Boxes
        i. Product data and/or catalog sheets on all products applicable to this project.
    f. Section 26 05 35 – Pull and Junction Boxes
        i. Product data and/or catalog sheets on all products applicable to this project.
    g. Section 26 05 37 – Surface Raceways
        i. Product data and/or catalog sheets on all products applicable to this project.
    h. Section 26 05 38 – Floor Boxes
        i. Product data and/or catalog sheets on all products applicable to this project.
        ii. Equipment supplier list for section's equipment.
        iii. Installation/removal instructions.
        iv. Parts list.
    i. Section 26 05 43 – Underground Ducts and Raceways for Electrical Systems
        i. Product data and/or catalog sheets on all products applicable to this project.

j. Section 26 05 53 – Identification for Electrical Systems
    i. Product data and/or catalog sheets on all products applicable to this project.
    ii. Equipment supplier list for each section's equipment.
k. Section 26 05 73 – Power System Study
    i. Copy of complete Study.
l. Section 26 09 23 – Occupancy Sensors
    i. Product data and/or catalog sheets on all products applicable to this project.
    ii. Equipment supplier list for section's equipment.
    iii. Wiring diagrams.
    iv. Parts list.
    v. Operation and maintenance requirements.
m. Section 26 22 13 - Dry Type Transformers.
i. Product data and/or catalog sheets on equipment applicable to this project.
ii. Equipment supplier list for section’s equipment.
iii. Recommended periodic testing procedures.
iv. Parts list.
v. Any special manufacturer suggested O & M information.
vi. Installation/removal instructions.
vii. Check-Out Memo Form.
n. Section 26 24 13 – Distribution Switchboards
    i. Product data and/or catalog sheets on equipment applicable to this project.
    ii. Equipment supplier list for section’s equipment.
    iii. Internal wiring diagrams.
    iv. Bus diagrams.
    v. Operation and maintenance requirements, instructions, and recommended testing.
    vi. Parts list.
    vii. Copy of directory.
    viii. Voltage and Amperage Readings Tabulated Data Form
    ix. Check-Out Memo Form
    x. Overcurrent protective devices: in addition to above provide the following for large circuit breakers:
        a) Parts list.
        b) Operation and maintenance requirements.
        c) Wiring diagrams.
        d) Testing data.
        e) Installation/removal instructions.
        f) Check-Out Memo Form.
o. Section 26 24 16 - Panelboards
    i. Product data and/or catalog sheets on equipment applicable to this project.
    ii. Equipment supplier list for section’s equipment.
    iii. Internal wiring diagrams.
    iv. Bus diagrams.

v. Operation and maintenance requirements, instructions, and recommended testing.
vi. Parts list.
vii. Copy of directory.
viii. Voltage and Amperage Readings Tabulated Data Form
ix. Check-Out Memo Form

p. Section 26 24 17 – Distribution Panelboards
i. Product data and/or catalog sheets on equipment applicable to this project.
ii. Equipment supplier list for section's equipment.
iii. Internal wiring diagrams.
iv. Bus diagrams.
v. Operation and maintenance requirements, instructions, and recommended testing.
vi. Parts list.
vii. Copy of directory.
viii. Voltage and Amperage Readings Tabulated Data Form
ix. Check-Out Memo Form
x. Overcurrent protective devices: in addition to above provide the following for large circuit breakers:
a) Parts list.
b) Operation and maintenance requirements.
c) Wiring diagrams.
d) Testing data.
e) Installation/removal instructions.
f) Check-Out Memo Form

q. Section 26 27 13 – Utility Service Entrance
i. Product data and/or catalog sheets on products applicable to this project.
ii. Equipment supplier list for section's equipment.
iii. Utility Company prepared drawings.

r. Section 26 27 16 – Cabinets and Enclosures
i. Product data and/or catalog sheets on products applicable to this project.
ii. Equipment supplier list for section's equipment.

s. Section 26 27 26 – Wiring Devices
i. Product data and/or catalog sheets on all products applicable to this project.
ii. Equipment supplier list for section's equipment.
iii. Ground faulty wiring devices; in addition to above provide:
a) Wiring diagram.

t. Section 26 28 19 – Enclosed Disconnect Switches.
i. Product data and/or catalog sheets on equipment applicable to this project.
ii. Equipment supplier list for section's equipment.

u. Section 26 29 13 – Motor Control.
i. Product data and/or catalog sheets on equipment applicable to this project.
ii. Equipment supplier list for section's equipment.
iii. Motor Control: in addition to above provide the following:
a) Internal wiring diagrams.
b) Wiring diagrams.

c) Bus diagrams.
d) Operation and maintenance requirements, instructions, and recommended testing.
e) Parts list.
f) Copy of directory.
g) Check-Out Memo Form

v. Section 26 36 23 - Manual Transfer Switch.
i. Internal wiring diagrams.
ii. Wiring diagrams.
iii. Bus diagrams.
iv. O and M maintenance requirements, instructions and recommended testing.
v. Parts list.
vi. Copy of directory.
vii. Testing data, motor test information sheets
viii. Check Out Memo Form
ix. Narrative of emergency system operation, control, etc.
w. Section 26 43 00 – Surge Protective Devices.
i. Product data and/or catalog sheets on all equipment applicable to this project.
ii. Equipment supplier list.
iii. Parts list.
iv. Recommended testing and replacement procedures.
x. Section 26 51 13 – Interior Lighting Fixtures, Lamps and Ballasts
i. Product data and/or catalog sheets on all equipment applicable to this project.
ii. Equipment supplier list.
iii. Operation and maintenance requirements/instructions for special light fixtures (these fixtures to be determined by A/E) including:
a) installation/removal instructions
b) special re-lamping instructions.
iv. Parts list.
y. Section 26 52 13 – Emergency Lighting Equipment.
i. Product data and/or catalog sheets on all equipment applicable to this project.
ii. Equipment supplier list.
iii. Operation and maintenance requirements/instructions for special light fixtures (these fixtures to be determined by A/E) including:
a) installation/removal instructions
b) special re-lamping instructions
iv. Parts list.
z. Section 26 56 00 – Exterior Lighting
i. Product data and/or catalog sheets on all equipment applicable to this project.
ii. Equipment supplier list.
iii. Operation and maintenance requirements/instructions for special light fixtures (these fixtures to be determined by A/E) including:
a) installation/removal instructions
b) special re-lamping instructions

iv. Parts list.

8. Division 27
   a. Section 27 41 00 – Audio Video Systems
      i. For each system; name, address, phone, cell, fax, email:
         a) Installer
         b) Authorized representative
         c) Equipment supplier
      ii. Product data and/or catalog sheets on equipment applicable to this project.
      iii. Parts list.
      iv. Wiring diagrams of panels.
      v. Shop drawings as submitted and accepted in submittal process.
   b. Section 27 41 33 – Local Area Sound System – Media Center
      i. For each system; name, address, phone, cell, fax, email:
         a) Installer
         b) Authorized representative
         c) Equipment supplier
      ii. Product data and/or catalog sheets on equipment applicable to this project.
      iii. Parts list.
      iv. Wiring diagrams of panels.
      v. Shop drawings as submitted and accepted in submittal process.
   c. Section 27 51 16 – Intercom System
      i. For each system; name, address, phone, cell, fax, email:
         a) Installer
         b) Authorized representative
         c) Equipment supplier
      ii. Product data and/or catalog sheets on equipment applicable to this project.
      iii. Parts list.
      iv. Wiring diagrams of panels.
      v. Shop drawings as submitted and accepted in submittal process.
   d. Section 27 53 13 – GPS Wireless Clock Systems
      i. For each system; name, address, phone, cell, fax, email:
         a) Installer
         b) Authorized representative
         c) Equipment supplier
      i. Product data and/or catalog sheets on equipment applicable to this project.
      ii. Parts list.
      iii. Wiring diagrams of panels.
      iv. Shop drawings as submitted and accepted in submittal process.

9 Division 28
   a. Section 28 13 10 – Access Control System
      i. For each system; name, address, phone, cell, fax, email:
         1. Installer
         2. Authorized representative
      ii. Product data and/or catalog sheets on equipment applicable to this project.

iii. Parts list.
iv. Wiring diagrams of panels.
v. Shop drawings as submitted and accepted in submittal process.

b. Section 28 16 00 – Intrusion Detection System
i. For each system; name, address, phone, cell, fax, email:
1. Installer
2. Authorized representative
ii. Product data and/or catalog sheets on equipment applicable to this project.
iii. Parts list.
iv. Wiring diagrams of panels.
v. Shop drawings as submitted and accepted in submittal process.

c. Section 28 20 00 – Camera Surveillance System
i. For each system; name, address, phone, cell, fax, email:
1. Installer
2. Authorized representative
ii. Product data and/or catalog sheets on equipment applicable to this project.
iii. Parts list.
iv. Wiring diagrams of panels.
v. Shop drawings as submitted and accepted in submittal process.

d. Section 28 31 00 – Addressable Fire Alarm-Detection System
i. For each system; name, address, phone, cell, fax, email:
1. Installer
2. Authorized representative
ii. Product data and/or catalog sheets on equipment applicable to this project.
iii. Parts list.
iv. Wiring diagrams of panels.
v. Shop drawings as submitted and accepted in submittal process.

e PROCESSING SUBMITTALS.
i. Refer to Division 01 General Requirements.

f DELAYS
ii. Contractor is responsible for delays in job project accruing directly or indirectly from late submissions or resubmissions of shop drawings, or product data.

g RESUBMITTALS
iii. The A/E shall be reimbursed cost to review resubmittals subsequent to the second submittal.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

END OF SECTION

EXHIBIT A

PROJECT INFORMATION SHEET

School: _____

Project Name: _____

Project Number: _____

Substantial Completion Date: _____

Certificate of final Completion Date: _____

	Name & Address	Phone/Fax	Contact
Martin County School District Authorized Construction Representative			
Architect			
Mechanical Engineer			
Electrical Engineer			
Civil Engineer			
Structural Engineer			
Food Service Consultant			
Other Consultant(s)			

Brief Description of Project Scope:

_____

_____

_____

_____

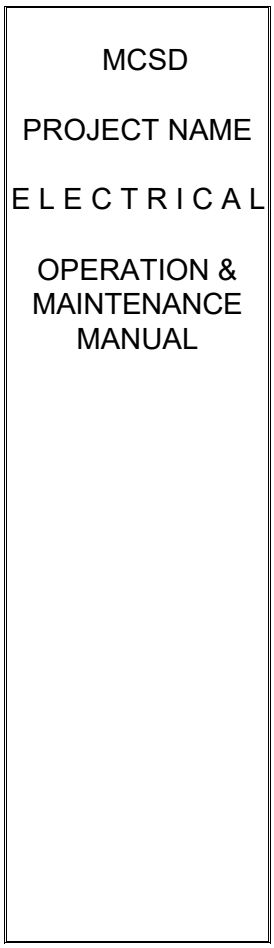
EXHIBIT B

MANUAL COVER (face)

MARTIN COUNTY SCHOOL DISTRICT STUART, FLORIDA PROJECT NAME OPERATION AND MAINTENANCE MANUAL DATE (substantial completion date)	MARTIN COUNTY SCHOOL DISTRICT STUART, FLORIDA PROJECT NAME OPERATION AND MAINTENANCE MANUAL DATE (substantial completion date)

EXHIBIT C

MANUAL COVER (spine)



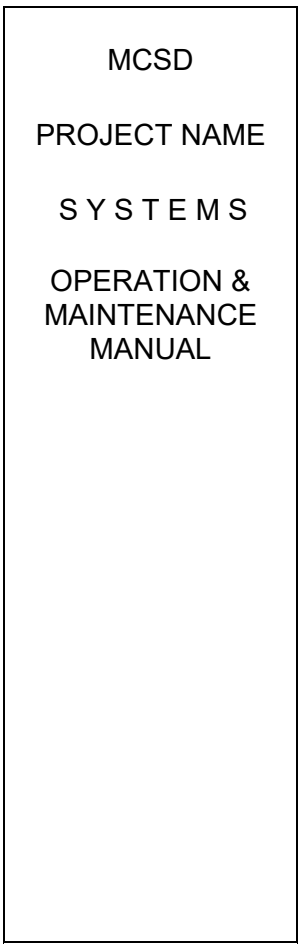


EXHIBIT D

SPARE PARTS / MAINTENANCE STOCK CERTIFICATION

This form verifies that the parts/stock listed below has been delivered to and received by Martin County School District Maintenance. Original shall be included in the Closeout Documentation Manual. Copies shall also be included in the O & M Manual.

Project Name:

_____

Type/Name of Spare Parts/Attic Stock:

_____

_____

Specification Reference:

_____

Quantity of Spare Parts/Attic Stock:

_____

_____

_____

Signature below by the Contractor and Subcontractor signifies that the spare parts/maintenance stock, required by the Contract Documents, have been delivered to the Owner.

_____
Contractor/CM

_____ Date:
_____ Authorized Signature, Title

Subcontractor _____

_____ Date:
_____ Authorized Signature, Title

Signature by the Owner acknowledges receipt of the same spare parts/maintenance stock.

_____
Martin County School District - Department

_____ Date:
_____

Authorized Signature, Title CHECK OUT MEMO

Check Out Memo shall be completed and a copy provided to the Owner at the Owner's Performance Verification and Demonstration meeting. A copy shall also be included in the specification section of each O & M Manual for the equipment checked.

Project Name

Type of Equipment Checked

Equipment Number

Name of Manufacturer of Equipment

Signature below by the manufacturer's authorized representative signifies that the equipment has been satisfactorily tested and checked out on the job by the manufacturer.

1. The attached Test and Data and Performance Verification information was used to evaluate the equipment installation and operation.
2. The equipment is properly installed, has been tested by the manufacturer's authorized representative, and is operating satisfactorily in accordance with all requirements, except for items noted below. *
3. Written operating and maintenance information has been presented and reviewed in detail with the Contractor.
4. Sufficient copies of all applicable operating and maintenance information, parts lists, lubrication checklists, and warranties have been furnished to the Contractor for insertion in the Operation and Maintenance Manuals.

CHECKED BY:

_____
MANUFACTURER'S REPRESENTATIVE – PRINT NAME

_____
ADDRESS

_____
TELEPHONE, FAX, E-MAIL

_____
MANUFACTURER'S REPRESENTATIVE – SIGNATURE AND TITLE

_____
DATE CHECKED

WITNESSED BY:

_____

CONTRACTOR'S REPRESENTATIVE – SIGNATURE AND TITLE
*EXCEPTIONS NOTED AT TIME OF CHECK-OUT (USE ADDITIONAL PAGE IF

NECESSARY) CONDUCTOR INSULATION RESISTANCE TEST MEMO

PROJECT NAME

_____

CONDUCTOR FROM_____TO

SIZE

_____

INSULATION TYPE

_____

INSULATION VOLTAGE
RATING_____

DATE_____TIME_____

WEATHER
CONDITIONS

_____

TEST VOLTAGE (DC)

_____

RANGE

_____

MEGGER INSTRUMENT/SERIAL
NUMBER_____

TESTING METHODOLOGY

_____

INSULATION RESISTANCE MEASUREMENT (ACCEPTABLE MEASUREMENT NOT TO BE LESS THAN (1) MEGOHM):

PHASE A TO GROUND	_____
PHASE B TO GROUND	_____
PHASE C TO GROUND	_____
NEUTRAL TO GROUND	_____
ISOLATED GROUND TO GROUND	_____

CONTRACTOR'S REPRESENTATIVE

_____

DATE_____

OWNER'S REPRESENTATIVE:

_____

DATE: _____

ENGINEER'S REPRESENTATIVE:

_____

DATE: _____

GROUND TEST INFORMATION

PROJECT NAME:_____

GROUND TYPE:_____

TEST BY:_____

DATE OF TEST:_____

GROUND LOCATION:_____

GROUND TYPE (Rod, Water pipe, etc.):

PRIOR TO CONNECTION TO SYSTEM

GROUND _____(OHMS)

AFTER CONNECTION TO SYSTEM

GROUND _____(OHMS)

WEATHER CONDITIONS (Wet/Dry)_____

SOIL CONDITIONS (Wet/Dry) _____

CONTRACTOR'S REPRESENTATIVE

_____

DATE _____

ENGINEER'S REPRESENTATIVE

_____

DATE _____

OWNER'S REPRESENTATIVE

_____

DATE_____

VOLTAGE AND AMPERAGE READINGS (TABULATED DATA)

PROJECT NAME

_____

SWITCHGEAR/PANELBOARD

_____

FULL LOAD AMPERAGE READINGS: DATE _____
TIME _____

PHASE A _____
B_____ C__ N____ GROUND ___

FULL LOAD VOLTAGE READINGS: DATE _
TIME _____

PHASE A TO N_____A TO B _____ B TO N__A TO C _____
C TO N_____B TO C _____

VOLTAGE AT THE END OF THE LONGEST BRANCH

_____

TYPE OF LOAD

_____

NO LOAD VOLTAGE READINGS: DATE___
TIME _____

PHASE A TO N_____A TO B _____ B TO N_A TO C _____
C TO N_____B TO C _____

ENGINEER'S REPRESENTATIVE

_____
DATE _____

OWNER'S AUTHORIZED REPRESENTATIVE

_____

DATE _____

CONTRACTOR'S REPRESENTATIVE

_____

DATE _____

PROGRESS AND RECORD DRAWING CERTIFICATION

NAME OF PROJECT:

_____

DIVISION NUMBER AND NAME:

_____

This is to certify that the attached marked-up design prints were marked as the items were installed at the site during construction, and that these prints represent as accurate "As-Builts" record of the work as actually installed. One copy will be turned over to the Owner at the instruction in Operation Conference. The duplicate copy is for the Engineer's files.

_____
General Contractor

_____
By: Authorized Signature and Title

_____
Date

_____
Subcontractor

_____
By: Authorized Signature and Title

_____
Date

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 01, General Requirements, are included as a part of this Section as though bound herein.
B. The requirements in this section of the specification are in addition to all requirements in sections referenced above.

1.2 SUMMARY

A. This section includes Basic Electrical Requirements specifically applicable to Division 26 Sections, in addition to Division 01 - General Requirements - and any supplemental requirements/conditions.

1.3 DESCRIPTION OF WORK

A. The work required under this Division shall include all materials, labor and auxiliaries required to install a complete and properly operating electrical system.
B. The Contractor shall furnish, perform, or provide all labor including planning, purchasing, transporting, storing, installing, testing, cutting and patching, trenching, excavating, backfilling, coordination, field verification, equipment (installation and safety), supplies, and materials necessary for the correct installation of complete electrical systems (as described or implied by these specifications and the applicable drawings) in strict accordance with applicable codes, which may not be repeated in these specifications, but are expected to be common knowledge of qualified Bidders.
C. The Division 26 Contract Documents refer to work required in addition to (or above) the minimum requirements of the NEC 2017. Edition and applicable local codes. All work shall comply with all applicable codes as a minimum and with the additional requirements called for in these Contract Documents.
D. Only trained and licensed personnel shall be used by the Contractor to perform work. The Contractor shall not perform work, which violates applicable Codes, even if called for in the Contract Documents. The Contractor's Bid shall include work necessary to completely install the electrical systems indicated by the Contract Documents in accordance with applicable Codes.
E. Refer to other Division 26 Sections for additional work requirements.
F. Coordinate and verify power and telephone company service requirements prior to bid. Bid to include all work required for complete and properly operating systems.
G. Connections of all items using electric power shall be included under this division of the specifications, including necessary wire, conduit, circuit protection, disconnects and accessories. Securing of roughing-in drawings and connection information for equipment involved shall also be included under this division. See other divisions for specifications for electrically operated equipment.

H. The Contractor shall provide and install panic hardware on all electrical room doors where the electrical room houses equipment rated 800 amps or more per NEC 110.26. All electrical room doors shall open in the direction of egress.

1.4 WORK SEQUENCE

A. Install work in stages and/or phases to accommodate Owner's occupancy requirements. Coordinate electrical schedule and operations with Owner and Architect/Engineer.

1.5 CODES, FEES, AND STANDARDS

A. Obtain permits and request inspections from authority having jurisdiction and applicable utility companies.
B. Pay for all required licenses, fees, and inspections.
C. Contact the Utility Companies to determine if fees, charges, or costs are required by the Utility Company for permanent power and for temporary power, installations, and hook-ups. These fees, charges or costs shall be included in Contractor's bid.
D. Material shall be new and free of defects with UL listing or be listed with an approved, nationally recognized Electrical Testing Agency if and only if UL Listing is not available for material.

1.6 PROJECT/SITE CONDITIONS

A. Install Work in locations shown or described in the Contract Documents, unless prevented by Project conditions.
B. The Contractor shall install all equipment so that all Code required, and Manufacturer recommended servicing clearances are maintained. Contractor shall be responsible for the proper arrangement and installation of all equipment within any designated space. Should the Contractor determine that a departure from the Contract Documents is necessary, he shall submit to the A/E, for approval, detailed drawings of his proposed changes with his written reasons for the changes. No changes shall be implemented by the Contractor without the issuance of the required drawings, clarifications, and/or change orders.
C. The Contractor shall verify finish dimensions at the project site in preference to using dimensions noted on Contract Documents.

1.7 CONTRACT DOCUMENTS

A. These specifications and applicable drawings shall be considered supplementary, one to the other and are considered Contract Documents. All workmanship, methods, and/or material described or implied by one and not described or implied by the other shall be furnished, performed, or otherwise provided just as if it had appeared in both sets of documents.

B. Where a discrepancy or conflict is found between these specifications and any applicable drawing, the Contractor shall notify the A/E in written form. In the event that a discrepancy exists between specifications and any applicable drawing, the most stringent requirement shall govern unless the discrepancy conflicts with applicable codes wherein the code shall govern. The most stringent requirement shall be that work, product, etc. which is the most expensive and costly to implement.
C. The drawings are diagrammatic and are not intended to include every detail of construction, materials, methods, and equipment. They indicate the result to be achieved by an assemblage of various systems. Coordinate equipment locations with Architectural and Structural drawings. Layout equipment before installation so that all trades may install equipment in spaces available. Coordinate installation in a neat and workmanlike manner.
D. Wiring arrangements for equipment shown on the drawings are intended to be diagrammatic and do not show all required conductors and functional connections. All wiring and appurtenances required for the proper operation of all equipment to be connected shall be provided.
E. Specifications require the Contractor to provide shop drawings which shall indicate the fabrication, assembly, installation, and erection of a particular system's components. Drawings that are part of the Contract Documents shall not be considered a substitute for required shop drawings, field installation drawings, Code requirements, or applicable standards.
F. Locations indicated for outlets, switches, and equipment are approximate and shall be verified by instructions in specifications and notes on the drawings. Where instructions or notes are insufficient to locate the item, notify the A/E.
G. The Contractor shall take finish dimensions at the project site in preference to scaling dimensions on the drawings.
H. Where the requirements of another Division, section, or part of these specifications exceed the requirements of this Division those requirements shall govern.

1.8 MATERIALS AND EQUIPMENT

A. Material shall be new (except where specifically noted, shown, or specified as "Reused") and/or denoted as existing) and shall be UL listed and bear UL label. Where no UL label listing is available for a particular product, material shall be listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.
B. Where Contract Documents list design selection or manufacturer, type, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to A/E's review and acceptance. Where Contract Documents list accepted substitutions, these items shall comply with requirements in Division 01.
C. When a product is specified to be in accordance with a trade association or government standard and at the request of A/E the Contractor shall furnish a certificate that the product complies with the referenced standard and supporting test data to substantiate compliance.
D. Where multiple items of the same equipment or materials are required, they shall be the product of a single Manufacturer.

E. Where the Contract Documents require materials and/or equipment installed, pulled, or otherwise worked on, the materials and/or equipment shall be furnished and installed by the Contractor responsible for Division 26 methods and materials unless specifically noted otherwise.
F. Where the contract documents refer to the terms "furnish," "install," or "provide," or any combination of these terms) the materials and/or equipment shall be supplied and delivered to the project including all labor, unloading, unpacking, assembly, erection, anchoring, protecting supplies and materials necessary for the correct installation of complete system unless specifically noted otherwise.
G. Before the Contractor orders equipment, the physical size of specified equipment shall be checked to fit spaces allotted on the drawings, with NEC working clearances provided. Internal access for proposed equipment substitutions shall be provided.
H. Electrical equipment shall be protected from the weather, during shipment, storage, and construction per manufacturer's recommendations for storage and protection. Should any apparatus be subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test, at the expense of the Contractor, to ascertain the suitability of the apparatus, or it shall be replaced without additional cost to the Owner. No additional time will be allowed, and the project completion date shall be maintained.
I. Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service. Replace or repair and test damaged equipment in compliance with industry standards at no additional cost to the Owner. Equipment required for the test shall be provided by the Contractor.
J. Material and equipment shall be provided complete and shall function up to the specified capacity/function. Should any material and/or equipment as a part or as a whole fail to meet performance requirements, replacements shall be made to bring performance up to specified requirements. Damages to finish by such replacements, alterations, or repairs shall be restored to prior conditions, at no additional cost to the Owner.
K. Where tamperproof screws are specified or required, Phillips head or Allen head devices shall not be accepted. For each type used, provide Owner with three tools. Owner will designate the specific hardware design to correspond with existing devices elsewhere in the building, to limit special tool requirements.
L. Where the Contract Documents denote equipment and/or material to be 'new' and/or 'existing' and also provide no denotation for other equipment as to it being 'new' and/or 'existing,' this is not to infer that the non-denoted equipment is either new or existing, or opposite of the equipment that is denoted. The use of the terms 'new' or 'existing' is meant to clarify denoted equipment/materials for that item only, and the lack of the terms 'new' or 'existing' in relation to identifiers/notes/denotations on the drawings is not to infer that this non-denoted equipment or materials is new or existing.

1.9 MISCELLANEOUS CIRCUITS REQUIRED

A. Provide 120-volt, 20-amp circuit to post indicator valves (whether shown on drawings or not). Connect to spare 20-amp, 1 pole circuit breaker in nearest 120-volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with civil engineer (and drawings/specifications) or fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with valve installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.

B. Provide 120-volt, 20-amp circuit to fire protection system panel and bell (whether shown on drawings or not). Connect to spare 20-amp, 1 pole circuit breaker in nearest 120-volt panel. Re- label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with civil engineer (and drawings/specifications) or fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel when building has emergency generator system.
C. Provide 120-volt, 20-amp circuit to intercom system panel (whether shown on drawings or not). Connect to spare 20-amp, 1 pole circuit breaker in nearest 120-volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with intercom system engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel when building has emergency generator system.
D. Provide 120-volt, 20-amp circuit to all fire alarm panels, remote panels, etc. (whether shown on drawings or not). Connect to spare 20-amp, 1 pole circuit breaker in nearest 120-volt panel. Re- label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire alarm system engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel when building has emergency generator system.
E. Provide 120-volt, 20-amp circuit to fire and smoke dampers (whether shown on drawings or not). Connect to spare 20-amp, 1 pole circuit breaker in nearest 120-volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide all electrical. Nearest panel to be nearest emergency panel when building has emergency generator system.
F. Provide 120-volt, 20-amp circuit to building control panels for HVAC system (whether shown on drawings or not). Connect to spare 20-amp, 1 pole circuit breaker in nearest 120-volt panel. Re- label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide all electrical

1.10 SUPERVISION OF THE WORK

A. Reference the General Conditions for additional requirements.
B. The Contractor shall provide experienced, qualified, and responsible supervision for work. A competent foreman shall be in charge of the work in progress at all times. If, in the judgment of the A/E, the foreman is not performing his duties satisfactorily, the Contractor shall immediately replace him upon receipt of a letter of request from the A/E. Once a satisfactory foreman has been assigned to the work, he shall not be withdrawn by the Contractor without the written consent of the A/E.
C. Provide field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable size and complexity. Superintendent shall be on the site at all times during construction and must have an active Journeyman's Electrical License.

D. Superintendent shall be employed by a Florida Registered Electrical Contractor (ER) or Florida Certified Electrical Contractor (EC).

1.11 COORDINATION

A. Provide all required coordination and supervision where work connects to or is affected by work of others and comply with all requirements affecting this Division. Work required under other divisions, specifications, or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner including but not limited to electrical work required for:
   1. Door Hardware
   2. Roll-up doors
   3. Fire shutters
   4. Roll-up grilles
   5. Elevators
   6. Mechanical Division of the Specifications
   7. Landscape Architect drawings
   8. Kitchen Equipment
   9. Millwork design drawings and shop drawings
B. Contractor shall obtain set of contract documents from Owner for all areas of work noted above and include all electrical work in bid whether included in Divisions 26, 27 or 28 Contract Documents or not.
C. Installation studies shall be made to coordinate the electrical work with other trades. Work shall be preplanned. Unresolved conflicts shall be referred to the A/E prior to installation of the equipment.
D. For locations where several elements of electrical or combined mechanical and electrical work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings at 1/4" scale showing the actual physical dimension required for the installation to assure proper integration of equipment with building systems and NEC required clearances. Coordination drawings shall be provided for all areas determined by the A/E.
E. Secure accepted shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on accepted shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.
F. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner and the contract time for completion will not be extended.
G. The Contractor shall maintain an up-to-date set of Contract Documents and Specifications of all trades on the project site, including Architectural, Structural, Mechanical, Electrical and, where provided Interior Design Drawings.
H. It is the responsibility of this Contractor to coordinate the exact required location of floor outlets, floor ducts, floor stub-ups, etc. with Owner and Architect (and receive their written approval) prior to rough-in. Locations indicated in Contract Documents are approximate.

I. The Contract Documents describe specific sizes of switches, breakers, fuses, conduits, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.). The Contractor shall coordinate the requirements of each load with each load's respective circuitry shown and with each load's requirements as noted on its nameplate data and manufacturer's published electrical criteria. The Contractor shall adjust circuit breaker, fuse, conduit, and conductor sizes to meet the actual requirements of the equipment being provided and installed and change from single point to multiple points of connection (or vice versa) to meet equipment requirements. Changes due to these coordination efforts shall be made at no additional cost to the Owner.

1.12 PROVISION FOR OPENINGS

A. Locate openings required for work. Provide sleeves, guards, or other accepted methods to allow passage of items installed.
B. Coordinate with roofing Contractor on installation of electrical items which pierce roof. Roof penetrations shall not void warranty. The use of pitch pockets is not acceptable.
C. Where work pierces waterproofing, it shall maintain the integrity of the waterproofing. Coordinate roofing materials which pierce roof for compatibility with membrane or other roof types with Contractor prior to installation.

1.13 CONCRETE PADS

A. Furnish and install reinforced concrete housekeeping pads for transformers, switchgear, motor control centers, and other free-standing equipment. Unless otherwise noted, pads shall be four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by six (6) inches each side, except when equipment is flush against a wall where the side against the wall shall be flush with the equipment. Pads shall be reinforced with W1.4 x 1.4 6 x 6 welded wire mesh. Chamfer top edges 1/2". Trowel all surfaces smooth. Provide 3000 psi concrete.
B. Contractor to provide/install concrete pad for exterior pad mount transformers as required by Power Company.

1.14 SURFACE MOUNTED EQUIPMENT

A. Surface mounted fixtures, outlets, cabinets, conduit, panels, etc. shall have finish as directed by Engineer.

1.15 CUTTING AND PATCHING

A. New Construction:
   1. Reference Division 01 - General Requirements.
   2. Cutting of work in place shall be cut, drilled, patched, and refinished by trade responsible for initial installation.
   3. The Contractor shall be responsible for backfilling and matching new grades with adjacent undisturbed surface.

1.16 TRENCHING

A. Trench excavation in excess of 5 feet deep shall comply with OSHA Standard 29 CFRs. 1926. 650 Subpart P.

1.17 INSTALLATION

A. Erect equipment to minimize interferences and delays in execution of the work.
B. Take care in erection and installation of equipment and materials to avoid marring finishes or surfaces. Any damage shall be repaired or replaced as determined by the A/E at no additional cost to the Owner.
C. Equipment requiring electrical service shall not be energized or placed in service until A/E is notified and is present or have waived their right to be present in writing. Where equipment to be placed in service involves service or connection from another Contractor or the Owner, the Contractor shall notify the Owner in writing when the equipment will be ready. The Owner shall be notified as far in advance as possible of the date the various items of equipment will be complete.
D. Equipment supports shall be secured and supported from structural members except as field accepted by the A/E in writing.
E. Plywood material shall not be used as a backboard for mounting panel boards, disconnects, motor starters, and dry type transformers. Provide "cast in place" type inserts or install expansion type anchor bolts. Electrical equipment shall not be mounted directly to dry wall for support without additional channels as anchors. Channels shall be anchored to the floor and structure above. Panelboards and terminal cabinets shall be provided with structural framing located within drywall partitions.
F. The Contractor shall keep the construction site clean of waste materials and rubbish. Upon completion of the work, the Contractor shall remove from the site all debris, waste, unused materials, equipment, etc.
G. Inserts, pipe sleeves, supports, and anchorage of electrical equipment shall be provided. Where items are to be set or embedded in concrete or masonry, the items shall be furnished, and a layout made prior to the setting or embedment thereof, so as to cause no delay.

1.18 PROGRESS AND RECORD DRAWINGS

A. Keep two sets of blueline prints on the job, and neatly markup design drawings each day as components is installed. Different colored pencils shall be used to differentiate each system of electrical work. Cost of prints and this labor task shall be included under this Division. All items on Progress Drawings shall be shown in actual location installed. Change the equipment schedules to agree with items actually furnished.
B. Prior to request for substantial completion observation, furnish a set of neatly marked prints showing "as-installed" (as-built) condition of all electrical installed under this Division of the specifications. Marked up prints are to reflect all changes in work including change orders, field directives, addenda from bid set of Contract Documents, request for information responses, etc. Marked up set of prints are to show:
   1. All raceways 1-1/2" and above, exactly as installed.
   2. All site raceways exactly as installed.

3. Any combining of circuits (which is only allowed by specific permission) or change in homerun outlet box shall be made on as-builts.
4. Any circuit number changes on plan shall be indicated on as-builts.
5. Any panelboard schedule changes shall be indicated on as-builts.

C. Marked up prints as noted above are to be submitted to A/E for acceptance. Contractor shall review submitted "as-builts" with Engineer in the field. Contractor shall verify every aspect for accuracy.
D. After acceptance of marked up prints by A/E with all changes, additions, etc. included on accepted marked up prints, submit prior to request for final payment and/or request for final observation.
E. Where the Contractor has failed to produce representative "as-built" drawings in accordance with requirements specified herein, the Contractor shall reimburse Engineer all costs to produce a set of "as-built" drawings to the Architect/Owner satisfaction.

1.19 "OBSERVATION OF WORK" REPORT

A. Reference the General Conditions.
B. Items noted by A/E or his representative during construction and before final acceptance which do not comply with the Contract Documents will be listed in an "Observation of Work" report which will be sent to the Contractor for immediate action. The Contractor shall correct all deficiencies in a prompt concise manner. After completion of the outstanding items, provide a written confirmation report for each item. The report shall indicate each item noted, and method of correction. Enter the date on which the item was corrected and return the signed reports so items can be rechecked. Failure to correct the deficiencies in a prompt concise manner or failure to return the signed reports shall be cause for disallowing request for payments.
C. Items noted after acceptance during one-year guarantee period shall be checked by the Contractor in the same manner as above. The signed reports are to be returned by him when the items have been corrected.

1.20 TRAINING OF OWNERS OPERATORS: (Refer to Appendix A)

A. The owners shall be given comprehensive training in the understanding of the systems and operation and maintenance of each major piece of equipment.
B. The contractor shall be responsible for scheduling the training which shall start with classroom sessions followed by hands on training on each piece of equipment. Hands on training shall include start-up, operation in all modes possible, shutdown and any emergency procedures.
C. The manufacturer’s representative shall provide the instructions on each major piece of equipment. These sessions shall use the printed installation, operation and maintenance instruction material included in the O&M manuals and shall emphasize safe and proper operating requirements and preventative maintenance.

1.21 SYSTEMS WARRANTY

A. Reference the General Conditions.

B. The work shall include a one-year warranty. This warranty shall be by the Contractor to the Owner for any defective workmanship or material which has been furnished at no cost to the Owner for a period of one year from the date of substantial completion of System. Warranty shall not include light bulbs in service after one month from date of substantial completion of the System. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.
C. Where items of equipment or materials carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material.
D. Where extended Warranty or Guarantees are called for herein, furnish three copies to be inserted in Operation and Maintenance Manuals.
E. All preventative maintenance and normal service will be performed by the Owner's maintenance personnel after final acceptance of the work which shall not alter the Contractor's warranty.

1.22 WASTE MATERIALS DISPOSAL

A. Contractor shall include in his bid the transport and disposal, or recycling of all waste materials generated by this project in accordance with all rules, regulations, and guidelines applicable. Contractor shall comply fully with Florida statute 403.7186 regarding mercury containing devices and lamps. Lamps, ballasts, and other materials shall be transported and disposed of in accordance with all DEP and EPA guidelines applicable at time of disposal. Contractor shall provide owner with written certification of accepted disposal.

1.23 SUBSTANTIAL COMPLETION

A. The Contractor shall be fully responsible for contacting all applicable parties to schedule required observations of the work by Engineer.
B. Work shall be complete as required by authorities having jurisdiction and the general conditions of the contract prior to request for substantial completion observation. Work must be deemed substantially complete by A/E to fulfill requirements.

1.24 PROHIBITION OF ASBESTOS AND PCB

A. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound of material containing or incorporating asbestos or PCB, is prohibited. The requirements of this specification for complete and operating electrical systems shall be met without the use of asbestos or PCB.
B. Prior to the Final Review field visit, the Contractor shall certify in writing that the equipment and materials installed in this Project under this Division 26 contain no asbestos or PCB’s. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB’s. This statement shall be signed and dated by a duly authorized agent of the manufacturer.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

(Not Applicable)

END OF SECTION

APPENDIX A

Training Schedule							
Div.	**Training Description**	**Subcontractor**	**Demo Date**	**Time**	**Hours**	**Comments**	**Personnel to attend training**
	Premise Distribution System IT Network/Data				4 hours	Familiarize the owner with the locations of all TR's, cable and jack labeling and numbering systems, data and voice connections.	
	Electrical Systems				2-4 hour	Complete overview of all electrical systems. See specifications for list of essential features to be demonstrated, include generator.	
	Occupancy Sensors				4 hours	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	
	Local Area Sound System-Media Center				4 hours	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	
	Audio Video Systems				2-4 hour	Demo system operation and provide a 2-hour videotaped instruction with manufacture's training personnel to school personnel upon all aspects of the CATV system from the head-end to the user TV.	
	School Intercom System				2-4 hour	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	

	Wireless Clock System				2 hours	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	
	Access Control System				4 hours	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	
	Intrusion Detection				2-4 hour	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	
	Camera Surveillance				2-4 hour	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	
	Addressable Fire Alarm Detection System				2-4 hour	Demonstrate to owner selected personnel proper operation and maintenance of all related equipment.	

SECTION 26 05 03
EQUIPMENT WIRING SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:
   1. Electrical connections to equipment specified under other sections.

1.2 RELATED SECTIONS

A. Summary of Work
B. Conduit.
C. Building Wire and Cable.
D. Boxes.
E. Electric Doors

1.3 REFERENCES

A. NEMA WD 1 - General Requirements for Wiring Devices
B. NEMA WD 6 - Wiring Devices-Dimensional Requirements
C. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract Documents and Section Submittals.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.6 COORDINATION

A. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections.
B. Determine connection locations and requirements.
C. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
D. Sequence electrical connections to coordinate with start-up schedule for equipment.

PART 2 – PRODUCTS

2.1 CORDS AND CAPS

A. Attachment Plug Construction: Conform to NEMA WD 1.
B. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
C. Cord Construction: ANSI/NFPA 70, Type SO multi-conductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify conditions under provisions of Section Investigation of Existing Electrical Systems.
B. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.
B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations (including inside of coolers/freezers).
C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment and in cooler/freezers.
D. Provide receptacle outlet where connection with attachment plug is required. Provide cord and cap where field-supplied attachment plug is required.
E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
F. Install disconnect switches, controllers, control stations, and control devices as required.
G. Modify equipment control wiring with terminal block jumpers as required.
H. Provide interconnecting conduit and wiring between devices and equipment where required.
I. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.3 EQUIPMENT CONNECTION SCHEDULE

A. By local authority and as required for a complete and operating service.
B. Electric Door(s):
    1. Electrical Connection: liquid tight flexible conduit with local field installed disconnect switch and field installed control switch.
    2. Voltage: 120 volts, 1 phase, 60 Hz.
    3. Load rating: 1/2 hp.

C. CCTV Equipment:
   1. Electrical Connection: Wiremold plug strips as required with surge suppression.
   2. Voltage: 120 volts, 1 phase, 60 Hz.
   3. 2 #10, plus ground, 3/4"c.
   4. Use manual motor starter switch with overloads and with pilot light for disconnect switch.
   5. Connect unit provided control switch as recommended by manufacturer. (3/4"c.)

END OF SECTION

SECTION 26 05 07
SUBMITTALS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Requirements for submittals specifically applicable to Division 26, 27, 28 Sections.
B. See Section Substitutions for additional requirements when submittal consists of accepted substitution equipment.

1.3 SUBMITTAL OF "ACCEPTED SUBSTITUTE" EQUIPMENT/PRODUCT

A. Representation: In submitting item, equipment, product, etc. that has been listed on contract drawings, in contract documents or in an addendum, Contractor represents that he:
   1. Has investigated substituted item and has determined that it is equal or superior to specified product in all aspects and that use of substituted item will not require any additional time to the Contract.
   2. Will coordinate installation of accepted substitution into work, making changes as may be required to complete work in all aspects.
   3. Waives all claims for additional costs related to substitution which may subsequently become apparent.
   4. Will provide the same warranties for the substitution as for the product specified.
   5. Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.
   6. Will absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or miss-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.
B. Substitutions that cannot meet space requirements or other requirements of these Specifications, whether accepted or not, shall be replaced at the Contractor's expense with no additional time added to the Contract.

1.4 SUBMITTALS

A. Submittals shall consist of a minimum of one view type 3-ring binder, white, sized to hold 8- 1/2" x 11" sheets for "ELECTRICAL SUBMITTALS" (Power and Lighting).
1. Binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3" (provide additional binders if 3" size is not sufficient to properly hold submittals).

2. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket; see Binder Examples for Submittals included at end of this Section. Description sheet is to be white with black letters, minimum of 11" high and full width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e., "ELECTRICAL SUBMITTALS" for Power and Lighting.

B. Submittals Binders to include:
   1. First sheet shall be prepared and filled out by Contractor and shall list project addresses, telephones, etc.; see "PROJECT ADDRESSES" Form included at end of this section.
   2. Second sheet in binder shall be a photocopy of the Electrical Index pages in Specifications.
   3. Provide reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Systems Schedule.
   4. Submittals consisting of marked catalog sheets or shop drawings shall be inserted in the binder in proper order. Submittal data shall be presented in a clear and thorough manner. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Markings shall be made with arrows or circles (highlighting is not acceptable).
   5. Shop Drawings: Drawings to include identification of project and names of Architect, Engineer, General Contractor, subcontractor and supplier, data, number sequentially and indicate the following:
      a) Fabrication and erection dimensions.
      b) Arrangements and sectional views.
      c) Necessary details, including complete information for making connections with other work.
      d) Kinds of materials and finishes.
      e) Descriptive names of equipment.
      f) Modifications and options to standard equipment required by the work.
      g) Leave blank area, size approximately 4 by 2 1/2 inches, near title block (for A/E's stamp imprint).
      h) In order to facilitate review of drawings, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and specification paragraph numbers where items occur in the Contract Documents.
      i) Conduit/raceway rough-in drawings.
      j) Items requiring shop drawings include (but not limited to):
         1. Manual transfer switch
         2. Special built light fixtures
         3. Each section of fire alarm, television, etc.
         4. UPS systems
         5. Emergency generator systems
         6. Special and/or modified equipment
         7. Main switchboard(s)
         8. UL listed fire and smoke stopping assemblies for each applicable penetration.
      k) See specific sections of Specifications for further requirements.
   6. Product Data: Technical data is required for all items as called for in the Specifications regardless if item furnished is as specified.

a) Submit technical data verifying that the item submitted complies with the requirements of the Specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the Specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.
b) In order to facilitate review of product data, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where and/or what item(s) are used for and where item(s) occur in the contract documents.
c) See specific sections of Specifications for further requirements.

1.5 PROCESSING SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract and this section of the Specifications, whichever is the most strict.
B. Quantity of submittals with marking on each copy shall be submitted under provisions of General Requirements of the Contract, Division 01, and this and other sections of the Specifications. Original submittal must contain 3-ring binders with:
   1. Project Addresses
   2. Index
   3. Separation Sheets
   4. Basic Materials
   5. Panelboards
   6. Light Fixtures
   7. Long Lead Items
   8. Systems Product Data
C. Remainder of submittals are to be submitted no later than 60 days after award of contract or 60 days prior to Request for Substantial Completion whichever is earlier.
D. The Contractor shall review all submittals before submitting to the A/E. No request for payment will be considered until the submittals have been reviewed and submitted for approval.
E. Product Data: For standard manufactured materials, products, and items, submit one (1) copy or sets of data (per binder). If submittal is rejected, resubmittal shall contain same quantity of new data.
F. Shop Drawings: For custom fabricated items and systems shop drawings, initially submit a transparency (suitable for reproduction) together with two (2) prints made therefrom. When submittal is acceptable, furnish one (1) print per binder made from the accepted transparency.
G. Shop Drawing Review Notation:

Action	Description
1. No Exception Noted	No exceptions taken. Resubmittal not required.
2. Rejected	Not in compliance with Contract Documents. Resubmit.
3. Submit Specific Item	Resubmit item as specified.
4. Make Corrections Noted	Make corrections noted, resubmittal not required.
5. Revise and Resubmit	Make corrections noted, resubmittal is required
6. Review not Required	Not required for review.
7. No action taken.	Copy retained for reference.

H. Acceptance: When returned to Contractor, submittals will be marked with A/E's stamp. If box marked "Rejected" "Revise and Resubmit" or "Submit Specific Item" is checked, submittal is not accepted and Contractor is to correct and resubmit as noted, otherwise submittal is accepted, and Contractor is to comply with notation making necessary corrections on submittal. Review comments will generally not be on each individual submittal sheet and will be on a separate sheet attached to shop drawing transmittal, submittal as a whole or each submittal section.

I. Note that the acceptance of shop drawings or other information submitted in accordance with the requirements specified above, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved, the ability of the material or equipment involved or the Mechanical/Electrical performance of equipment. Acceptance of shop drawings does not invalidate the plans and Specifications if in conflict, unless a letter requesting such change is submitted and accepted on the Engineer's letterhead.

1.6 DELAYS

A. Contractor is responsible for delays in job progress accruing directly or indirectly from late submissions or resubmissions of shop drawings, or product data.

1.7 RE-SUBMITTALS

A. The A/E shall be reimbursed for all costs to review resubmittals subsequent to the second submission for the same product. Cost will be billed to Contractor at Engineer's standard hourly rate.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 26 05 08
SUBSTITUTIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies general, administrative. and procedural requirements for substitutions for Divisions 26, 27 28 above and beyond the requirements of Division 1 General Requirements and any Supplemental requirements/conditions.
B. Request for substitutions must be submitted no later than 10 days prior to bid due date.
C. Request for substitution will not be considered after bid due date.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.
B. Substitutions: Products, materials, equipment, finishes, and methods of construction are considered substitutions if they meet any one of the following conditions:
   1. Does not meet all the requirements of these specifications under Part 1 - General or Part 2 - Products for any section included in Divisions 26, 27 28.
   2. Is a different design which accomplishes the same result as that design specified in Division 26 Sections.
   3. Is of similar or different design that:
      a) Requires more space.
      b) Requires more power.
      c) Requires changes in other elements of the work such as (but not limited to) architectural, mechanical, structural, or other electrical work.
      d) Affects the construction schedule.
   4. Is listed in these specifications on the Contract Documents or in any addenda as an accepted substitution.

1.4 REQUEST FOR SUBSTITUTION SUBMITTALS (10 Days Prior to Bid Due Date)

A. A separate request for substitutions shall be submitted for each product, material, etc. that is defined as a substitution.
B. Submittal must consist of written request for substitution with data as required below. Request must be very specific as to what specified item, request for substitution is submitted for.
C. Each request for substitution submittal for each product, etc. shall include:
   1. Name of material or equipment for which it is to be substituted.

2. Drawings, product data, performance data and/or other information necessary for the engineer to determine that the equipment meets all specifications and requirements.
3. Proof that pole lighting fixture and pole meet applicable wind loading requirements. Pole lighting fixtures must be submitted showing proof that they comply with the applicable wind loading requirements for location of this project.
4. Compliance Statement. Each request shall include the following compliance statement typed on letterhead of submitting company:
   a) Submittal complies with all aspects/requirements of Contract Documents. (Yes or No). If no, state deviance.
   b) Submittal complies with all applicable codes. (Yes or No). If no, state deviance.
   c) Submittal complies with all other elements of the work and does not require any other changes. (Yes or No). If No, state required change.
   d) Meets or exceeds the performance of specified product. (Yes or No). If no, state required change.

1.5 REQUEST FOR SUBSTITUTION SUBMITTALS (AFTER BID)

A. Substitution requests submitted after bid will not be reviewed.
B. Submittals for items noted as an Accepted Substitution on Contract Drawings, these specifications, or listed in addenda, shall be submitted as required in Section Submittals.

1.6 CONSIDERATION AND ACCEPTANCE

A. Request for substitutions will not be considered if:
1. Submittal does not comply with all requirements as noted above or contain all information required above.
2. If submittal does not contain Compliance Statement, fully filled out.
3. If Compliance Statement contains a 'no' or 'N'.
4. Submittals are submitted beyond time limitations noted above.

B. Samples.
1. Sample may be required to be submitted, if deemed necessary by the A/E to determine if the substitution meets specifications.
2. Where required by A/E on an individual basis, samples may be required after written notice of acceptance and approval has been made of each substitution.
3. The A/E reserves the right to reject sample and consequently the substitution should the sample not meet the requirement of the contract documents.

C. Substitutions will be considered on basis of design, concept of the Work, and overall conformance with information given in Contract Documents, including but not limited to:
   1. Design criteria, which shall be equal or superior to the specified item.
   2. Finishes, which shall be identical or superior to finishes of specified product.
   3. Lenses or louvers, which shall be identical size, thickness and type material specified.
   4. Physical size and dimension which are identical or within design criteria limitations as determined by the Engineer.
   5. Photometric data, which shall be identical or superior in quantity and quality.

6. Trim detail and mechanical qualities, which shall be identical or within design criteria limitations as determined by the Engineer.

D. The Engineer's decision on acceptance or rejection of substitutions will be final.
E. Substitution requests, if accepted will be included in addenda.
F. Approval of a substituted item or listing a substituted item as an accepted substitution, does not modify or act as a waiver in any way, the requirements of the contract documents. See Section Submittals for additional requirements on accepted substitution submittals, equipment, etc.
G. The naming of any manufacturer as an accepted substitution does not imply automatic approval as a substitution. It is the sole responsibility of the Contractor to ensure that any price quotations received, and submittals made are for systems that meet or exceed these specifications.

PART 2 – PRODUCTS

(Not Applicable)

PART 3 – EXECUTION

(Not Applicable)

END OF SECTION

SECTION 26 05 09
REFERENCE STANDARDS AND REGULATORY REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Reference Standards and Regulatory Requirements applicable to Divisions 26, 27 28 sections.

1.3 REFERENCES

A. The following references may be referenced within these specifications:

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
AHERA	Asbestos Hazard Emergency Response Act
AIA	American Institute of Architects
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	ASME International American Society of Mechanical Engineers International
ASTM	American Society for Testing and Materials International
BOR	Board of Regents
BICSI	BICSI, Inc.
BOCC	Board of County Commissioners St Johns County
CRSI	Concrete Reinforcing Steel Institute
DCA-ADAIA	Department of Community Affairs Florida Americans with Disabilities Accessibility Implementation Act
DCA-ADAAG	Department of Community Affairs Florida Americans with Disabilities Act Accessibility Guidelines
DCA-ARM	Department of Community Affairs Accessibility Requirements Manual
DER Rule 17-761	Department of Environmental Regulation Chapter 17-761 on Underground Storage Tank Systems
DER Rule 17-762	Department of Environmental Regulation, Chapter 17-762 on Above Ground Storage Tank Systems.
DMS/DOC	Department of Management Services Division of Communications
DOCA or DCA	State of Florida Department of Community Affairs

EIA/TIA	Electronics Industries Alliance/Telecommunications Industry Association
EJCDC	Engineers Joint Contract Documents Committee American Consulting Engineers Council
FAC	Florida Administrative Code
FBC	Florida Building Code
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FFPC	Florida Fire Prevention Code
FGC	Florida Building Code (Fuel Gas)
FLA	State of Florida
FMC	Florida Building Code (Mechanical)
FMG	FM Global (formerly Factory Mutual System)
FPC	Florida Building Code (Plumbing)
FS	Florida Statutes
HL	Hospital Licensure
ICC	International Code Council
IEEE	Institute of Electrical and Electronics Engineers, Inc
IES	Illumination Engineering Society of North America
ICPEA	International Power Cable Engineer's Association
IMCFMR	Intermediate Care Facilities for the Mentally Retarded
LPCR	Local Power Company Requirements
LPI	Lightning Protection Institute
LTCR	Local Telephone Company Requirements
NEC	National Electrical Code
NECPA	National Energy Conservation Policy Act
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NHRF	Nursing Homes and Related Facilities
OEF	Office of Educational Facilities
OSHA	Occupational Safety and Health Act
SBE	State Board of Education
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFSRS	Uniform Fire Safety Rules and Standards of Insurance Division of State Fire Marshal
UL	Underwriters Laboratories, Inc.
FBC	Florida Building Code Section 423 State Requirements for Educational Facilities
FAC	Florida Administrative Codes, Chapter 33-8, Rules of the Department of Corrections, County and Municipal Detention Facilities.

1.4 REGULATORY REQUIREMENTS

A. Conform to all the applicable requirements of the following codes, standards, guidelines, etc. If there should be conflicting requirements between these codes, standards, guidelines, etc., the more or most stringent requirement shall apply that does not violate any codes or laws.

1. Standards and Miscellaneous Codes/Requirements (Comply with latest edition or notice available unless otherwise adopted by Authority Having Jurisdiction):
   a) Americans with Disabilities Act of 1990, as amended
   b) ADA Standards for Accessible Design, 2020
   c) American National Standards Institute
   d) American Society of Heating, Refrigerating and Air Conditioning Engineers
   e) American Society of Mechanical Engineers
   f) American Society for Testing and Materials
   g) Concrete Reinforcing Steel Institute
   h) Department of Community Affairs
   i) Electronics Industries Association/Telecommunications Industry Association
   j) Florida Building Code, 2020
   k) Florida Fire Prevention Code, 2020
   l) Institute of Electrical and Electronics Engineers
   m) Illumination Engineering Society
   n) Local Power Company Requirements
   o) Lightning Protection Institute
   p) Local Telephone Company Requirements
   q) National Electrical Code, 2017
   r) National Energy Conservation Policy Act
   s) National Electrical Safety Code
   t) National Electrical Manufacturers Association
   u) NFPA 1 Fire Code, 2018
   v) NFPA 101 Life Safety Code, 2018
   w) Occupational Safety and Health Act
   x) Safety Code for Elevators and Escalators ASME/A17.1-2016/CSA B44-16
   y) Sheet Metal and Air Conditioning Contractors
   z) Underwriters Laboratories, Inc.
   aa) Applicable Federal, State, Local Codes, Laws and Ordinances, Florida Statutes and Referenced Codes/Standards.

PART 2 – PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

END OF SECTION

SECTION 26 05 10
ELECTRICAL SYMBOLS AND ABBREVIATIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Symbols and abbreviations specifically applicable to all Division 26 27 28 sections in addition to those in Division 01 - General Requirements and any supplemental requirements/conditions.

1.3 SYMBOLS

A. In general, the symbols used on the drawings conform to the Standard Symbols of the Institute of Electrical and Electronic Engineers with the exception of special systems or agencies as hereinafter noted. Corps of Engineers. Special Symbols as shown in schedules or legends.

1.4 ABBREVIATIONS

A. The following abbreviations or initials are used.

A/C	Air Conditioning
AFD	Adjustable Frequency Drive
A.C.	Alternating Current ADD # Addendum #
A/E	Architect/Engineer (or Engineer when Architect not applicable)
AFF	Above Finished Floor
AFG	Above Finished Grade
AHU	Air Handler Unit
AIC	Amps Interrupting Capacity
AL	Aluminum
ALT	Alternate AMP Ampere
ANSI	American National Standards Institute AWG American Wire Gauge
@	At
B.C.	Bare Copper
BLDG	Building
BRKR	Breaker
BTU	British Thermal Unit
BTUH	BTU Per Hour
C.	Conduit
C.B.	Circuit Breaker
CBM	Certified Ballast Manufacturers
cd	Candela
CFM	Cubic Feet per Minute
CKT.	Circuit

CKT	BRKR Circuit Breaker
C/L	Center Line
Clg.	Ceiling Comp. Compressor
Conn.	Connection
Cond.	Condenser
Cont.	Continuous
C.R.I.	Color Rendering Index
C.T.	Current Transformer
C.U.	CU. Copper
C.V.	Compressor Condenser Unit
C.W.	Cold Water
D.B.	Direct Burial
D.C.	Direct Current
D.D.	Disc. Disconnect
D.E.	DN. Down
DPST	Double Pole Single Throw
DWG	Drawing
E.C.	Electrical Contractor (or General Contractor)
ELEV.	Elevator
EMT	Electrical Metallic Tubing Equip. Equipment
EST	Estimate
FAAP	Fire Alarm Annunciator Panel
FACP	Fire Alarm Control Panel
FARP	Fire Alarm Remote Panel
FATC	Fire Alarm Terminal Cabinet
FCCP	Fire Alarm Command Center Panel
FHC	Fire Hose Cabinet
FLA	Full Load Amperes
FT	Feet
FLR	Floor
F.C.	Footcandles
FVNR	Full Voltage Non-Reversing
GAL.	Gallon
Galv.	Galvanized
GPH	Gallons per Hour
GPM	Gallons per Minute
GFI	Ground Fault Interrupting
GRS	Galvanized Rigid Steel Conduit
GND.	Ground
HTG	Heaters
HT	Height
HZ	Hertz (Cycles)
HPF	High Power Factor
HPS	High Pressure Sodium
HP.	Horsepower
HR.	Hour
H.S.	Heat Strip
IMC	Intermediate Metallic Conduit
Incand.	Incandescent
In.	Inches

J.B.	Junction Box
KVA	KiloVolt Ampere
KW	Kilowatts
KWH	Kilowatt Hour
K	Kelvin
L.L.D.	Lamp Lumen Depreciation
LED	Light Emitting Diode
LIU	Light Interface Unit (Fiber Optic Patch Panel)
LT.	Light
LTG.	Lighting LTS. Lights
L.P.F.	Low Power Factor
M.C.B.	Main Circuit Breaker
M.L.O.	Main Lugs Only
Maint.	Maintenance
MH.	Manhole; Metal Halide
MFG.	Manufacturer
Max.	Maximum
MCM/KCMIL	Thousand Circular Mils
MPH	Miles Per Hour
MM	Millimeter Min. Minimum
MCP	Motor Circuit Protector
MTD	Mounted
N.	Neutral
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
N.P.T.	National Pipe Thread
NF	Non-Fused
N.C.	Normally Closed
N.O.	Normally Open
NIC.	Not in Contract
No.	Number
OB	Outlet Box
OD	Outside Diameter
O.L.	Overload
OLS	Overloads
OS&Y	Outside Screw and Yoke (Sprinkler)
%	Percent
Ø	Phase
P.	Pole
PL	Compact Fluorescent Lamp
P.T.	Potential Transformer
PSF	Pounds per Square Foot
PSI	Pounds per Square Inch
PB	Pullbox
PNL	Panel
PR	Pair
Pri.	Primary
PTZ	Pan, Tilt, Zoom
PVC	Polyvinyl Chloride

Recept	Receptacle
RPM	Revolutions per Minute
R.S.	Rapid Start
SCA	Short Circuit Amps
Sec.	Secondary
SHT	Sheet
S/N	Solid Neutral
SPST	Single Pole Single Throw
SF	Square Foot
SW.	Switch
SWBD	Switchboard
Sys.	System
THHN;	THWN Nylon Jacketed Wire
TSP	Twisted Shielded Pair
TTB	Telephone Terminal Board
TTC	Telephone Terminal Cabinet
TV	Television
TVTC	Television Terminal Cabinet
TVEC	Television Equip. Cabinet
TYP	Typical
Temp.	Temperature
UL	Underwriters' Laboratories
UTP	Unshielded Twisted Pair
VFD	Variable Frequency Drive
VHF	Very High Frequency
VHO	Very High Output
V	Volt
VA	Volt Amperes
Vol.	Volume
W	Wire
W.P.	Weatherproof
XFMR	Transformer
Y	Wye
Yd.	Yard
Yr.	Year
3R	Rainproof
4X	Stainless Steel Dust tight, Watertight

PART 2 – PRODUCTS

(Not Applicable)

PART 3 – EXECUTION

(Not Applicable)

END OF SECTION

SECTION 26 05 19
BUILDING WIRE AND CABLE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Provide all equipment, labor, material, accessories, and mounting hardware to properly install all conductors and cables rated 600 volts and less for a complete and operating system for the following:
   1. Building wire and cable.
   2. Wiring connectors and connections.
B. All sizes shall be given in American Wire Gauge (AWG) or in thousand circular mils (MCM/KCMIL).

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.
B. ANSI/Fed. Spec J-C 30B – Metal Clad Cables, Interlocking Galvanized Steel Tape Armor.

1.4 SUBMITTALS

A. Product Data: Submit catalog cut sheet showing, type and UL listing of each type of conductor, connector, and termination.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.7 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.8 COORDINATION

A. Determine required separation between cable and other work.
B. Determine cable routing to avoid interference with other work.

PART 2 – PRODUCTS

2.1 BUILDING WIRE AND CABLE

A. Description: Single conductor insulated wire.
B. Conductor: Copper.
C. Insulation Voltage Rating: 600 volts.
D. Insulation: ANSI/NFPA 70, Type THHN/THWN and XHHW. PART 3 – EXECUTION

3.1 GENERAL

A. Install products in accordance with manufacturer's instructions.
B. Conductors #10 AWG or #12 AWG shall be 600-volt type THWN/THHN unless noted otherwise, rated 90 degrees C dry, 75 degrees C wet.
C. Conductors #8 AWG and larger shall be type THWN-2/THHN unless noted otherwise, rated 90 degrees C wet or dry.
D. Use solid conductor for feeders and branch circuits 14 AWG and smaller (except for control circuits).
E. Use conductor not smaller than 12 AWG for power and lighting circuits.
F. Neatly train and lace wiring inside boxes, equipment, and panelboards.
G. All conductors shall be installed in raceway.
H. Conductor sizes indicated on circuit homeruns or in schedules shall be installed over the entire length of the circuit unless noted otherwise on the drawings or in these specifications.
I. Before installing raceways and pulling wire to any mechanical equipment, verify electrical characteristics with final submittal on equipment to assure proper number and AWG of conductors. (As for multiple speed motors, different motor starter arrangements, etc.).
J. Coordinate all wire sizes with lug sizes on equipment, devices, etc. Provide/install lugs as required to match wire size.
K. Where oversized conductors are called for (due to voltage drop, etc.) provide/install lugs as required to match conductors, or provide/install splice box, and splice to reduce conductor size to match lug size.

3.2 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire has been completed.

3.3 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.4 WIRING METHODS

A. Use only building wire, type (THHN/THWN for #10 and #12 and THHN/THWN-2 for #8 and larger) insulation, in raceway or cable (AC or MC) unless noted otherwise.
B. Wiring in vicinity of heat producing equipment: Use only XHHW insulation, in raceway.
C. Conductors installed within fluorescent fixture channels shall be Type THHN or XHHW, rated 90 degrees C dry. Conductors for all other light fixtures shall have temperature ratings as required to meet the UL listing of the fixture; however, in no case shall the temperature rating be less than 90 degrees Centigrade. Remove incorrect insulation types in new work.
D. Pre-manufactured cable systems for power distribution are not allowed.
E. MC Type cable is not allowed.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Section Identification for Electrical Systems.
B. Identify each conductor with its circuit number or other designation indicated on Drawings.
C. Identify neutrals with its associated circuit number(s).

3.6 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of the General Requirements of the Contract Documents and Section Tests and Performance Verification of Electrical Systems.
B. Inspect wire for physical damage and proper connection.
C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
D. Verify continuity of each branch circuit conductor.

3.7 PULLING

A. No wire shall be pulled until the conduit system is complete from pull point to pull point and major equipment terminating conduits have been fixed in position.
B. Mechanical pulling devices shall not be used on conductors sized #8 and smaller. Pulling means which might damage the raceway shall not be used.
C. Use only powdered soapstone or other pulling lubricant acceptable to the A/E. Compound or lubricant shall not cause the conductor or insulation to deteriorate.
D. All conductors to be installed in a common raceway shall be pulled together. The manufacturer's recommended pulling tensions shall not be exceeded.
E. Bending radius of insulated wire or cable shall not be less than the minimum recommended by the manufacturer.

F. Where communications type conductors are installed, special requirements shall apply as outlined under that specific system detail specifications.

3.8 CONTROL AND SIGNAL CIRCUITS

A. For control and signal circuits above 50 VAC, conductors shall be #14 AWG minimum size, Type XHHW or THWN-THHN as permitted by NFPA 70, within voltage drop limits, increased to #12 AWG as necessary for proper operation.
B. For control and signal circuits 50 VAC and below, conductors, at the Contractor's option, may be #16 AWG, 300 volts rated, PVC insulated, except where specifically noted otherwise in the contract documents.
C. Conductor insulation for Fire Alarm Systems shall be as accepted by Code Inspection Authority only. Wire acceptance by the A/E shall not supersede this final Acceptance for conditions of this specific project.
D. Install circuit conductors in conduit.
E. Circuit conductors to be stranded.

3.9 COLOR CODING

A. All power feeders and branch circuits No. 6 and smaller shall be wired with color-coded wire with the same color used for a system throughout the building. Power feeders above No. 6 shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape or paint in all junction boxes and panels. Tape or paint shall completely cover the full length of conductor insulation within the box or panel.
B. Unless otherwise accepted or required by A/E to match existing, color-code shall be as follows: Neutrals to be white for 120/208V system, natural grey for 277/480V system; ground wire green, bare. 120/208V, Phase A - black; Phase B - red; Phase C - blue. 480/277V, Phase A brown; Phase B - orange; Phase C - yellow. All switchlegs, other voltage system wiring, control and interlock wiring shall be color-coded other than those above.

3.10 TAPS/SPLICES/CONNECTORS/TERMINATIONS

A. Clean conductor surfaces before installing lugs and connectors.
B. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
C. Power and lighting conductors shall be continuous and unplaced where located within conduit. Splices shall occur within troughs, wireways, outlet boxes, or equipment enclosures where sufficient additional room is provided for all splices. No splices shall be made in in-ground pull boxes (without written acceptance of engineer).
D. Splices in lighting and power outlet boxes, wireway, and troughs shall be kept to a minimum, pull conductors through to equipment, terminal cabinets, and devices.
E. No splices shall be made in junction box, and outlet boxes (wire No. 8 and larger) without written acceptance of Engineer.
F. No splices shall be made in communications outlet boxes, pull boxes or wireways (i.e., fire alarm, computer, telephone, intercom, sound system, etc.) without written acceptance of Engineer. Pull cables through to equipment cabinets, terminal cabinets, and devices.

G. Allow adequate conductor lengths in all junction boxes, pull boxes and terminal cabinets. All termination of conductors in which conductor is in tension will be rejected and shall be replaced with conductors of adequate length. This requirement shall include the providing by the Contractor of sleeve type vertical cable supports in vertical raceway installations provided in pull boxes at proper vertical spacings.
H. A calibrated torque wrench shall be used for all bolt tightening.
I. Interior Locations:
   1. All (non-electronic systems) copper taps and splices in No. 8 or smaller shall be fastened together by means of "spring type" connectors. All taps and splices in wire larger than No. 8 shall be made with compression type connectors and taped to provide insulation equal to wire.
J. Exterior Locations:
   1. Make splices, taps and terminations above grade in splice or termination cabinets. Do not splice any cable in ground or below finished grade.
   2. All taps and splices shall be made with compression type connectors and covered with Raychem heavy wall cable sleeves (type CRSM-CT, WCSM or MCK) with type "S" sealant coating with sleeve kits as per manufacturer's installation instructions or be terminated/connected to terminal strips in above grade terminal boxes suitable for use.
   3. Provide and install above grade termination cabinets sized to meet applicable codes and standards, where required for splicing.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Provide all labor, materials, and equipment necessary to properly install a grounding system conductor in all new branch wiring and feeder installations, which shall be in full compliance with all applicable Codes as accepted by the Authorities having jurisdiction. The secondary distribution system shall include a grounding conductor in all raceways in addition to the return path of the metallic conduit.
B. In general, all electrical equipment (metallic conduit, motor frames, panelboards, etc.) shall be bonded together with a green insulated or bare copper system grounding conductor in accordance with specific rules of Article 250 of the NEC and State codes. Bonding conductor through the raceway system shall be continuous from main switch ground bus to panel ground bar of each panelboard, and from panel grounding bar of each panelboard to branch circuit equipment and devices.
C. All raceways shall have an insulated copper system ground conductor throughout the entire length of circuit installed with-in conduit in strict accordance with NEC. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included, or shown on drawings. Grounding conductors that run with feeders in PVC conduit outside of building(s) shall be bare only.
D. Provide and install all grounding and bonding as required by the National Electrical Code (NEC) including but not limited to Article 250 of the NEC.
E. Section Includes
    1. Grounding electrodes and conductors
    2. Equipment grounding conductors
    3. Bonding
    4. Counterpoise system
    5. Ground ring

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Refer to Division 01 requirements.
B. Submit catalog cut sheet/product data on:
    1. Ground rods and couplings
    2. Mechanical connectors
    3. Ground wells
    4. Ground bus bars and associated components

5. Ground ring conductor
6. Counterpoise conductor
7. Exothermic welding materials and molds
8. Testing equipment and procedures.

C. Product data shall prove compliance with Specifications. National Electrical Code, manufacturer's specifications, and written installation data.

1.5 PROJECT RECORD DOCUMENTS

A. Submit record documents to accurately record actual locations of grounding electrodes.
B. Submit test results of each ground rod. See Section Tests and Performance Verification of Electrical Systems.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 – PRODUCTS

2.1 ROD ELECTRODE

A. Material: Copper-clad steel.
B. Diameter: 5/8 inch.
C. Length: 30 feet (minimum). Increase lengths as required to meet and achieve specified resistance.

2.2 MECHANICAL CONNECTORS

A. All grounding connectors shall be in accordance with UL 467 and UL listed for use with rods, conductors, reinforcing bars, etc., as appropriate.
B. Connectors and devices used in the grounding systems shall be fabricated of copper or bronze materials, and properly applied for their intended use. Specified items of designated manufacturers indicate required criteria and equal products may be provided if approved. All connectors and devices shall be compatible with the surfaces being bonded and shall not cause galvanic corrosion by dissimilar metals. Materials in items not listed herein shall be of equal quality to the following specified items:
   1. Lugs: Substantial construction, of cast copper or cast bronze, with "ground" (micro-flat) surfaces, twin clamp, two-hole tongue, equal to Burndy QQA Series or T&B equal. Lightweight and "competitive" devices shall be rejected.
   2. Grounding and Bonding Bushings: Malleable iron, Thomas, and Betts (T&B), or equal.
   3. Piping Clamps: Burndy GAR-TC Series with two-hole compression terminal or T&B equal.
   4. Grounding Screw and Pigtail: Raco No. 983 or equal.
   5. Building Structural Steel, Existing: Thompson 701 Series heavy duty bronze "C" clamp with two-bolt vise-grip cable clamp.

C. Mechanical lugs or wire terminals shall be used to bond ground wires together or to junction boxes and panel cabinets and shall be manufactured by Anderson, Buchanan, Thomas and Betts Co., or Burndy.

2.3 WIRE

A. Material: Stranded copper.
B. Size: Size to meet NFPA 70 requirements as a minimum. Increase size if called for on drawings, in these specifications, or as required for voltage drop.
C. Insulated THWN (or bare as noted elsewhere).

2.4 GROUNDING WELL COMPONENTS

A. Grass Non-Traffic Areas:
1. Well: Minimum 18-inch (600 mm) long sleeve with minimum 12-inch diameter.
2. Well Cover: High-density plastic, composolite, or cast iron with legend "GROUND" embossed on cover.
3. Material: Structural Plastic, composolite, or concrete.
4. Manufacturer: Carson 2200 Series or equal by Quazite.
5. Increase depth, diameter or size as required to provide proper access at installed location.

B. Paving and Low Traffic Areas:
1. Well: Minimum 12 inch long by 12 inch wide by 18 inches deep with open bottom.
2. Well Cover: Traffic rated for use with "GROUND" embossed on cover.
3. Material: Composolite.
4. Manufacturer: Quazite.
5. Increase depth, diameter or size as required to provide proper access at installed location.

2.5 GROUNDING BARS/GROUND BUS (INCLUDING 'SYSTEMS' GROUND BUS/BARS AND GROUND BUS BARS)

A. Ground bars shall be copper of the size and description as shown on the drawings. If not sized on drawings, bus bar shall be minimum 1/4" x 2" bus grade copper, spaced from wall on insulating 2" polyester molded insulator standoff/supports, and be 12" or greater minimum overall length, allowing 2" length per lug connected thereto. Increase overall length as required to facilitate all lugs required while maintaining 2" spacing. Size of bus bar used in main electrical room shall be similar except minimum of 4" high and 24" long.
B. Provide bolt-tapping lug with two hex head mounting bolts for each terminating ground conductor, sized to match conductors. Mount on bus bar at 2 inches on center spacing. Lugs to be manufactured by Burndy or T&B.
C. Standoff supports to be 2" polyester as manufactured by Glastic #2015-4C.

PART 3 – EXECUTION

3.1 GENERAL

A. Install products in accordance with manufacturer's instructions.

B. Install grounding electrodes conductor, bonding conductors, ground rods, etc. with all required accessories.
C. Grounding shall meet (or exceed as required to meet these specifications) all the requirements of the NEC, the NFPA, and applicable standards of IEEE.
D. Where there is a conflict between these specifications and the above applicable codes/standards, or between this section of these specifications and other sections, then the most stringent or excessive requirement shall govern. Where there is an omission of a code/standard requirement in these specifications then the code/standard requirements shall be complied with.
E. Requirement in these specifications to comply with a specific code/standard article, etc. is not to be construed as deleting of requirements of other applicable codes/standards and their articles, etc.

3.2 GROUNDING ELECTRODES

A. All connections shall be exothermic welded unless otherwise noted herein. All connections above grade and in accessible locations may be by exothermic welding or by braising or clamping with devices UL listed as suitable for use except in locations where exothermic welding is specifically specified in these specifications or called for on drawings.
B. Each rod shall be die stamped with identification of manufacturer and rod length.
C. Install rod electrodes at locations indicated and/or as called for in these specifications.
D. Ground Resistance:
    1. Main Electrical Service (to each building) and Generator Locations:
        a. Grounding resistance measured at each main service electrode system and at each generator electrode system shall not exceed 5 ohms.
    2. Other Locations:
        a. Resistance to ground of all non-current carrying metal parts shall not exceed 25 ohms measured at motors, panels, busses, cabinets, equipment racks, light poles, transformers, and other equipment.
        b. Lightning Protection system ground locations shall not exceed 25 ohms for the Franklin System measured at ground electrode.
    3. Resistance called for above shall be maximum resistance of each ground electrode prior to connection to grounding electrode conductor. Where ground electrode system being measured consists of two (2) or more ground rod electrodes then the resistance specified above shall be the maximum resistance with two (2) or more rods connected together but not connected to the grounding electrode conductor.
E. Install additional rod electrodes as required to achieve specified resistance to ground (specified ground resistance is for each ground rod location prior to connection to ground electrode conductor). Depending on soil condition, etc. of ground rod locations, it has been found that the ground rod lengths required to achieve the specified resistance may range from the minimum specified length to up to 80 feet or more in length.
F. Provide grounding well with cover at each rod location. Install grounding well top flush with finished grade.
G. Verify that final backfill, and compaction has been completed before driving rod electrodes.
H. Install ground rods not less than 1 foot below grade level and not less than 2 feet from structure foundation.

3.3 GROUNDING ELECTRODE CONDUCTOR

A. Conductor shall be sized to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250.

3.4 EQUIPMENT GROUNDING CONDUCTOR

A. Grounding conductors shall be provided with every circuit to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250.
B. At every voltage level, new portions of the electrical power distribution system shall be grounded with a dedicated copper conductor, which extends from termination back to power source in supply panelboard.
C. Provide separate, insulated (bare if with feeder in PVC conduit outside of building(s)) conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
D. Except as otherwise indicated, each feeder raceway on the load side of the service entrance shall contain a ground conductor sized as indicated and where not shown shall be sized to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250. Conductor shall be connected to the equipment grounding bus in switchboards and panelboards, to the Grounding Bus in all motor control centers, and as specified, to lighting fixtures, motors and other types of equipment and outlets. The ground shall be in addition to the metallic raceway and shall be properly connected thereto, using a lug device located within each item enclosure at the point of electric power connections to permit convenient inspection.
E. Provide green insulated ground wire for all grounding type receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental grounding wire and screw equal to Raco No. 983 shall be provided to connect receptacle ground terminal to the box.
F. All plug strips and metallic surface raceway shall contain a green insulation ground conductor from supply panel ground bus connected to grounding screw on each receptacle in strip and to strip channel. Conductor shall be continuous.
G. Where integral grounding conductor is specified elsewhere in bus duct construction, provide equivalent capacity conductor from supply switchboard or panelboard grounding bus to the bus duct grounding conductor. Bond integral conductor to bus duct enclosure at each tap and each termination.

H. All motors, all heating coil assemblies, and all building equipment requiring flexible connections shall have a green grounding conductor properly connected to the frames and extending continuously inside conduit with circuit conductors to the supply source bus with accepted connectors regardless of conduit size or type. This shall include Food Service equipment, Laundry equipment, and all other "Equipment by Owner" to which an electric conduit is provided under this Division.

3.5 MAIN ELECTRICAL SERVICE

A. Complete installation shall meet and exceed the requirements of the NEC 250.
B. Artificial electrodes shall be provided for the main service in sufficient number and configuration to secure resistance specified.
C. Provide and bond to all of the following:

1. Ground rods.
2. Metal water pipe (interior and exterior to building).
3. Building metal frame, structural steel and/or reinforced structural concrete.
4. All piping entering or leaving all buildings (including chilled water piping).
5. Encased electrodes.
6. Ground ring.
7. Site distribution counterpoise ground system.
8. Lightning protection system.

D. A main ground, bare copper conductor, sized per applicable table in NEC 250, but in no case less than #2/0, shall be run in conduit from the main switchgear of each building to the building steel in respective building. This ground conductor shall also be run individually from the main switchgear and be bonded to the main water service ahead of any union in pipe and must be metal pipe of length and location as acceptable by authorities having jurisdiction. Provide properly sized bonding shunt around water meter and/or dielectric unions in the water pipe. Also required is the same size ground wire to ground rod electrode as called for below:
   1. Three 30 ft. ground rods in a delta configuration at no less than 30 ft. spacing driven to a minimum depth of 30 ft. plus 1 below grade. If three 30 ft rods in a delta configuration does not provide specified resistance change rod lengths from minimum specified to 40 or more feet as required to provide specified resistance. Adjust rod spacing as required to provide spacing equal to or greater than the driven depth of the deepest ground rod.
   2. Bond ground rod electrodes together with a bare copper ground conductor that matches size required by applicable table in NEC 250, but in no case less than #2/0.
   3. Provide additional rod electrodes as required to achieve specified ground resistance.
E. Ground/bond neutral per NEC 250.
F. A main ground, bare copper conductor, sized per applicable table in NEC 250, but in no case less than #2/0, shall be run in conduit from the main switchgear of each building to a concrete encased electrode per NEC 250.52(A)(3).
G. Bond grounding electrodes to site counterpoise grounding system and lightning protection system where provided.
H. Provide and install ground bus bar on wall near main service disconnect/switchboard. Connect to ground bar in disconnect/switchboard bonded to switchboard/disconnect enclosure/neutral with copper grounding conductor sized per applicable table in NEC 250.

3.6 TRANSFORMER GROUNDING

A. Ground all transformers and enclosures of 120/208V and 277/480V "separately derived systems" as specified herein.
   1. Ground per NEC 250 and these specifications.
   2. Bond neutral to transformer frame/enclosure and the equipment grounding conductors of the derived system with copper ground conductor sized per applicable table in NEC 250.
   3. Connect transformer neutral/ground to grounding electrode per NEC 250 with grounding electrode conductor sized per applicable table in NEC 250.

4. In addition to connection to grounding electrode conductor called for above (i.e., per NEC 250) provide, install, and connect supplemental grounding electrode as follows:
a. Where grounding required per NEC 250 is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.
b. Where grounding connection required per NEC 250 is to grounded metal water pipe, supplement this grounding with connection to building steel/structure in addition to any other available electrodes specified in NEC 250.
c. Where supplemental grounding electrodes required above is a ground rod electrode, provide, install, and connect two or more 30 ft. ground rod electrodes at no less than 30 ft. spacing, driven vertical to a minimum depth of 30 ft. plus 1 below grade.
5. Where neither building steel nor water pipe grounding electrodes are available (i.e., exterior locations with no available water pipe electrode) provide two (2) ground connections: each to two (2) or more 30 ft. ground rod electrodes at no less than 30 ft. spacing, driven vertical to a minimum depth of 30 ft. plus 1 below grade.
6. Where transformer is mounted exterior to building one (1) of the two (2) ground electrodes required shall be ground rod electrode as called for in 5 above. This ground rod electrode shall also be connected to counterpoise system (wherever counterpoise system is available).
7. Ground to water system service pipe as required by NEC 250.

B. Provide additional ground electrodes as required to achieve specified ground resistance.
C. Where two or more ground electrodes are used at any one required ground location, they shall be bonded together with a copper ground conductor, sized to meet applicable table in NEC 250, but in no case less than #2/0.
D. Complete installation shall exceed the minimum requirements of NEC 250.
E. Equipment ground conductors shall be provided in addition to above grounding. See 'EQUIPMENT GROUNDING CONDUCTOR'.
F. Provide and install ground bus bar on wall near transformer (or in associated electrical room for exterior mounted transformers). Connect to ground lug in transformer bonded to transformer enclosure/neutral with copper ground conductor sized per applicable table in NEC 250.
G. Multiple separately derived systems may be grounded as allowed in NEC 250-30 (A) (4).

3.7 GENERATOR GROUNDING

A. Separately derived systems (i.e., systems where generator neutral is not solidly interconnected to service supplied system neutral such as 4-pole switched neutral transfer switch systems).
1. Ground per NEC 250 and these specifications.
2. Bond neutral to transformer frame/enclosure and the equipment grounding conductors of the derived system with copper ground conductor sized per applicable table in NEC 250.
3. Connect generator neutral/ground to grounding electrodes per NEC 250 with grounding electrode conductor sized per applicable table in NEC 250.

4. In addition to connection to grounding electrode conductor called for above (i.e., per NEC 250) provide, install, and connect supplemental grounding electrode as follows:
   a. Where grounding required per NEC 250 is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.
   b. Where grounding connection required per NEC 250 is to grounded metal water pipe, supplement this grounding with connection with connection to other electrodes specified in NEC 250.
   c. Where supplemental grounding electrodes required above is a ground rod electrode, provide, install, and connect two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.
5. Where neither building steel nor water pipe grounding electrodes are available (i.e., exterior locations with no available water pipe electrode) provide two ground connections: each to two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' belowgrade.
6. Where generator is mounted exterior to building one of the two ground electrodes required shall be ground rod electrode as called for in paragraph 5. above. This ground rod electrode shall also be connected to counterpoise system.

B. Non separately derived systems (i.e., systems where generator neutral is solidly interconnected to service supplied system neutral such as 3-pole non-switched neutral transfer switch systems).
   1. Ground per NEC 250 and these specifications.
   2. Do not bond neutral to transformer frame/enclosure or the equipment grounding conductors of the derived system.
   3. Connect generator frame/enclosures ground to grounding electrode per NEC 250 with grounding electrode conductor sized per applicable table in NEC 250.
   4. In addition to connection to grounding electrode conductor called for above (i.e., per NEC 250) provide, install, and connect supplemental grounding electrode as follows:
      a. Where grounding required per NEC 250 is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.
      b. Where grounding connection required per NEC 250 is to grounded metal water pipe, supplement this grounding with connection to other electrodes specified in NEC 250.
      c. Where supplemental grounding electrodes required above is a ground rod electrode, provide, install, and connect two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.
   5. Where neither building steel nor water pipe grounding electrodes are available (i.e., exterior locations with no available water pipe electrode) provide two ground connections: each to two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' belowgrade.
   6. Where generator is mounted exterior to building one of the two ground electrodes required shall be ground rod electrode as called for in paragraph 5. above. This ground rod electrode shall also be connected to counterpoise system.

C. Provide additional ground electrodes as required to achieve specified ground resistance.

D. Where two or more ground electrodes are used at any one required ground location, they shall be bonded together with a copper ground conductor, sized to meet applicable table in NEC 250, but in no case less than #2/0.
E. Complete installation shall exceed the minimum requirements of NEC 250.
F. Equipment ground conductors shall be provided in addition to above grounding. See "Equipment Grounding Conductors."

3.8 LIGHTNING PROTECTION SYSTEMS

A. Ground per applicable section on lightning protection system, NFPA 780, and as specified herein. The most stringent requirements shall govern.
B. Bond lightning protection system grounds to electrical service system ground, all piping entering or leaving all buildings, and counterpoise system ground where provided.
C. See Section Lightning Protection System.

3.9 EXTERIOR GRADE (OR FREE-STANDING ABOVE GROUND) MOUNTED EQUIPMENT

A. General:
   1. All equipment (including chillers, pumps, disconnects, starters, control panels, panels, etc.) mounted exterior to building shall have their enclosures grounded directly to a grounding electrode at the equipment location in addition to the building equipment ground connection.
   2. Bond each equipment enclosure, metal rack support, mounting channels, etc. to ground electrode system at each rack with an insulated copper ground conductor sized to match the grounding electrode conductor required by applicable table in NEC 250 based on equipment feeder size, but in no case shall conductor be smaller than #6 copper or larger than #2 copper. This connection is in addition to grounding electrode connections required for services.
B. Main electrical service rack mounted equipment.
   1. Ground per "MAIN ELECTRICAL SERVICE".
   2. Bond all metal parts as noted above.
C. Electrical sub service rack mounted equipment.
   1. Ground per "MAIN ELECTRICAL SERVICE", except do not bond neutral to ground.
   2. Bond all metal parts as noted above.
D. Electrical equipment connection rack mounted equipment.
   1. Bond all metal parts as noted above.
E. Grounding electrodes (ground electrodes system) shall be:
   1. Located at each rack location.
   2. For service equipment: Ground electrode required per "MAIN ELECTRICAL SERVICE".
   3. For equipment connection equipment: Two or more 30 ft. ground rods at no less than 30 ft. spacing, driven vertical to a minimum depth of 1 ft below grade. Bond the two or more ground rods together with a size to meet applicable table in NEC 250, but no less than a #2 copper ground conductor. Provide additional rod electrodes as required to achieve specified ground resistance.
F. Complete installation shall exceed the minimum requirements of NEC 250 and, when applicable, NFPA 780.

3.10 ROOF MOUNTED EQUIPMENT

A. Bond all roof mounted electrical equipment to lightning protection system (when provided) per NFPA 780.
B. Where lightning protection system is not provided, ground/bond all roof mounted electrical equipment to building steel and to two (2) or more 30 ft. ground rods at no less than 30 ft. spacing driven vertically to a minimum depth of 30 ft. plus 1 below grade.
    1. Bond the two or more ground rods together with a Class I or Class II as required per NFPA 780 lightning protection main copper conductor.
    2. Provide additional rod electrodes as required to achieve specified ground resistance.
    3. Complete installation shall exceed the minimum requirements of NFPA 780.

3.11 LIGHTING FIXTURES

A. All new fixtures in building interior, and exterior fixtures shall be provided with green grounding conductor, solidly connected to unit. Individual fixture grounds shall be with lug to fixture body, generally located at point of electrical connection to the fixture unit.
B. All suspended fixtures and those supplied through flexible metallic conduit shall have green ground conductor from outlet box to fixture. Cord connected fixtures shall contain a separate green ground conductor.
C. Pole Light Fixtures:
    1. Metal Pole Light Fixtures:
        a. Freestanding pole mounted lighting fixtures shall each have a Class I or Class II lightning protection main copper down conductor connected to grounding electrodes at base of pole.
        b. Conductor shall be bonded to metal pole via UL Listed ground clamp suitable for use. Locate ground lug opposite to handhole (or adjacent if visible through handhole).
    2. Concrete or Non-Metallic Pole:
        a. Freestanding pole mounted lighting fixtures shall each have a Class I or Class II lightning protection main copper down conductor connected to grounding electrodes at base of pole.
        b. Conductor shall be extended from grounding electrode to top of pole and terminate at the top of pole in a Class I or Class II copper lightning protection air terminal.
        c. Each metal part of light fixture assembly, bracket, ballast cabinet, disconnect, transformer, etc. that is mounted to pole shall be bonded to down conductor.
    3. Fixtures located on elevated roadway ramps shall be specially provided with a connection to lightning counterpoise grounding system, properly installed.
    4. Grounding electrode(s) at each pole shall be connected (bonded) to site distribution counterpoise system.
    5. Grounding Electrodes:
        a. Two or more 10 ft. ground rods at no less than 10 ft. spacing shall be driven vertically to a minimum depth of 10 ft. plus 1 below grade.
        b. Bond the two or more ground rod electrodes together with a Class I or Class II lightning protection main copper conductor.
        c. Provide additional rod electrodes as required to achieve specified ground resistance.

d. The two (2) or more grounding rod electrodes shall be installed at each light pole.

6. Installation shall exceed minimum requirements of NFPA 780.

3.12 PULLBOX, MANHOLE, HANDHOLE GROUNDING.

A. One 30 ft. ground rod electrode shall be driven vertically to a minimum depth of 30 ft. plus 1 ft. below grade in each manhole, handhole or pull box (in ground).
B. The complete installation shall exceed the minimum requirements of the NEC.
C. Provide additional ground rod electrodes as required to provide resistance called for herein.
D. Where more than one ground rod electrode is required bond the two or more ground rod electrodes together with a copper ground conductor.
E. Bond to counterpoise system (whenever counterpoise system is provided.)
F. Bond grounding electrode to all exposed metal parts of manhole, handhole, and pull box (including metal cover) with #6 copper ground conductor. Connect to ground rod electrode with exothermic weld. Connect to metal cover with exothermic weld. Connect to other metal parts with exothermic weld or UL accepted grounding clamp. Provide 3 ft. or more slack ground cable on cover connection as required to facilitate removal of cover.

3.13 HAZARDOUS LOCATIONS

A. Ground in hazardous locations shall be done in accordance with applicable portions of NEC 500, 501, 502, 503, 511 and 514.

3.14 GROUND RING

A. Provide complete underground building perimeter ground ring system, completely encircling each building.
B. Conductor shall be minimum of Class II lightning protection copper conductor (bare).
C. Install at not less than 2-1/2 feet depth into earth.
D. Install ground rods (minimum 30 feet long) at 150-foot intervals along ground ring conductor.
E. Bond ground ring to building steel every 150 feet of building perimeter, bond to any and all electrical and piping systems that cross the ground ring system, bond to lightning protection down conductors and to any lightning or other earth grounding electrodes that may be present on the premises.
F. Bond to building service and counterpoise ground systems.

3.15 MISCELLANEOUS GROUNDING CONNECTIONS

A. Provide bonding to meet regulatory requirements.
B. Required connections to building steel shall be with UL accepted non-reversible crimp type ground lugs exothermically welded to bus bar that is either exothermically welded to steel or bolted to steel in locations where weld will affect the structural properties of the steel. Required connections to existing building structural steel purlins/I beams shall be with heavy duty bronze "C" clamp with two bolt vise-grip cable clamp.

C. Grounding conductors shall: be so installed as to permit shortest and most direct path from equipment to ground; be installed in conduit; be bonded to conduit at both ends when conduit is metal; have connections accessible for inspection; and made with accepted solderless connectors brazed (or bolted) to the equipment or to be grounded; in NO case be a current carrying conductor; have a green jacket unless it is bare copper; be run in conduit with power and branch circuit conductors. The main grounding electrode conductor shall be exothermically welded to ground rods, water pipe, and building steel.
D. All surfaces to which grounding connections are made shall be thoroughly cleaned to maximum conductive condition immediately before connections are made thereto. Metal rustproofing shall be removed at grounding contact surfaces, for 0 ohms by digital Vm. Exposed bare metal at the termination point shall be painted.
E. All ground connections that are buried or in otherwise inaccessible locations, shall be welded exothermically. The weld shall provide a connection which shall not corrode or loosen, and which shall be equal or larger in size than the conductors joined together. The connection shall have the same current carrying capacity as the largest conductor.
F. Install ground bushings on all metal conduits entering enclosures where the continuity of grounding is broken between the conduit and enclosure (i.e., metal conduit stub-up into a motor control center enclosure or at ground bus bar). Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
G. Install ground bushings on all metal conduits where the continuity of grounding is broken between the conduit and the electrical distribution system (i.e., metal conduit stub-up from wall outlet box to ceiling space. Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
H. Each feeder metallic conduit shall be bonded at all discontinuities, including at switchboards and all sub distribution and branch circuit panels with conductors in accordance with applicable table in NEC 250 for parallel return with respective interior grounding conductor.
I. Grounding provisions shall include double locknuts on all heavy wall conduits.
J. Bond all metal parts of pole light fixtures to ground rod at base.
K. Install grounding bus in all existing panelboards of remodeled areas, for connection of new grounding conductors, connected to an accepted ground point.
L. Bond together reinforcing steel and metal accessories in pool and fountain structures and bond to electrical system per NEC.
M. Where reinforced concrete is utilized for building grounding system, proper reinforced bonding shall be provided to secure low resistance to earth with "thermite" type devices, and #10AWG wire ties shall be provided to not less than ten (10) full length rebars which contact the connected rebar (by Division 26 contractor). Provide size and length of rod to meet NEC requirements.

3.16 GROUNDING BAR/GROUND BUS (INCLUDING 'SYSTEMS' GROUND BUS/BAR ON GROUND BUS/BAR) INSTALLATION

A. Where indicated on the drawings provide and install grounding bar/ground bus (bus bar). These bus installations are intended to provide a low-impedance "earthing" path for surge voltages, which are electrically "clamped" and shunted to earth by variable-impedance surge protective devices. Metal sheaths of underground cables are also to be grounded thereto at points of building entrance.

B. Mount bolt tapping lugs with hex head bolts to bus bar at 2" oc spacing, one for each ground conductor.
C. Mount bus bar to wall using 2" polyester molded insulator stand-off.
D. Extend a #2/0 (minimum size) or larger THWN insulated copper ground conductor (if larger size is called for on drawings or required by NEC for service ground, etc.) in PVC conduit to accepted service ground installation or ground bus/bar in main service equipment enclosure.
E. Extend #6 insulated copper ground wire from respective bus/bar to each 'local' ground bus/bar in each cabinet for Division 28 systems.
F. 'SYSTEMS' grounding bus/bar must be connected with #2/0 insulated copper conductor to grounding electrodes system as defined in NEC "Article 800.100 (B)".

3.17 COUNTERPOISE SYSTEM

A. Install counterpoise and ground over all sections of underground duct banks, conduits, or cables outside (exterior) to building.
B. No. 2 bare stranded copper counterpoise shall be run six (6) inches above all underground duct banks, conduits, and cables outside (exterior) to building.
C. Provide one (1) counterpoise conductor for duct banks (or conduit groupings) 12 inches wide or less. Provide two (2) counterpoise conductors above outside edge of duct bank (or conduit groupings) over 12 inches wide.
D. Counterpoise shall run to building and be grounded at each building to the main building electrical service ground rod electrode (exterior to building). Counterpoise shall be bonded to ground rod at all light poles, pull boxes, manholes, handholes and at each building. Provide and install appropriate ground rod every 150 ft. length of counterpoise conductor (see "GROUNDING ELECTRODES"). Counterpoise conductor shall not be run into interior of building. Route counterpoise underground around exterior perimeter of building to main service ground rod installation.

3.18 COMMUNICATIONS SYSTEMS

A. Provide and install all grounding as required by NEC Article 800 and where available on project: Articles 810 (Radio and Television Equipment); 820 (Community Antenna Television and Radio Distribution Systems); and 830 (Network-Powered Broadband Communications Systems.
B. Provide and install grounding electrode at point of entry of communication cables and bond to service entrance grounding electrodes per NEC 800. Install ground bus bar at point of entry of communications cable and connect electrode to ground bus. Connect communications cable metal sheath and surge protection devices to ground bar.

3.19 TESTING AND REPORTS

A. Raceway Continuity: Metallic raceway system as a component of the facilities ground system shall be tested for electrical continuity. Resistance to ground throughout the system shall not exceed specified limits.

B. Ground resistance measurements shall be made on each system utilized in the project. The ground resistance measurements shall include building structural steel, driven grounding system, water pipe grounding system and other accepted systems as may be applicable. Ground resistance measurements shall be made in normally dry weather, not less than 24 hours after rainfall, and with the ground under test isolated from other grounds and equipment. Resistances measured shall not exceed specified limits.
C. Upon completion of testing, the testing conditions and results shall be certified by the Contractor and submitted to the Architect/Engineer as called for in Section Tests and Performance Verification of Electrical Systems.

3.20 INTERFACE WITH OTHER PRODUCTS

A. Interface with site grounding system.
B. Interface with lightning protection system installed under Section Lightning Protection System.
C. Interface with communications system installed under Division 27 sections.

3.21 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Furnish and install all supports, hangers and inserts required to mount fixtures, conduit, cables, pull boxes and other equipment furnished under this Division.
B. Section Includes:
   1. Conduit and equipment support.
   2. Anchors and fasteners.

1.3 REFERENCES

A. NECA - National Electrical Contractors Association.
B. ANSI/NFPA 70 - National Electrical Code.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 – PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide corrosion resistance.
B. Exterior locations: Provide stainless steel hangers, anchors, etc. Strut may be PVC Coated or Stainless Steel.
C. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
D. Do not use spring steel clips and clamps.

E. Obtain permission from Architect/Engineer before using powder-actuated anchors.
F. Obtain permission from Architect/Engineer before drilling or cutting structural members.
G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
H. Install surface-mounted cabinets and panelboards with minimum of four anchors.
I. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch (25 mm) off wall.
J. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
K. All items shall be supported from the structural portion of the building.
L. This Contractor shall lay out and install his work in advance of the laying of floors or walls, and shall furnish and install all sleeves that may be required for openings through floors, wall, etc. Where plans call for conduit to be run exposed, this Contractor shall furnish and install all inserts and clamps for the supporting of conduit. If this Contractor does not properly install all sleeves and inserts required, he will be required to do the necessary cutting and patching, later at his own expense, to the satisfaction of the Architect.
M. All conduits shall be securely fastened in place per NEC, and hangers, supports or fastenings shall be provided at each elbow and at the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits will not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger, and cables. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clamp-backs, or other accepted devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.
N. Where two or more conduits are run parallel or in a similar direction, they shall be grouped together and supported by means of Kindorf type trapeze hanger system (racking) consisting of concrete inserts, threaded solid rods, washers, nuts, and galvanized "L" angle iron, or Unistrut cross members. These conduits shall be individually fastened to the cross member of every other trapeze hanger with galvanized cast one-hole straps, clamp backs, bolted with proper size cadmium machine bolts, washers, and nuts. If adjustable trapeze hangers are used to support groups of parallel conduits, U-bolt type clamps shall be used at the end of a conduit run and at each elbow. J-bolts, or accepted clamps, shall be installed on each third intermediate trapeze hanger to fasten each conduit.
O. Hanger assemblies shall be protected after fabrication by galvanizing. Hangers for PVC coated conduit shall be PVC coated galvanized conduit or stainless steel.
P. On concrete or brick construction, insert anchors shall be installed with round head machine screws. In wood construction, round head screws shall be used. An electric or hand drill shall be used for drilling holes for all inserts in brick, concrete or similar construction. In brick, inserts shall be near center of brick, not near edge or in joint. Where steel members occur, same shall be drilled and tapped, and round head machine screws shall be used. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust-resisting metal, or accepted substitution. Fasteners similar to "TAP-CON" self-tapping power-driven type are acceptable. Plastic anchors are <u>not</u> acceptable.
Q. Conduit supporting devices such as spring type conduit clips manufactured by Caddy Corporation may not be used.

R. Threaded rod hangers shall be galvanized continuous thread type, minimum 3/8" diameter.
S. Concrete/insert anchors, threaded rods, or similar fasteners installed on side or bottom of pre- stressed beams are not acceptable.

END OF SECTION

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Raceways, boxes, enclosures, handholes, sleeves, and accessories required for fully functional electrical and communication systems pathways.

1.2 RELATED SECTIONS

A. Section 01 25 13 - Product Substitution Procedures
B. Section 01 31 00 - Project Coordination
C. Section 01 33 00 - Submittal Procedures
D. Section 01 35 53 – Security Procedures
E. Section 01 42 00 – References
F. Section 01 45 00 - Quality Control
G. Section 01 66 00 – Product Storage and Handling Requirements
H. Section 01 78 00 - Closeout Submittals
I. Section 07 84 00 - Fire Stopping
J. Section 07 92 00 - Joint Sealants
K. Section 26 05 00 - Common Work Results for Electrical
L. Section 26 05 29 – Hangers and Supports for Electrical Systems
M. Section 26 05 43 – Underground Ducts and Raceways for Electrical Systems
N. Section 26 05 53 – Identification for Electrical Systems
O. Section 26 20 00 – Low Voltage Electrical Transmission
P. Section 28 05 13 – Conductors and Cables for Electronic Safety and Security.

1.3 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. American National Standards Institute (ANSI):
   1. ANSI C80.1-2005: Electrical Rigid Steel Conduit.
   2. ANSI C80.3-2005: Electrical Metallic Tubing (EMT).
C. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code, 2017 Edition.
D. Underwriters Laboratories (UL):
   1. UL 5-2011: Standard for Surface Mounted Raceways and Fittings.
   2. UL 5A-2015: Nonmetallic Surface Raceways and Fittings.
   3. UL 6-2007: Electrical Rigid Metal Conduit.
   4. UL 651-11: Standard for Schedule 40, 80, Type E, B and A rigid PVC Conduit and Fittings.
   5. UL 797-2007: Electrical Metallic Tubing – Steel.
E. National Electrical Contractors Association (NECA):
   1. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010.
   2. NEC 101-2006: Standard for Installing Steel Conduits (Rigid, IMC, EMT).

F. National Electrical Manufacturers Association (NEMA):
   1. NEMA FB1-2012: Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Conduit.
   2. NEMA TC 2-2013: Electrical Polyvinyl Chloride (EMT) Conduit.
   3. NEMA TC 3-2013: Polyvinyl Chloride Fittings for Use with PVC Conduit and Tubing.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Product Data: Submit data for metallic conduit, metallic tubing, nonmetallic conduit, flexible nonmetallic conduit, nonmetallic tubing, fittings, and conduit bodies.
C. Comply with Section 01 78 00 – Closeout Submittals. Project Record Documents shall accurately record routing of conduits 2” (52mm) or larger.

1.5 QUALITY ASSURANCE

A. Comply with Section 01 45 00 - Quality Control.
B. Conform to requirements of NFPA 70 - National Electrical Code; National Fire Protection Association; 2017 Edition.
C. Florida Building Code, 5^{th} Edition.
D. Products shall be listed and classified by Underwriters Laboratories, Inc. and be suitable for purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.
B. Upon receipt of materials on site, promptly inspect for damage.
C. Store materials in lockable trailer or other similar lockable storage facility on site. Payment will not be allowed for products either unprotected on site or stored off-site.
D. Protect PVC conduit from sunlight and UV degradation.

PART 2 – PRODUCTS

2.1 ALLOWABLE CONDUIT TYPES PER LOCATION

A. Conduit Size: Comply with NFPA 70.
   1. Minimum Size: 0.75” (19.1mm) unless otherwise specified or indicated for electrical pathways and 1” (25.4mm) for communication pathways.
B. Underground Installations:
   1. Beyond 5’ (1.5m) from structures foundation walls: Use rigid steel conduit, thick wall non-metallic conduit, or thin wall non-metallic conduit.
   2. Within 5’ (1.5m) of foundation wall: Use rigid steel conduit.
   3. Within or under slab on grade: Use rigid steel conduit or thick wall non-metallic conduit.
   4. Minimum Size: 4” (101.6mm).
C. Outdoor Locations Above Grade: Use rigid steel conduit or intermediate metal conduit.

D. In Slab Above Grade:
   1. Use rigid steel conduit or thick wall nonmetallic conduit.
   2. Maximum Size Conduit in Slab: 1” (25.4mm).
E. Wet and Damp Locations: Use rigid steel conduit or thick wall nonmetallic conduit.
F. Dry Location:
   1. Concealed: Use rigid steel conduit, intermediate metal conduit, electrical metallic tubing, or thick wall nonmetallic conduit.
   2. Exposed: Use rigid steel conduit, intermediate metal conduit, electrical metallic tubing, or thick wall nonmetallic conduit.

2.2 METAL CONDUIT AND TUBING

A. Approved Manufacturers:
   1. AFC Cable Systems, 272 Duchaine Blvd, New Bedford, MA 02745-1214; Tel: 508-998- 1131; Fax: 508-998-1447; website: www.afcweb.com.
   2. Allied Tube and Conduit, 16100 South Lathrop Ave., Harvey, IL 60426; Tel: 800-882- 5543; Fax: 954-574-0714; website: www.alliedtube.com.
   3. Anamet Electrical Inc., 1000 Broadway Ave. East, P.O. Box 39, Mattoon, IL 61938; Tel: 900-801-8845; Fax: 800-677-2706; website: www.anacondasealtite.com.
   4. O-Z/Gedney, 9377 W. Higgins Rd., Rosemont, IL 60018; Tel: 847-268-6000; Fax: 847-268-6018; website: www.o-zgedney.com.
   5. Wheatland Tube Co., Division of John Maneely Co., 700 South Dock St.’ Sharon, PA 16146; Tel: 800-257-8182; Fax: 724-346-7260; website: www.wheatland.com.
   6. Other manufacturers shall request material approvals in accord with Section 01 25 13 – Product Substitution Procedures.
B. Rigid Steel Conduit: ANSI C80.1-2005.
C. Electrical Metallic Tubing (EMT): ANSI C80.3-2005.
D. Intermediate Metal Conduit (IMC): Rigid steel.
E. Fittings and Conduit Bodies: NEMA FB 1-2012; fittings shall match conduit.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Approved Manufacturers:
   1. AFC Cable Systems, 272 Duchaine Blvd, New Bedford, MA 02745-1214; Tel: 508-998- 1131; Fax: 508-998-1447; Website: www.afcweb.com.
   2. Allied Tube and Conduit, 16100 South Lathrop Ave., Harvey, IL 60426; Tel: 800-882- 5543; Fax: 954-574-0714; Website: www.alliedtube.com.
   3. CANTEX, Inc., 301 Commerce St., Suite 2700, Ft. Worth, TX 76102; Tel:817-215-7000; Fax: 817-215-7001; Website: www.CANTEXinc.com.
   4. RACO, a Hubbell Company, 3902 West Sample St., P.O. Box 4002, South Bend, IN 46634-4002; Tel: 219-283-4300; Fax: 800-722-6462; Website: www.hubbell-raco.com.
   5. Thomas & Betts Corp.,8155 T & B Blvd., Memphis, TN 38125; Tel: 901-252-8000; Fax: 901-252-1345; Website: tnb.com.
   6. Other manufacturers shall request material approvals in accord with Section 01 25 13 – Product Substitution Procedures.
B. Description: NEMA TC 2-2013; Schedule 40 PVC.
C. Fittings and Conduit Bodies: NEMA TC 3-2013; fittings shall match conduit.

2.4 NONMETALLIC TUBING (INTERIOR USE ONLY)

A. Approved Manufacturer: IPEX, Inc; 3 Place du Commerce, Suite 101, Ile-des-Soeurs, Verdun, Quebec, Canada H3E 1K7; Tel: 514-769-2200; Fax: 514-7569-1672; Website:www.ipexinc.com.
   1. Product Kwikpath.
B. Description: 1.25” (3.18mm) minimal size, riser or plenum rated as required.
C. Fittings: As required and provided by manufacturer. Fittings shall be by same manufacturer as tubing.
D. Other manufacturers shall request material approvals in accord with Section 01 25 13 – Product Substitution Procedures.

2.5 BOXES, ENCLOSURES AND CABINETS

A. Approved Manufacturers:
   1. EGS/Appleton Electric., 9377 West Higgins Rd., Rosemount, IL 60018; Tel: 800-621- 1506; Fax: 800-356-4714; Website: www.appletonelec.com.
   2. Hoffman Enclosures, Inc., 2100 Hoffman Way, Anoka, MN 55303; Tel: 763-421-2240; Fax: 763-422-2178; Website: www.hoffmanonline.com.
   3. Killark Electric, a Hubbell Company; 3940 Martin Luther King Drive; St. Louis, MO 63115; Tel: 314-531-0460; Fax: 314-531-7164; Website: www.killark.com.
   4. Other manufacturers shall request material approvals in accord with Section 01 25 13 – Product Substitution Procedures.

2.6 HANDHOLES AND BOXES

A. Approved Manufacturers:
   1. Armorcast Products Company, 13230 Saticoy St., North Hollywood, CA 91605; Tel: 818-982-3600; Fax: 818-918-7742; Website: www.armoncastprod.com.
   2. Carlson Industries, LLC, 1160 Nicole Ct., Glendora, CA 91740; Tel: 800-735-5566; Fax: 800-827-1777; Website: carsonind.com.
   3. Nordic Fiberglass, Inc., P.O. Box 27, Warren, MN 56762; Tel: 218-745-5095; Fax: 218- 745-4990; Website: nordicfiberglass.com.
   4. Other manufacturers shall request material approvals in accord with Section 01 25 13 – Product Substitution Procedures.

2.7 NONMETALLIC TUBING (EXTERIOR USE)

A. See Section 33 81 26 - Communications Underground Ducts, Manholes, and Handholes.

2.8 SLEEVES

A. Manufacturer: Specified Technologies, Inc., 200 Evans Way, Sommerville, NJ 08876; Tel: 800-992-1180, 908-526-8000; Fax: 909-526-9623; Website: www.sticfirestop.com.
   1. Product: EZ Path firestop fittings, EZDP133K.
B. Other manufacturers shall request material approvals in accord with Section 01 25 13 – Product Substitution Procedures.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated. Immediately notify Contractor/CM of field variances from measurements indicated.
B. Verify with Contractor/CM routing and termination locations of conduit prior to rough-in.

3.2 INSTALLATION

A. Install conduit securely, in neat and workmanlike manner, as specified in NECA 1-2010.
B. Install steel conduit per NECA 101-2006.
C. Install nonmetallic conduit in accord with manufacturer's written instructions.
D. Arrange supports to prevent misalignment during wiring installation.
E. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
F. Fasten conduit supports to building structure and surfaces.
G. Do no attach conduit to ceiling support wires.
H. Arrange conduit to maintain headroom and present neat appearance.
I. Route exposed conduit level, parallel and perpendicular to walls.
J. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
K. Route conduit in and under slab from point-to-point.
L. Maintain adequate clearance between conduit and piping.
M. Maintain 12" (304.8mm) clearance between conduit and surfaces with temperatures exceeding 104° F (40° C).
N. Cut conduit square using saw or pipe cutter; de-burr cut ends.
O. Bring conduit to shoulder of fittings; fasten securely.
P. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
Q. Innerduct containing backbone cabling shall end with two feet of cable tray in network rooms. Innerduct may be shortened as needed to accommodate service loops.
R. Secure innerducts to wall of network rooms to prevent horizontal movement of cable (D-rings are acceptable). Secure cables to the wall in non-deforming manner to prevent vertical movement of cable.
S. Install no more than equivalent of two 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2" (52.1 mm) size.
T. "Dog legs" within stud space shall be avoided. Conduits shall not run horizontally through studs before stubbing out of wall.
U. Conduits from work area outlets shall turn at right angles into area served by WAO box from adjoining hallway.
V. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
W. Provide suitable fittings to accommodate expansion and deflection where conduit crosses expansion joints.

X. Provide suitable pull string in each empty conduit except sleeves and ripples.
Y. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
Z. Ground and bond conduit under provisions of Section 27 05 26 - Grounding and Bonding for Communications Systems.
AA. Firestop conduit in accord with Section 07 84 00 – Firestopping. Conduits in fire-rated penetrations shall be fire-stopped as soon as conduit is installed. Firestopping may be delayed if, during new construction, partitions and floors are not completed to point of forming final fire barriers. Installed shall consult with Contractor or local AHJ to determine if temporary fire-stopping is required.
AB. Identify conduit under provisions of Section 26 05 53 - Identification for Electrical Systems.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00 - Firestopping.
B. Route conduit through wall openings in neat and cleanly cut or drilled penetrations for conduits. Roof penetrations are not permitted.

END OF SECTION

SECTION 26 05 34
OUTLET BOXES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Provide and install all outlet boxes (flush or surface) complete with all accessories as required to facilitate installation of electrical system and as required by the NEC.
B. Section includes: Wall and ceiling outlet boxes (and/or small junction/pullboxes).

1.3 REFERENCES

A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
B. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
C. ANSI/NFPA 70 - National Electrical Code.
D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 SUBMITTALS

A. Submit catalog cut sheet/product data on:
   1. Surface cast boxes.
B. For pullboxes and junction boxes not covered in Section Pull and Junction Boxes for Electrical Systems, submit product data showing dimensions, covers, and construction.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.6 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.
B. Verify locations of outlets in offices and work areas prior to rough-in.
C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

PART 2 – PRODUCTS

2.1 GENERAL

A. All boxes and fittings shall be labeled by Underwriters Laboratories.
B. Provide box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, outlet boxes, and corrosion-resistant knockout closures compatible with outlet boxes being used and meeting requirements of individual wiring situations.
C. All boxes shall be of the size and shape required by NFPA 70 for their respective locations.
D. Boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size and number of conduits connecting thereto.
E. Handy boxes shall not be used.
F. Where a box is used as the sole support for a ceiling paddle fan, the box must be listed for this purpose and the weight of the fan.
G. 4” x 4” boxes and 4 11/16” x 4 11/16” boxes used as junction boxes shall be one piece.

2.2 SHEET METAL OUTLET BOXES: ANSI/NEMA OS 1, GALVANIZED STEEL

A. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch (13 mm) male fixture studs where required.
B. Concrete Ceiling Boxes: Concrete type.
C. Interior flush outlet boxes shall be galvanized steel constructed with stamped knockouts in back and sides, and threaded holes with screws for securing box coverplates or wiring devices. T & B, Steel City, Raco or accepted substitution.
D. Ceiling outlet boxes shall be 4" octagonal or 4" square X 1 1/2" deep or larger as required for number and size of conductors and arrangement, size and number of conduits terminating at them.
E. Switch, wall receptacle, telephone and other recessed wall outlet boxes in drywall shall be 4" square X 1 1/2" deep. For recessing in exposed masonry, provide one piece 4" square x 1 1/2" deep wall boxes with appropriate 4" square cut tile wall covers Steel City series #52-C-49/52-C- 52 or accepted substitution. For recessing in furred-out block walls, provide 4" square box with required extension for block depth and required extension for drywall depth.

2.3 CAST BOXES: NEMA FB 1

A. Interior surface outlet boxes and conduit bodies installed from 0" AFF to 90" AFF (including fire alarm device backbox) shall be the heavy cast aluminum or iron with external threaded hubs for power devices and threaded parts for low voltage devices - Appleton, Crouse-Hinds, or accepted substitution. Trim rings shall also be of one-piece construction.
B. Weatherproof outlet boxes shall be constructed of corrosion-resistant cast metal suited to each application and having threaded conduit hubs, cast metal faceplate with spring-hinged waterproof cap suitable configured, gasket, and corrosion-proof fasteners.
C. Boxes to be Type FD unless otherwise noted on drawings.

D. Freestanding cast boxes are to be type FSY (with flange). Other cast zinc boxes are not acceptable.

PART 3 – EXECUTION

3.1 GENERAL

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
C. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.
D. Install boxes to preserve fire resistance rating of partitions and other elements.
E. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
F. Use flush mounting outlet boxes in finished areas.
G. Do not install flush mounting boxes back-to-back in walls; provide minimum 6-inch (150 mm) separation. Provide minimum 24 inches (600 mm) separation in acoustic rated walls.
H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
I. Use stamped steel bridges to fasten flush mounting outlet box between studs.
J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
K. Support all outlet boxes from structure with minimum of one (1) 3/8" all-thread rod hangers. Boxes larger than 25 square inches shall be supported with two (2) all-thread rod hangers, minimum.
L. Do not fasten boxes to ceiling support wires.
M. Support boxes independently of conduit.
N. Use gang box where more than one device is mounted together. Do not use sectional box.
O. Use gang box with plaster ring for single device outlets.
P. Use cast outlet box in exterior locations and wet locations.
Q. Comply with applicable portions of the National Electrical Contractor's Association's (NECA) "Standard of Installation".
R. Install outlets in the locations shown on the drawings; however, the Owner shall have the right to make, prior to rough-in, slight changes in locations to reflect room furniture layouts.
S. The Contractor shall coordinate his work with that of the General Contractor so that each electrical box is the type suitable for the wall or ceiling construction provided and suitable fireproofing is inbuilt into fire rated walls.
T. The Contractor shall relocate electrical boxes as required so that electrical devices, once installed, will be symmetrically located with respect to the room layout.
U. All boxes shall be installed in a flush rigid manner with box lines at perpendicular and parallel angles to finished surfaces. Boxes shall be supported by appropriate hardware selected for the type of surface from which the box shall be supported. For example, provide metal screws for metal, wood screws for wood, and expansion devices for masonry or concrete.

V. For locations exposed to weather or moisture (interior or exterior), provide weatherproof boxes and accessories.
W. As a minimum, provide pull boxes in all raceways over 150 feet long. The pull box shall be located near the midpoint of the raceway length.
X. Provide knockout closures to cap unused knockout holes where blanks have been removed and plugs for unused threaded hubs.
Y. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.
Z. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.
AA. Avoid using round boxes where conduit must enter box through side of box, which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.
BB. All flush outlets shall be mounted so that covers and plates will finish flush with finished surfaces without the use of shims, mats or other devices not submitted or accepted for the purpose. Add- a-Depth rings or switch box extension rings (Steel City #SBEX) are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8" of finish wall surface.
CC. Outlet boxes mounted in metal stud walls, are to be supported to studs with two (2) screws inside of outlet box to a horizontal stud brace between vertical studs or one side of outlet box supported to stud with opposite side mounted to section of stud or device to prevent movement of outlet box after wall finished.
DD. All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.
EE. Mount Height.
1. Height of wall outlets to bottom above finished floors shall be as follows, unless specifically noted otherwise, or unless otherwise required by applicable codes including ADA. Verify with the Architectural plans and shop drawings for installing.

Switches	4'-0" AFF to top
Receptacles	1'-4" AFF to bottom
Lighting Panels	6'-6" AFF to centerline of highest breaker/fuse
Phone outlets	1'-4" AFF to bottom Intercom Call-in
button/handsets	4’-0” AFF to top
Fire Alarm Pull Stations	4'-0" AFF to top
Fire Alarm Strobe Lights	80" AFF to bottom
Thermostats	4'-0" AFF to top
Space Sensors	4'-0" AFF to top

2. Bottoms of outlets above counter tops or base cabinets shall be minimum 2" above countertop or backsplash, whichever is highest. Outlets may be raised so that bottom rests on top of concrete block course, but all outlets above counters in same area shall be at same height. It is the responsibility of this Division to secure cabinet drawings and coordinate outlet locations in relation to all cabinets as shown on Architectural plans, prior to rough-in, regardless of height shown on Division 26 Drawings.

3. Height of wall-mounted fixtures shall be as shown on the drawings or as required by Architectural plans and conditions. Fixture outlet boxes shall be equipped with fixture studs when supporting fixtures.

FF. Special Purpose Outlets.

1. Locate special purpose outlets as indicated on the drawings for the equipment served. Location and type of outlets shall be coordinated with appropriate trades involved. The securing of complete information for proper electrical roughing-in shall be included as work required under this section of specifications. Provide plug for each outlet.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for products furnished under all Sections of these specifications.
B. Coordinate locations and sizes of required access doors with applicable sections in these specifications.
C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
D. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
E. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.3 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.
B. Install knockout closure in unused box opening.

END OF SECTION

SECTION 26 05 35
PULL AND JUNCTION BOXES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Provide and install pull and junction boxes as shown on drawings or as required by the National Electrical Code (NEC).
B. Provide and install pull and junction boxes wherever required for a complete and operating distribution system whether shown on drawings or not.
C. Where outlet boxes are used for pull and/or junction boxes, they shall meet the requirements of the outlet box section of these specifications.

1.3 REFERENCES

A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
B. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
C. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
D. ANSI/NFPA 70 - National Electrical Code.
E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 SUBMITTALS

A. Submit actual shop drawings on all pull boxes showing.
   1. Covers.
   2. Dimensions - inside and out.
   3. Rating of concrete or gauge of metal.
   4. Manufacturer.

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations and mounting heights of pull and junction boxes.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.7 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.
B. Verify locations of pull and junction boxes prior to rough-in.
C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose and to maintain required access.

PART 2 – PRODUCTS

2.1 GENERAL

A. Dimensions of pull and junction boxes shall meet dimensions shown on drawings or dimensions required by NEC, whichever is largest.
B. Pull and junction boxes shall meet all requirements of UL and NEC.
C. Small pull boxes (i.e., 4" x 4") shall meet the requirements of these specifications for outlet boxes as a minimum.
D. All boxes (above ground) of 100 cubic inches or more shall be constructed of 14-gauge steel with hot dip galvanized coating.

2.2 SHEET METAL BOXES:

A. NEMA OS 1, galvanized steel (interior locations only).
B. Boxes to be fully weatherproof and watertight stainless steel NEMA 4SS where installed outside.

2.3 IN-GROUND PULL BOXES:

A. Material: Precast concrete, or composite.
B. Bottom: Open with 6" of gravel for drainage.
C. Cover: Meet Florida Dept. of Transportation requirements for installed location. (Pedestrian, heavy traffic, light traffic).
D. Solid sides constructed to facilitate conduit entries.

PART 3 – EXECUTION

3.1 GENERAL

A. Install per NEC.
B. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
C. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
E. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.
F. Install boxes to preserve fire resistance rating of partitions and other elements.

G. Align adjacent wall-mounted boxes with each other.
H. Use flush mounting boxes in finished areas.
I. Do not install flush mounting boxes back-to-back in walls; provide minimum 6-inch (150 mm) separation. Provide minimum 24 inches (600 mm) separation in acoustic rated walls.
J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
L. Pull and junction boxes larger than 25 square inches shall be supported with two (2) 3/8" all- thread rod hangers minimum.
M. Do not fasten boxes to ceiling support wires.
N. Support boxes independently of conduit.
O. Large Pull Boxes: Boxes larger than 100 cubic inches (1600 cubic centimeters) in volume or 12 inches (300 mm) in any dimension.
   1. Interior Dry Locations: Per NEC, with screw covers.
   2. Other Locations: Use hinged enclosure under provisions of Section Cabinets and Enclosures.
P. Outdoor Locations: All boxes installed outdoors to be NEMA 4 Stainless Steel, fully weatherproof and watertight.

3.2 IN GROUND PULL BOXES

A. Provide and install ground rod in each pull box. Connect #2 copper ground wires (counterpoise) to ground rod, run out pull box 6" over conduits to next pull box; tie to respective building electrical ground rod at each building.
B. Install pull boxes flush with finished grade. Provide extensions as required.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations and sizes of required access doors with applicable sections in these specifications.
B. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

3.4 ADJUSTING

A. Install knockout closure in unused box opening.

END OF SECTION

SECTION 26 05 37
SURFACE RACEWAYS

PART 1 – GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:
   1. Wireways.

1.2 REFERENCES

A. NECA (National Electrical Contractors Association) Standard of Installation.

1.3 SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract Documents and Section Submittals.
B. Submit Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.
C. Submit Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum five years’ experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 – PRODUCTS

2.1 WIREWAY

A. Manufacturers:
   1. Hoffman.
   2. Square "D"
   3. Electrical Enclosures

4. Substitutions: Under provisions of Section Substitutions.

B. Description: General purpose, Oil tight and dust tight or Raintight type wireway as indicated on drawings. If not indicated provide type required to meet applicable codes.
C. Knockouts: Manufacturer's standard.
D. Size: As indicated on Drawings, or larger as required by the NEC
E. Cover: Hinged cover with full gasketing for raintight and oil tight types.
F. Connector: Slip-in for general purpose and raintight types and flanged for oil tight types.
G. Fittings: Lay-in type with removable top, bottom, and side; captive screws for general purpose, and drip shield for raintight type, and removable top for oil tight type.
H. Finish: Rust inhibiting primer coating with gray enamel finish.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.
B. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.
C. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
D. Wireway Supports: Provide steel channel as specified in Section Supporting Devices.
E. Close ends of wireway and unused conduit openings.
F. Ground and bond raceway and wireway under provisions of Section Grounding and Bonding.
G. Install only in locations deemed accessible by the NEC and local authority. Provide all access panels, etc., as required to maintain required access.

END OF SECTION

SECTION 26 05 38
FLOOR BOXES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Furnish and install floor boxes as shown on the Drawings. Installation shall be in accordance with the NEC and shall be complete with service fittings as indicated. Equipment shall be listed by Underwriters Laboratories.

1.3 REFERENCE

A. ANSI/NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
B. ANSI/NFPA 70 National Electrical Code
C. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
D. Underwriters Laboratories Fire Resistance Directory - Current Publication Year

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.
C. Floor boxes shall be UL classified and listed to match fire rating of floor (minimum 2-hour fire rating).

1.5 SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract Documents and Section 26 05 07 Submittals.
B. Submit catalog cut sheet on floor box with all accessories.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of the General Requirements of the Contract Documents and Section 26 05 00 Common Work Results.
B. Accurately record actual locations of floor boxes.

1.7 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.
B. Verify locations of floor boxes and outlets in all areas prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

PART 2 – PRODUCTS

2.1 GENERAL

A. Each floor box to be complete with devices as called for on Drawings, complete with plates, trims, and accessories as required for a complete system.
B. Covers to be metal (unless specifically noted otherwise).

2.2 FLUSH IN FLOOR CAST IN PLACE CAST FLOOR BOXES

A. UL listed.
B. Threaded hubs.
C. Fully adjustable.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install floor boxes complete with all devices, accessories, etc. as recommended by manufacturer and to meet all applicable codes.
B. Adjust boxes as required for flush with floor installation.
C. Use cast floor boxes for installations in slab on grade with thread conduit hubs; formed steel boxes are acceptable for other installations.
D. Where floor or fill depth is 3" or more, adjustable boxes with maximum vertical and angular adjustment for after concrete pour shall be used. After pour is complete, boxes shall be set and readjusted to provide a smooth surface conforming to the elevation and slope of the surrounding finished floor.
E. In carpeted areas, Brass carpet flanges shall be installed to protect carpet edges where flush floor boxes are installed.
F. All assemblies shall be designed and installed to maintain grounding continuity, fireproofing and watertight integrity.
G. Box trim, service fittings and accessories shall be as specified on the drawings and/or as required for a complete and operational system.
H. Flush caps removed to install service fittings shall be turned over to the Owner.
I. Install floor boxes per UL Fire Resistance Directory. Do not exceed spacing and square foot area per unit requirements of specific product, UL fire resistance rating/classification for rating of floor.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Provide and install all equipment, labor, and material for a complete identification system, including but not limited to:
   1. Nameplates and labels.
   2. Wire and cable markers.
   3. Conduit markers.

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.
B. Americans with Disabilities Act – 1990 including Amendments

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 – PRODUCTS

2.1 NAMEPLATES

A. Nameplates shall be laminated phenolic plastic, chamfer edges.
   1. For 120/208 Volt System:
      a. Black front and back with white core, with lettering etched through the outer covering. White engraved letters on black background.
   2. For 277/480 Volt System:
      a. Orange with white letters.
   3. Emergency Power:
      a. Red front and back, white core, lettering etched through outer covering, white engraved letters on red background.
B. Nameplates for emergency power shall be laminated phenolic plastic. Red front and back, with white core, with lettering etched through outer covering, white engraved letters on red background.
C. Letter Size:
   1. 1/8-inch letters for identifying individual equipment and loads.
   2. 1/4-inch letters for identifying grouped equipment and loads.

D. Nameplates shall adequately describe the function of the particular equipment involved. Where nameplates are detailed on the drawings, inscription and size of letters shall be as shown and shop drawing submitted for acceptance. Nameplates for panelboards, switchboards, motor control centers, disconnects and enclosed breakers shall include the panel designation, voltage, and phase of the supply. For example, "Panel A, 120/208V, 3-phase, 4-wire". In addition, provide phenolic label in panel to describe where the panel is fed from and location. For example, "Fed From MDP-1:3:5 Electrical Room #E101 Level 1". Nameplates for equipment listed below shall describe particular equipment name and associated panel/ckt (if applicable). The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and P.B. station nameplates for that machine.
E. The following items shall be equipped with nameplates:
   1. All motors, motor starters, motor-control centers, pushbutton stations, control panels, time switches, disconnect switches, transformers, panelboards, circuit breakers (i.e., all 2 pole, 3 pole C.B's.), contactors or relays in separate enclosures, power receptacles where the nominal voltage between any pair of contacts is greater than 150V, wall switches controlling outlets that are not located within sight of the controlling switch, high voltage boxes and cabinets, large electrical, and electrical systems (Divisions 27, 28 sections), junction and pull boxes (larger than 4-11/16"), terminal cabinets, terminal boards, and equipment racks. Nameplates shall also describe the associated panel and circuit number (if applicable).
F. All Electrical system panels, transfer switches, motor control centers, disconnect switches, motor controllers, etc. shall be labeled as per branch, *i.e.*: “Panel ABC Emergency-Life Safety Branch” (similar for emergency legally required standby branch, or emergency optional standby branch).

2.2 WIRE MARKERS

A. Description: Cloth, tape, split sleeve, or tubing type wire markers.
B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
C. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings including neutral conductor.
   2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on shop drawings.

2.3 CONDUIT/JUNCTION BOX COLOR CODE

A. All conduit system junction boxes (except those subject to view in public areas) shall be color coded as listed below:

COLOR CODE FOR JUNCTION BOXES	COLOR
System Emergency 277/480 volt	Red
System Emergency 120/208	Pink
Fire Alarm	Orange
Normal Power 277/480-volt	Brown
Normal Power 120/208-volt	Black
Fiber Optics	Purple
Sound System	Yellow
Intercom	Blue
Computer/Data	Gold
TV	White
BAS	White
Security/CCTV	Green
Telephone	Dark Green
Grounding	Fluorescent Green

B. Conduits (not subject to public view) longer than 20 feet shall be painted with above color paint band 20 ft. on center. Paint band shall be 4" in length, applied around entire conduit. Where conduits are parallel and on conduit racking, the paint bands shall be evenly aligned. Paint shall be neatly applied and uniformed. Paint boxes and raceways prior to installation or tape conduits and surrounding surfaces to avoid overspray. Paint overspray shall be removed.
C. Junction boxes and conduit located in public areas (i.e., areas that can be seen by the public) shall be painted to match surface attached to. Provide written request to A/E for interpretation of those public areas, which may be in question.

2.4 CONDUIT/JUNCTION BOX MARKER

A. All new and existing junction boxes/cover plates for power, lighting, and systems (except those installed in public areas) shall adequately describe its associated panel and circuit reference number(s) within, (i.e., ELRW-2, 4, 6) or systems within (i.e., fire alarm, intercom, etc.). Identification shall be neatly written by means of black permanent marker. (Paint 1/2 cover plate with appropriate color above and 1/2 with associated panel/circuit or system as described above.) Junction box cover plates located in public areas shall be identified with small phenolic labels securely attached. Label colors to be determined by A/E. Large pull/junction boxes (8" x 8" or larger) shall be color identified by painting the corners of box cover plate with specified colors at 45^{o} angles and phenolic labels as specified herein.
B. Identify conduit not installed in public areas with corresponding panel/circuit numbers or corresponding system type as described above. Spacing: 20 ft. on center adjacent to color identification bands.

2.5 UNDERGROUND WARNING TAPE

A. Description: Minimum 6-inch-wide plastic tape, detectable type, with suitable warning legend describing buried lines. Systems conduits shall have orange colored tape and power/lighting conduits shall have red colored tape.

PART 3 – EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

A. Install nameplate parallel to equipment lines.
B. Secure nameplate to equipment front using stainless steel pop rivets.
C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
D. Nameplates installed inside on dead front cover shall be self-adhesive tape. (Do not drill or install screws in dead front.)
E. Identify new conduit, junction boxes, and outlet boxes using field painting.
F. Identify new underground conduits using underground warning tape. Install a minimum of one tape per trench at 6 inches below finished grade. For trenches exceeding 24 inches in width, provide one tape per 24 inches of trench width spaced evenly over trench width.
G. Install wire markers at all new connections and terminations and existing connections and terminations, modified or altered.

END OF SECTION

SECTION 26 09 23
OCCUPANCY SENSORS

PART 1 – GENERAL REQUIREMENTS

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensors, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.
B. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 26.
C. The Occupancy Sensor system shall sense the presence of human activity within the desired space and fully control the “ON”/“OFF” function of the lights.
D. Sensing technologies shall be completely passive meaning that they will not emit any radiation that is known to interfere with certain types of hearing aids, or electronic devices such as electronic white board readers. Acceptable programmable shall be Passive Infrared (PIR), and/or PIR/Microphonic Passive Dual Technology (PDT). Ultrasonic or Microwave based sensing technologies shall not be accepted.
E. Time Delay settings shall be factory set at 10 minutes and shall not be field adjusted unless specifically instructed by Engineer. This delay selection is based on lamp life vs. energy savings and sensor performance. Automatic adjustments to this delay period by the sensor shall not be permitted.
F. In high humidity or cold environments, the sensors must be conformably coated and rated for condensing humidity and -40-degree Fahrenheit (and Celsius) operation.
G. Installer, in accordance with manufacturer’s recommendation, shall determine final sensor location. All sensors shall have non-adjustable factory calibrated sensitivity for maximum performance. Time Delay field adjustments shall be provided as needed.
H. The installer shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.3 EQUIPMENT QUALIFICATION

A. All components shall be UL listed and offer a five (5) year warranty.

1.4 DESIGN REQUIREMENTS

A. The objective of this section is to ensure the proper installation of the occupancy sensor-based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.
B. The occupancy sensor-based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

1.5 SUBMITTALS

A. Shop Drawings:
1. Submit shop drawings in AutoCAD 2006 showing actual field conditions for this project's installation.
B. Product Data:
   1. Submit data sheets on sensors, control units and all junction boxes and mounting accessories, including all wiring diagrams (standard).

1.6 PROJECT RECORD DOCUMENTS

A. Submit record documents to accurately record actual location of each sensor and control unit.
B. Revise diagrams included in Drawings to reflect actual control device connections.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.
C. Submit manufacturer's installation instructions.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit instructions for operation, use, and adjustment of system.
B. Submit recommended preventive maintenance procedures and materials.
C. Submit parts list.

1.9 APPROVED MANUFACTURER AND SUBSTITUTIONS

A. Approved manufacturer shall be Sensor Switch, Inc. (800) 727-7483 www.sensorswitch.com.
B. Substitutions must be submitted no less than 14 days prior to bid date. An AutoCAD drawing of the facility showing coverage patterns and technical data must be provided with substitution request. All substitutions must clearly identify any and all exceptions to the specifications with a detailed explanation as to the exception. If substitution is approved, the contractor shall bear the responsibility of a fully functional system to the Engineer's satisfaction.
C. Product must be manufactured in the USA and be warranted for 5 years.

1.10 WARRANTIES

A. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications.
B. The supplier's obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective, or non-conforming and returned to the supplier.
C. Warranty in sensors and controls units will be for a period of five (5) years.

D. The warranty shall commence upon Final Completion of the project.
E. Warranty on labor shall be for a minimum period of one (1) year.

1.11 INSTRUCTION TO OWNER

A. The contractor shall provide, at the Owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem-solving diagnosis of the occupancy sensing devices and systems.

PART 2 – PRODUCTS

2.1 WALL SWITCH SENSORS – SMALL AREAS

A. Sensor shall recess into single gang switch box and fit a standard Decora opening.
B. Sensor must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (OFF) condition.
C. Sensor shall use PIR sensing incorporating a nominal one-half inch focal length lens viewing 9 inches above and below horizontal view pattern measured at 10 feet.
D. Sensor shall have optional features for photocell/daylight override, vandal resistant lens, and no switch as specified.
E. In areas with inboard/outboard switching, sensor shall provide two dedicated relays and override switches. Each relay shall have independent programmable time delays.
F. In areas with obstructions to the occupant’s workspace, sensor shall utilize programmable dual technology PIR/Microphonic sensing.
G. All models shall have “Reduced Turn On”. This is a field programmable function for problematic areas with unforeseen reflective surfaces. False turn on shall be eliminated with this feature.
H. Sensor shall be the following Sensor Switch model numbers. Device color and optional features as specified herein or shown on Drawings.
    1. WSD (PIR)
    2. WSD-2P (PIR inboard/outboard)
    3. WSD-PDT (PIR/Microphonic)
    4. WSD-PDT-2P (PIR/Microphonic inboard/outboard)
    5. WSD-SA (PIR Semi-Automatic)
    6. WSD-PDT-SA (PIR/Microphonic Semi-Automatic)

2.2 WALL SWITCH SENSORS – LARGE AREAS

A. Sensor shall surface mount to single gang switch box.
B. Sensor shall use PIR sensing incorporating a nominal one-inch focal length lens viewing 9 inches above and below horizontal view pattern measured at 20 feet.
C. Sensor shall have optional feature for photocell/daylight override.
D. In areas with inboard/outboard switching or two circuits, sensor shall provide two dedicated relays and override switches.
E. In areas with obstructions to the occupant’s workspace, sensor shall utilize dual technology PIR/Microphonic sensing.

F. Sensor shall be the following Sensor Switch model numbers. Device color and optional features as specified.
   1. LWS (PIR)
   2. LWS-2P (PIR inboard/outboard or two circuits)
   3. LWS-PDT (PIR/Microphonic)
   4. LWS-PDT-2P (PIR/Microphonic inboard/outboard or two circuits

2.3 LOW VOLTAGE SENSORS

A. Sensors shall operate on a class 2, three-conductor system. Sensors shall operate on 12 to 24 VAC or VDC and consume no more than 5 milliamps so that up to 14 sensors may be connected to a single power pack.
B. Upon initial power up, sensors must immediately turn on. Power packs may be wired on the line or load side of local switching and must not exhibit any delays when switch is energized.
C. In areas with clear line of site view of the workspace, sensors shall use PIR detection. In areas with obstructions, sensors shall use PIR/Microphonic detection.
D. Specific sensors shall have optional feature for photocell/daylight override, and/or Low Temperature/High Humidity environments.
E. Sensors shall be the following Sensor Switch model numbers.
   1. CM-9 (PIR Ceiling)
   2. CM-PDT (PIR/Microphonic Ceiling)
   3. CM-10 (PIR Ceiling-Extended Range)
   4. CM-PDT-10 (PIR/Microphonic Ceiling-Extended Range)
   5. WV-PDT (PIR/Microphonic Wall Mount)
   6. HW-13 (PIR Hallway)
   7. HM-10 (PIR High Bay Aisle Way)
   8. CM-6 (PIR High Bay)

2.4 POWER PACKS

A. Power Packs shall accept 120 or 277 VACS, be plenum rated, and provide class 2 power for up to 14 remote sensors.
B. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple. Plastic clips into junction box shall not be accepted. All class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
C. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
D. Power Pack shall incorporate a Class 1 relay and an A/C electronic switching device. The A/C electronic switching device shall make and break the load, while the relay shall carry the current in the ON condition. This system shall provide full 20 amp switching of all load types and be rated for 400,000 cycles.

E. Power Packs shall be single circuit, or two circuits. Slave Packs may be used to control additional circuits. When two circuit power packs, or slave packs are used, the power packs must be wired directly to circuit breaker. Otherwise, power packs may be wired on the line or load side of the local switch.
F. Power Packs shall be the following Sensor Switch model numbers.
   1. PP-20 (Single Pole)
   2. PP-20-2P (Two Pole)
   3. SP-20 (Slave Pack)

2.5 LINE VOLTAGE SENSORS

A. Sensors shall be self-contained and accept Class 1 wiring directly without the use of a power pack.
B. In areas with clear line of site view of the workspace, sensors shall use PIR detection. In areas with obstructions, sensors shall use PIR/Microphonic detection.
C. Multiple sensors controlling the same load shall be wired in parallel.
D. Wall Mounted Sensors must be installed at 7 to 8 feet above the floor. Single and two circuit units shall be available.
E. High Bay sensors controlling HID Bi-Level must incorporate a Start to High timer on initial power up to provide full light output for up to 20 minutes to prevent shortened lamp life.
F. Specific sensors shall have optional feature for Low Temperature/High Humidity environments.
G. Sensors shall be the following Sensor Switch model numbers.
   1. CMR-9 & CMR-9-2P (PIR Ceiling Mount- single and two pole)
   2. CMR-PDT & CMR-PDT-2P (PIR/Microphonic Ceiling Mount- single and two pole)
   3. CMR-10 & CMR-10-2P (PIR Ceiling Mount Extended Range - single and two pole)
   4. CMR-PDT-10 & CMR-PDT-10-2P (PIR/Microphonic Ceiling Mount Extended Range - single and two pole)
   5. WVR-16 & WVR-16-2P (PIR Wall Mount single and two pole)
   6. WVR-PDT & WVR-PDT-2P (PIR/Microphonic Wall Mount single and two pole)
   7. HMR-10 (PIR High Bay Aisle Way)
   8. CMR-6 & CMR-6-SH (High Bay Ceiling)

2.6 WIRING

A. Between sensors and controls, units shall be a minimum three (3) conductors, 18 AWG, stranded UL Classified, PVC insulated, or TEFLON jacketed cable accepted for use in plenums.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install devices and equipment in accordance with manufacturer's instructions.
B. It shall be the contractor's responsibility to obtain from the manufacturer occupancy layout and design assistance to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas and to provide shop drawings.

C. Sensors shall be placed so that corridor traffic passing an open door or by a window will not cause sensors to activate.
D. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within in the room(s).
E. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only rooms which are to be provided with sensors.
F. The contractor shall provide additional sensors if required to cover the respective room properly and completely.

END OF SECTION

SECTION 26 22 13
DRY TYPE TRANSFORMERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for energy efficient dry type transformers per TP-1.

1.3 REFERENCES:

A. NEMA TP-1
B. UL 1561
C. CSA C22.2
D. NECA National Electrical Contractors Association
E. NEMA ST 1 - Specialty Transformers
F. NEMA ST 20 - Dry Type Transformers for General Applications.
G. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Submit Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum five years' experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store, protect, and handle products to site.
B. Deliver transformers individually wrapped for protection and mounted on shipping skids.
C. Accept transformers on site. Inspect for damage.
D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
E. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 – PRODUCTS

2.1 TWO-WINDING TRANSFORMERS

A. Manufacturers:
   1. Square D (Basis of Design)
   2. G.E.
   3. Eaton
   4. Siemens
B. Description: NEMA ST 20, factory-assembled, air cooled dry type transformers, ratings as indicated.
C. Insulation system and average winding temperature rise for rated kVA as follows:
   1. 1-15 kVA: Class 185 with 115 degrees C rise.
   2. 16-500 kVA: Class 220 with 115 degrees C rise.
D. Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point.
E. Winding Taps:
   1. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
   2. Transformers 15 kVA and Larger: NEMA ST 20.
F. Sound Levels: NEMA ST 20.
G. Basic Impulse Level: 10 kV.
H. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
I. Mounting: Suitable for wall, floor, or trapeze mounting, except transformers larger than 75 KVA, suitable for floor or trapeze mounting.
J. Coil Conductors: Continuous windings with terminations brazed or welded.
K. Transformer windings shall be continuous wound copper (98% conductivity) construction.
L. Enclosure: NEMA ST 20; Type 1 or Type 3R ventilated as indicated. Provide lifting eyes or brackets.
M. Isolate core and coil from enclosure using vibration-absorbing mounts.
N. Nameplate: Include transformer connection data.

2.2 SOURCE QUALITY CONTROL

A. Provide testing of transformers under provisions of Section Hangers and Supports.
B. Provide production testing of each unit in accordance with NEMA ST20.

2.3 K RATED TRANSFORMERS

A. Provide double size neutral terminals for additional neutral cables.
B. For K rating of transformers, refer to Power Riser Diagram in the Contract Documents. If not listed, provide K-13 rating.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify site condition.
B. Verify that surfaces are suitable for installing transformer supports.

3.2 PREPARATION

A. Provide concrete pad sized minimum of 3" larger on all sides of the transformer.

3.3 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.
B. Set transformer plumb and level.
C. Use flexible conduit, under the provisions of Section Conduit, 1 ft (0.6 M) minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
D. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
E. Provide grounding and bonding in accordance with Section Grounding and Bonding.
F. Ground per NEC 250-26 and all applicable codes per authority having jurisdiction.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed.
B. Check for damage and tight connections prior to energizing transformer.
C. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

SECTION 26 24 13
DISTRIBUTION SWITCHBOARDS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Description of System:
   1. Factory-assembled, metal-enclosed switchboard for distribution and control of power from incoming line terminals to outgoing feeder terminals, installed and tested in place.
   2. Switchboard shall include all protective devices and equipment as listed on drawings or as included in these specifications, with necessary interconnections, instrumentation, and control wiring.

1.3 REFERENCES AND REGULATORY REQUIREMENTS

A. The switchboard(s) and overcurrent protection devices referenced herein are designed and manufactured according to the following appropriate specifications
   1. ANSI/NFPA 70 National Electrical Code (NEC)
   2. ANSI/IEEE C12.16 – Solid State Electricity Metering
   3. ANSI C57.13 – Instrument Transformers
   4. NEMA AB1 – Molded Case Circuit Breakers and Molded Case Switches, and Circuit Breaker Enclosures
   5. NEMA PB2 – Deadfront Distribution Switchboards, File E8681
   6. NEMA PB2.1 – Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less
   7. NEMA PB2.2 – Application Guide for Ground Fault Protective Devices for Equipment.
   8. UL50 – Cabinets and Boxes
   9. UL98 – Enclosed and Dead Front Switches
   10. UL 489 – Molded Case Circuit Breakers
   11. UL 891 – Deadfront Switchboards
   12. UL 943 – Ground Fault Circuit Interrupters
   13. Federal Specification W-C 375D Circuit Breakers, Molded Case, Branch Circuit and Service

1.4 SUBMITTALS

A. Shop Drawings and Product Data:
   1. Shop Drawings:

a. Layouts showing concrete pad dimensions conduit entrance and available space, bus duct connections, electrical ratings, nameplate nomenclature, and single-line diagrams in accordance with ANSI Y32.2 indicating connections and controls.
b. Shop Drawings shall clearly indicate:
i. Frame sizes and Interrupting Capacity of each breaker, and total assembly.
ii. Horsepower ratings at rated voltage of fused switches and/or breakers.
iii. Type of labels and labeling for every device and what it feeds.
iv. Nameplate on main switchboard only giving name of project; Architect, Engineer, and contractor.
v. Bus bar size, arrangement and spacing.

2. Product Data:
a. Manufacturer's written recommendations for storage and protection, installation instructions and field test requirements.

B. Test Reports:
1. Reports of production and field tests.

C. Operations and Maintenance Data:
1. Manufacturer's instructions for tightening bus connections, performing cleaning, and operating and maintaining switchboard.

PART 2 – PRODUCTS

2.1 GENERAL

A. Switchboards with circuit breaker, branch protective devices shall comply with NEMA PB2 as a minimum requirement. Switchboard shall be NEMA Class II, Type I construction and shall meet Underwriter's Laboratories enclosure requirements for service conditions.
B. Each cubicle shall have UL Label affixed, unless special construction prohibits, and no labeling or listing is available.
C. The sides and tops shall be covered with removable screw-on code gauge steel plates.
D. Switchboards shall be completely self-supporting structures, 90" high.
E. Provide lugs on bus, distribution panelboard and circuit breakers as required to match conductors being connected/terminated.

2.2 FINISH

A. All steel surfaces shall be chemically cleaned and treated to provide a bond between paint and metal surfaces to help prevent the entrance of moisture and formation of rust under the paint film.
B. The switchboard exterior shall be finished in indoor light grey No. 61, ANSI Z55.1.
C. Apply corrosion-protective undercoating to undersurfaces.

2.3 BUSSING AND TERMINATIONS

A. Bus bars:
1. Buses shall be tin-plated copper sized per UL 891.

2. The bus structure shall be braced to withstand mechanical forces exerted during short circuit conditions when connected directly to a power source having minimum 100,000 amps symmetrical short circuit current.
3. A ground bus shall be furnished secured to each vertical section structure.

B. Bus connections shall be accessible from front.
C. Where space for future is called for on drawings, all necessary buses except device connecting straps shall be furnished.
D. Line and load terminations shall be provided suitable for the size, number or conductors, and conductor material. Terminations shall be accessible from the front.
E. Provide full height wiring gutter doors for quick access to wiring terminals.
F. All hardware shall have high tensile strength and have a suitably protective finish.

2.4 ACCESSORIES

A. Switchboard shall be provided with adequate lifting means and shall be capable of being rolled or moved into installation position and bolted directly to the floor without the use of floor sills.

2.5 MAIN/DISTRIBUTION SECTION

A. Main device shall be as called for on drawings.
B. Circuit breaker, fusible switch, or current limiting branch circuit breaker protective devices shall be group-mounted with necessary connections accessible from the front.
C. Provide Electronic Power Metering with capabilities to transmit kW, kWh, amps, and peak demand via DDC open protocol translator, coordinate with BCS contractor. Basis of Design: Square D - PM800 Series.

2.6 ACCEPTABLE MANUFACTURERS

A. Square D (Basis of Design)
B. G.E.
C. Eaton
D. Siemens

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine area to receive switchboard to assure adequate clearance for switchboard installation.
B. Check that concrete pads are level and free of irregularities.
C. Start work only after unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install switchboard in accordance with manufacturer's written instructions, and NEC.
B. Mount switchboard on 3" concrete base extending 3" outside all sides.

3.3 ADJUSTMENT AND CLEANING

A. Adjust operating mechanisms for free mechanical movement.
B. Tighten bus connections and mechanical fasteners.
C. Touch-up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Provide all labor, materials, and equipment necessary to install panelboards properly and completely as scheduled on the drawings and as required by this section.

1.3 REFERENCES

A. NECA (National Electrical Contractors Association) "Standard of Installation."
B. NEMA AB 1 - Molded Case Circuit Breakers.
C. NEMA PB 1 - Panelboards.
D. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
E. NFPA 70 - National Electrical Code.
F. UL 67 – Panelboards
G. UL 50 Enclosures for Electrical Equipment
H. UL 489 Molded Case Circuit Breakers and Circuit Breaker Enclosures
I. Federal Specification W-P-115C – Type I Class I
J. Federal Specification W-C-375 B/GEN – Circuit Breakers, Molded Case, Branch Circuit and Service.

1.4 SUBMITTALS

A. Product data shall be submitted on:
   1. Panel
   2. Cabinet
   3. Bus
   4. Construction
   5. Dimensions
B. Shop drawing shall be submitted for each and every panel for this project, each and every panel drawing shall clearly indicate the following information:
   1. UL Label
   2. Each circuit breaker amperage rating, circuit number and position/location in panel
   3. Electrical characteristics of panel
   4. Mains rating
   5. Main device rating
   6. Mounting

7. Dimension, width, depth, height
8. Bus material
9. Interrupting capacity of minimum rated breaker
10. Panel type
11. Series AIC rating with upstream breakers.
12. Definitive statement that ends walls are blank
13. Identify that panel include a lockable cover.

1.5 PROJECT RECORD DOCUMENTS

A. Submit record documents to record actual locations of Products; indicate actual branch circuit arrangement.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.
B. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years' experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as instructed by manufacturer.

1.10 MAINTENANCE MATERIALS

A. Provide two of each panelboard key.

1.11 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle panelboards and enclosures carefully to prevent damage.
B. Store equipment indoors and protect from weather.
C. Deliver tubs and internal assemblies sufficiently in advance of installation period as necessary to prevent delay of work. This time shall be established by a CPM provided by the Contractor and accepted by the supervising authorities.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Basis of design: Square "D"
B. G.E.
C. Eaton
D. Siemens
E. Manufacturers (including accepted substitutions) must provide equipment equal to or superior to the basis of design used on this project.
    1. Panels or circuit breakers with an AIC rating less than that shown on the drawings will not be approved.
    2. Where basis of design panelboard can accept a certain type, frame, and/or AIC rated breaker, then the accepted substitution manufacturer must also be able to accept all equal breaker type, frame, and/or AIC rating.

2.2 GENERAL

A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB1, circuit breaker type, dead front. UL 67.
B. Panelboard Bus: Copper ratings as indicated. Provide copper ground bus in each panelboard. Provide isolated full size neutral bus where neutral is applicable. Provide non-linear load panelboards as specified on drawings. Non-linear panelboards shall have 200 percent rated neutral busbar.
C. Short Circuit Rating:
    1. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 240-volt panelboards; 14,000 amperes rms symmetrical for 480-volt panelboards. Bus shall be braced for minimum capacity equal to or greater than the lowest breaker symmetrical interrupting capacity. Minimum short circuit rating shall be increased to meet the following requirements:
        a. Individual CB AIC Rating shown on panel schedules indicate lowest AIC rating allowed for individual circuit breaker in panel.
        b. Panel Series AIC rating shown is the required rating of panel and its circuit breakers based on series rating of individual panel circuit breakers with panel main circuit breaker or upstream feeder breaker.
        c. Circuit breaker types are not shown or called for. The contractor must provide breakers in panel or feeder breakers in upstream breakers to comply with the required AIC ratings given including providing current limiting breakers where required to achieve all ratings given.
    2. Short Circuit Rating Label:
        a. Panelboards shall be labeled with a UL short-circuit rating.
    b. When series ratings are applied with integral or remote upstream devices, a label or manual shall be provided. It shall state the conditions of the UL series ratings including:
        i. Size and type of upstream device
        ii. Branch devices that can be used
        iii. UL series short-circuit rating

D. Enclosure:
   1. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
   2. Enclosures shall be provided with blank ends
   3. Where indicated on the drawings, branch circuit panelboards shall be column width type.
   4. Regulatory requirements:
      a. NEMA PB 1, Type 1, Type 3R, or Type 4X as indicated on drawings. Use only type 3R or Type 4X for units to be installed outdoors. Use only Type 4X in interior wet locations and designated wash-down areas. For the purposes of this specification, a wash-down area is defined as any area that is directly washed or rinsed with any form of water hose.
   5. Cabinet box: 6 inches (153 mm) deep; width: 20 inches (508 mm) minimum. Constructed of code gauge steel, galvanized, or bowdlerized to prevent rust.

E. Cabinet Front: Flush or surface (as indicated on drawings) cabinet front with concealed trim clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard baked enamel finish for interior panels. Exterior panels to be painted with rust inhibit primer painted over on all surfaces with epoxy paint.

F. Panels and breakers shall be rated for voltage and class of service to which applied.

G. Spaces:
   1. Space provisions or spaces for future breakers shall be located at the bottom of the panel and be fully bussed complete with all necessary mounting hardware less the breaker.

H. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.

2.3 MAINS

A. Provide main lug only (MLO) or main circuit breaker (MCB) as noted on drawings either by riser diagram or by schedule. Where conflict exists, provide MCB.

B. Regardless of what is shown on drawings provide the following minimum requirements.
   1. Main circuit breaker on each panel serving building main if required by applicable codes.
   2. Main circuit breaker on each panel fed directly from a transformer (unless disconnect with overcurrent devices is installed in feeder between transformer and panel).

C. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.

D. Main circuit breaker is not to be mounted as branch breaker or sub feed breaker.

2.4 CIRCUIT BREAKERS

A. General
   1. Molded Case Circuit Breakers: NEMA AB 1, plug-in type for 250V or less, bolt-on type for over 250V, thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
   2. Current Limiting Molded Case Circuit Breakers: NEMA AB 1. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

B. Main Breakers:
   1. Main breakers shall be individually mounted separate from branch breakers.
   2. Covered by a metal plate, except for operating handle.
   3. Connection from the load's side to the panel bus shall be bus bar. Insulated wire not permitted.

C. Branch Breakers:
   1. Thermal-magnetic molded case, with inverse time-current overload and instantaneous magnetic tripping, unless otherwise shown. Breakers shall be calibrated for 40 degrees C or shall be ambient compensating.
   2. Quick-make, quick-break, with tripped indication clearly shown by breaker handle taking a position between ON and OFF.
   3. Multi-pole breakers shall have common internal trip. No handle ties between single pole breakers are acceptable for this Project.
   4. Multi-wire branch circuit breakers shall have multi-pole breakers as required by the NEC. Handle ties between breaker handles are not acceptable.
   5. Single pole 15 and 20 ampere circuit breakers shall be rated for switching duty and shall be labeled as "SWD".
   6. AIC rating shall be as called for under "2.2 GENERAL".
   7. Breakers feeding heating and air-conditioning equipment shall be rated HACR type breaker.
   8. Breakers feeding High Intensity Discharge lamps systems shall be HID rated.

D. All breakers are to have lugs sized to match conductors called for on drawings.

2.5 SERVICE ENTRANCE EQUIPMENT

A. Panelboards used as service entrance equipment shall be listed and labeled by UL for use as service equipment.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1. Install all panelboards and panelboard enclosures in accordance with the manufacturer's written instructions, NECA's "Standard of Installation", the applicable requirements of the National Electrical Code, and recognized industry practices.

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes. Provide supports in accordance with Section Hangers and Supports for Electrical Systems.
C. Height: 6 ft (2 M) to top of panelboard; install panelboards taller than 6 ft (2 M) with bottom no more than 4 inches (10 cm) above housekeeping curb.
D. Provide filler plates for unused spaces in panelboards.
E. Provide typed circuit directory for each branch circuit panelboard. Mount a typewritten directory showing the actual circuit numbers, type of load and room names on inside of door. Room names shall be actual names or numbers used, not necessarily shown on the drawings. Progress Drawings shall show same arrangements as the Directory. Revise directory to reflect circuiting changes required to balance phase loads.
F. Provide engraved plastic nameplates under the provisions of Section Identification for Electrical Systems.
G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: 4 empty 1 inch. Identify each as SPARE.
H. Proper working clearances shall be maintained at every panelboard location. The working space in front of a panelboard shall be as a minimum, 30 inches wide extending 3 feet, 3.5 feet, or 4 feet (per NEC Article 110-26) out perpendicular to the panelboard.
I. All enclosures shall be firmly anchored to walls and supporting structures (where used) using appropriate hardware. Provide supporting (Unistrut type) channels on walls constructed of gypsum board or where otherwise necessary to provide a mechanically secure and permanent installation. Enclosures shall be installed so that the top is 6'-6" above finished floor. Where the size of the enclosure is such that the top cannot be installed at 6'-6", the top of the enclosure shall be kept as low as possible.
J. Clean the interior of each panelboard before installing conductors. At all times, keep the interior trim and exterior surfaces of the panelboard free of rust and debris. Repaint finishes if necessary.
K. Coordinate all raceways and conductors with their respective panelboards so that all connections and conductors routing present an orderly appearance. Conductors in the panelboards shall be laced and arranged in orderly manner.
L. Collect all keys upon delivery of panelboard. Store keys on one ring to be kept by project superintendent. Forward key ring with keys to Owner upon substantial completion.

3.2 IDENTIFICATION

A. Refer to Section Identification for Electrical Systems for products and content.
B. Provide nameplate shall state panel name, voltage and name of panel that feeds this respective panel, UL short-circuit rating.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed.
B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

C. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.
D. Feeder conductors shall be checked by accepted means to establish the absence of shorts to ground; insulation value etc. and the result recorded and submitted to the Engineer.
E. All circuits shall be operated to establish a good working order and checked for shorts.
F. All panel directory circuit numbers shall be checked to verify accuracy of the number.
G. Where and when requested by engineer provide:
    1. Inspection of equipment by authorized equipment manufacturer technician complete with submittal of statement of findings by technician, and providing any adjustments deemed necessary for a complete and operating system.
    2. Ground, voltage, and/or load readings complete with submittal on legible form with applicable data.

END OF SECTION

SECTION 26 24 17
DISTRIBUTION PANELBOARDS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Factory-assembled, metal-enclosed panelboard for distribution and control of power from incoming line terminals to outgoing feeder terminals, installed and tested in place.
B. Distribution panelboard shall include all protective devices and equipment as listed on drawings or as included in these specifications, with necessary interconnections, instrumentation.

1.3 REFERENCES AND REGULATORY REQUIREMENTS

A. ANSI/NFPA 70 - National Electrical Code.
B. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
C. NEMA KS 1 - Enclosed Switches.
D. NEMA PB 2 - Deadfront Distribution Switchboards.
E. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.
F. UL 67 - Panelboards
G. UL 50 – Enclosures for Electrical Equipment
H. UL 489 Molded Case Circuit Breakers and Circuit Breaker Enclosures
I. Federal Specification W-P-115C-Type I Class I
J. Federal Specification W-C-375 B/GEN-circuit Breakers, Molded Case, Branch Circuit and Service.

1.4 SUBMITTALS

A. Submit Shop Drawings: Indicate:
   1. Front and side views of enclosures with overall dimensions shown.
   2. Conduit entrance locations and requirements.
   3. Nameplate legends.
   4. Size and number of bus bars per phase, neutral, and ground.
   5. Frame sizes and Interrupting Capacity of each breaker, and total assembly.
   6. Horsepower ratings at rated voltage of fused switches and/or breakers.
   7. Type of labels and labeling for every device and what it feeds.
   8. Nameplate on main panelboard only giving name of project; Architect, Engineer and Contractor.
   9. Bus bar size, arrangement and spacing.

B. Submit Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.
C. Submit Test Reports: Indicate results of factory production tests.
D. Submit Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum 10 years' experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site.
B. Deliver in sections as required to fit equipment through doors, individually wrapped for protection and mounted on shipping skids.
C. Accept switchboards on site. Inspect for damage.
D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
E. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

1.10 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated and comply with instructions by manufacturer.

1.11 MAINTENANCE MATERIALS

A. Provide two of each key (where applicable).
B. Provide two fuse pullers (where applicable).

PART 2 – PRODUCTS

2.1 GENERAL

A. Panelboards with circuit breaker, or fusible switch, branch protective devices shall comply with NEMA PB2 as a minimum requirement. Panelboards shall be NEMA I and shall meet Underwriter's Laboratories enclosure requirements for service conditions.
B. Each cubicle shall have UL Label affixed, unless special construction prohibits, and no labeling or listing is available.
C. See drawings for acceptable manufacturers. Basis of design is Square D.
D. Short-Circuit Rating Label
    1. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 240 volts; 14,000 amperes rms symmetrical for 480 volts. Bus shall be braced for minimum capacity equal to or greater than the lowest breaker symmetrical interrupting capacity. Minimum short circuit rating shall be increased to meet the following requirements:
    2. Individual CB AIC Rating shown on panel schedules indicate lowest AIC rating allowed for individual circuit breaker in panel.
    3. Panel Series AIC rating shown is the required rating of panel and its circuit breakers based on series rating of individual panel circuit breakers with panel main circuit breaker or upstream feeder breaker.
    4. Circuit breaker types are not shown or called for. The contractor must provide breakers in panel or feeder breakers in upstream breakers to comply with the required AIC ratings given including providing current limiting breakers where required to achieve all ratings given.
E. When series ratings are applied with integral or remote upstream devices, a label or manual shall be provided. It shall state the conditions of the UL series ratings including:
    1. Size and type of upstream device
    2. Branch devices that can be used
    3. UL series short-circuit rating
F. Provide lugs on bus, distribution panelboard and circuit breakers as required to match conductors being connected/terminated.

2.2 MANUFACTURERS

A. Basis of Design: Square D
B. G.E.
C. Eaton
D. Siemens.

2.3 DISTRIBUTION PANELBOARDS

A. Description: NEMA PB 2 with electrical ratings and configurations as indicated.
B. Main Section Devices: Panel mounted.
C. Distribution Section Devices: Panel mounted.
D. Bus Material: Copper with tin plating standard size.
E. Bus Connections: Bolted, accessible from front for maintenance.
F. Ground Bus: Extend length of board.
G. Molded Case Circuit Breakers: NEMA AB 1, integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
H. Solid-state Molded Case Circuit Breakers: NEMA AB 1, provide with electronic sensing, timing, and tripping circuits for adjustable current settings; ground fault trip; instantaneous trip; and adjustable short time trip. Provide ground fault sensing integral with circuit breaker.
I. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.
J. Ground Fault Sensor: (Where called for on drawings). Zero sequence or Ground return type.
K. Ground Fault Relay: (Where called for on drawings). Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches.
L. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.
M. Enclosure: Type 1 - General Purpose for interior locations and 2 - Raintight for exterior locations.
    1. Align sections at front and rear.
    2. Finish:
        a. Interior: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
        b. Exterior: Coat interior and exterior of enclosure with rust inhibiting primer and paint over with epoxy paint
    3. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
    4. Enclosures shall be provided with blank ends.
    5. Where indicated on the drawings, branch circuit panelboards shall be column width type.
N. Breakers
    1. All breakers are to have lugs sized to match conductors called for on drawings.
    2. Main circuit breaker is not to be mounted as branch breaker or sub-feed breaker.
    3. Breakers feeding heating and air conditioning equipment shall be rated HACR type breaker.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that surface is suitable for distribution panelboard installation.

3.2 PREPARATION

A. Provide concrete housekeeping pad.

3.3 INSTALLATION

A. Install distribution panelboard in locations shown on Drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1.
B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
C. Install fuses in each switch (where applicable).

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section Tests and Performance Verification of Electrical Systems.
B. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.
C. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each, at test voltage of 1000 volts; minimum acceptable value for insulation resistance is 2 megohm.
D. Check tightness of accessible bolted bus joints using calibrated torque wrench.

3.5 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement.
B. Tighten bolted bus connections in accordance with manufacturer's instructions.
C. Adjust circuit breaker trip and time delay settings to values as instructed by the Architect/Engineer or (if so, directed by A/E) as manufacturer's recommendation.

3.6 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

3.7 LABELING

A. Provide nameplate/label at each protective device.
B. Nameplate shall state panel name, voltage and name of panel that feeds this respective panel.

END OF SECTION

SECTION 26 24 19
MOTOR CONTROL CENTER

PART 1 – GENERAL

1.1 WORK INCLUDES

A. Base Bid:
   1. Electrical Contractor shall provide:
      a. Complete motor control center, including all motor starters, switches and overcurrent protection and control devices as shown on the drawings and as required to complete all power wiring to motor loads and miscellaneous mounting hardware.

1.2 RELATED WORK

A. Specified Elsewhere:
   1. Basic Electrical Materials and Methods
   2. Raceways
   3. Wire and Cables
   4. Overcurrent Protective Device
   5. Motor Starters

1.3 SUBMITTALS

A. In accord with Division 1.
1. Shop Drawings: Complete motor control center.
2. Product Data: All components.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Control centers shall be metal enclosed, dead front, rigid free standing, low voltage, multi-unit type. Control centers shall be furnished NEMA Class 1, Type B construction. They shall be for 480-volt, 3 phase, 60 hertz, power service, as indicated and shall consist of the required vertical sections. Vertical sections shall be 90 inches high, assembled into a group having a common horizontal power bus and forming an enclosure to which additional sections may readily be added. The depth shall be 21 inches.
B. Side plates of each vertical section shall be sheet steel with full height flanges drilled to provide interchangeable mounting of standard units. Sections shall have removable plates on the top, back, upper front, lower front, and end. Standard sections shall include a vertical wireway. Unused portions of the section shall be covered by blank doors. Sections shall be arranged for front mounting only. Where “spaces” are indicated on the drawings, provisions shall be complete, except for the starters.
C. Finish shall be applied to both interior and exterior surfaces in the manufacturer’s standard type finish.

D. The main horizontal bus shall be silver plated copper, rated as shown on the drawings. This main bus shall run continuously the full width. Both top and bottom compartments shall include a wireway which lines up with the wireways in the vertical sections. Space shall be provided at the top and bottom for conduit entrance and wiring. Each vertical section shall have bus bars running full height of the section and shall be connected to the horizontal bus. There shall be no splices in the vertical bus. All bus work shall be properly braced and supported to withstand short circuits of 50,000 RMS amperes. Provide ground bus.
E. Sections shall be divided into units, each containing a combination magnetic starter, circuit breaker or other control assembly. Starters shall be combination starters with MCP overcurrent device and disconnect. Starters shall be FVNR or two speed as shown on the drawings. The starter units shall have external manual reset. No starter shall be smaller than NEMA size 1. Access to each starter shall be through a hinged door held firmly in place and interlocked with its breaker switch so that the door cannot be opened while the switch is closed. Switches shall be externally operated, with provision for locking in the open position with as many as three padlocks. Starter operation coils shall be for operation at 115 volts and individual control transformers with fused secondary, rated 460/115 volts shall be furnished with each starter. Each combination starter or assembly shall be removable as a unit. Individual enclosures shall be NEMA type 1 with neoprene gaskets in the door. A key operated hand-off-auto selector switch shall be furnished on each starter cover. Provide a green ('Power On') and red ('Run') pilot light, in the door of each compartment.
F. Provide phase failure protection relays on all 3 phase motors 5 HP and above. Phase failure relays shall provide for momentary power interruption. Provide time delay relays along with phase failure relays to provide staggered starting of motors. All overloads shall be the solid-state adjustable type. For additional requirements, see Section 16480.
G. On each compartment door shall be fitted a 1" x 3" laminated phenolic nameplate, engraved to show white letters on a black background. Nameplates shall be fastened to the door with two self-tapping metal screws and shall be removable.
H. Motor control centers shall be manufactured by:
    1. G.E.
    2. Square D
    3. Cutler Hammer
    4. Siemens.

PART 3 – EXECUTION

3.1 INSTALLATION

A. The complete control centers shall be thoroughly tested in accordance with NEMA Standards before shipment.
B. Mount control center on concrete equipment pad, 4" high.

END OF SECTION

SECTION 26 27 13
UTILITY SERVICE ENTRANCE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 01, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Furnish, install, or otherwise provide all equipment, and/or coordination, and supervision necessary to furnish a new electrical service to the facility. This shall include all necessary temporary services and connections.
B. Assessments by the utility for permanent electrical service shall be paid by the Owner.
C. Assessments for temporary electrical services shall be paid by the Contractor who shall contact the utility company prior to bid for inclusion of these charges.

1.3 SECTION INCLUDES

A. Arrangement with Utility Company for permanent electric service, including payment of Utility Company charges for service.
B. Underground service entrance.
C. Metering equipment.
D. Temporary Service.

1.4 COORDINATION

A. Fully coordinate with the local Utility Company to provide electrical service to the facility. Provide underground raceways, trenching, backfilling, etc. where required.

1.5 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.6 SUBMITTALS

A. Submit Utility Company prepared drawings.
B. Submit product data on:
   1. Surge protection.
   2. Lightning arresters.
   3. Meter/C.T. cabinet if applicable.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with Utility Company written requirements.

B. Arrange for all inspections required by the Utility Company and obtain written approval to proceed.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.
C. The rules and regulations of the local Utility Company shall govern all service and metering requirements.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated.

PART 2 – PRODUCTS

2.1 GENERAL

A. Refer to appropriate sections contained within these specifications for standards concerning materials used.

2.2 UTILITY METERS

A. Meters will be furnished by Utility Company.

2.3 UTILITY METER BASE

A. Meter base will be furnished by the Utility Company installed by the contractor.

2.4 TRANSFORMER PAD

A. Description: Transformer pad will be furnished by the Utility Company installed by the contractor.

2.5 LIGHTNING ARRESTER

A. Unit shall be UL Listed and in accordance with Section Surge Protection Devices.

2.6 SURGE SUPPRESSION

A. Suppressors shall be in accordance with Section Surge Protection Devices.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that service equipment is ready to be connected and energized.

3.2 PREPARATION

A. Make arrangements with Utility Company to obtain permanent electric service to the Project.
B. Coordinate location of Utility Company's facilities to ensure proper access is available.
C. This Contractor shall notify the Utility Company in writing, with two copies to the Engineer, no later than ten (10) days after signing contracts as to when this Contractor anticipates the building power service will be required.
D. Contact Power Company within 15 days of award of contract. Provide power company copies of contract documents needed and/or required by Power Company within 30 days of contract Notice to Proceed.

3.3 TEMPORARY SERVICES

A. Throughout the period of construction, provide all temporary services and connections necessary to maintain without interruption all electrical services in support of construction and Owner activities. The only exception to this requirement shall be scheduled interruptions made with the prior acceptance of the Owner.
B. The facilities and equipment required to provide all electrical power for construction, lighting and balancing and testing consumed prior to final acceptance of the project shall be provided under this section of the specifications. All wiring, outlets and other work required to provide this power at the site and within the building for all trades shall be arranged for, furnished, and installed under this section of the specifications including any fee, charge or cost due the utility company for temporary power installation or hook-ups.
C. Facilities shall be furnished in a neat and safe manner in compliance with governing codes, good working practices and OSHA regulations.

3.4 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall furnish all labor, materials, etc., necessary for a complete accepted electrical service as required for this project, including inspection and acceptance by the Utility and local Inspection Departments (if any) and inform the Engineer prior to energizing power lines within the structure.

3.5 UNDERGROUND ELECTRICAL SERVICE

A. Furnish and install underground service from power company pad mounted transformer to main service equipment. Seal conduit with duct-seal where entering building.
B. The underground service shall comply with all the requirements of the NEC, local Utility Company and State enforcing authority.
C. The concrete pad shall be furnished by the Utility Company and installed by this Contractor.
D. Install Utility Company provided buried primary conduits from the pad to point of Utility Company service as shown on drawings or as required by Utility Company.

E. Install service entrance conduits from Utility Company's pad-mounted transformer to building service entrance equipment. Connect service lateral conductors to service entrance conductors.

3.6 METERING

A. Meters and metering equipment shall be furnished by the Utility Company and installed under this Division of the specifications.

3.7 LIGHTNING ARRESTERS AND SURGE SUPPRESSION

A. A lightning arrestor shall be provided on the line side of each main service from transformer. A surge suppression device shall be provided on the load side. Units shall match service voltage.
B. Installation including mounting connections, grounding and length of leads shall conform to manufacturers' recommendations.
C. Surge suppression unit shall be installed in accordance with Section Surge Protection Devices.

3.8 PAD

A. Install Utility Company precast concrete pad as directed/required by Utility Company.

END OF SECTION

SECTION 26 27 16
CABINETS AND ENCLOSURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 01, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:
   1. Hinged cover enclosures.
   2. Cabinets.
B. Cabinets and enclosures are to include:
   1. Terminal blocks,
   2. Mounting panel,
   3. Ground bus/bar, and
   4. All accessories as required for a complete and operating system.
C. Provide and install cabinets and enclosures, as specified herein, for all systems specified in all sections of the Division 26, Division 27 and Division 28 sections when included in specifications.

1.3 REFERENCES AND REGULATORY REQUIREMENTS

A. Conform to the requirements of the following:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems.
   3. ANSI/NFPA 70 - National Electrical Code.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.4 SUBMITTALS

A. Submit Product Data: Provide manufacturer's standard data for enclosures and cabinets.
B. Submit Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
C. Submit actual shop drawings on all cabinets and enclosures showing:
   1. Covers.
   2. Dimensions - inside and out.
   3. Gauge of metal.
   4. Manufacturer.
   5. Terminal mounting plate, construction, etc.

6. Ground bus/bar.

1.5 EXTRA MATERIALS

A. Provide two of each cabinet key.

PART 2 – PRODUCTS

2.1 GENERAL

A. Unless specifically called for otherwise on contract drawings, provide "CABINETS" as specified herein for terminal cabinets mounted indoor. Similarly, provide "HINGED COVER ENCLOSURES" as specified herein for terminal cabinets mounted outdoors or in locations other than NEMA 1 locations. Also, provide "HINGED COVER ENCLOSURES" for locations where size required is not available in "CABINET" construction, or if specifically specified as "enclosure" on contract documents.
B. Size.
   1. Dimensions of cabinets and enclosures shall meet the dimensions shown on drawings, dimensions required by NEC, or dimensions sized as required to facilitate all equipment/connections involved installation, whichever is largest.
   2. Coordinate with Division 27 and 28 sections and Section Surge Protection Devices of these specifications to assure that size of equipment cabinet or enclosure will house and facilitate proper installation and access to equipment, to be installed/mounted in cabinet or enclosure.
C. Provide metal barriers to separate compartments containing control wiring operating at less than 50 volts from power wiring.
D. Provide accessory feet and/or mounting brackets for free-standing equipment.
E. Cabinets and enclosures installed outdoors shall be fully weatherproof and watertight.

2.2 HINGED COVER ENCLOSURES

A. Construction:
   1. Interior Locations: NEMA Type 1 (unless otherwise noted), steel.
   2. Exterior Locations: NEMA Type 4X.
      a. Stainless steel.
B. Covers: Continuous hinge.
C. Enclosure Finish:
   1. NEMA 1: manufacturer's standard metallic gray enamel over phosphatized surfaces.
   2. NEMA 4X:
      a. Stainless steel.
D. Lock/handle.
   1. Provide/install key lock handle on all enclosures mounted in rooms/areas/spaces that are not electrical rooms or mechanical rooms. Enclosures installed in electrical rooms need not be and are not required to be lockable.
E. Interior mounting plate.
   1. Each enclosure is to have interior mounting plate/panel for mounting terminal blocks and electrical components.
   2. Plate/panel is to be metal.

F. Ground bus/bar.
1. Each enclosure housing surge suppression equipment or other equipment shall have "local" ground bar/bus installed. See specification for "Local Ground Bus/Bar" included within this section.
G. Manufacturers:
   1. Hoffman
   2. Schaeffer

2.3 CABINETS

A. Construction: Code gauge steel with removable end-walls.
B. Finish:
   1. Boxes: galvanized steel.
   2. Fronts: gray baked enamel.
C. Fronts:
   1. Electrical or mechanical room locations: screw cover with flush handle or as noted below.
   2. Other locations: mono-flat with concealed trim clamps, concealed hinges, and flush lock lockable handle.
3. Flush or surface type as shown or called for on contract documents.
D. Interior mounting plate.
1. Each enclosure is to have interior mounting plate/panel for mounting terminal blocks and electrical components.
2. Panel/plate may be constructed of wood if painted with fire retardant paint of a flame spread rating of Class A, if it meets all applicable codes, and it is acceptable to the authority having jurisdiction, otherwise plate to be metal.
E. Ground bus/bar.
   1. Each cabinet housing surge suppression equipment or other equipment shall have "local" ground bar/bus installed. See specification for "Local Ground Bus/Bar" included within this section.
F. Manufacturer:
   1. Sq. "D" Class 6650 Series.
   2. Hoffman.

2.4 TERMINAL BLOCKS

A. Terminal Blocks: ANSI/NEMA ICS 4.
B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
C. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
D. Provide ground bus terminal block, with each connector bonded to enclosure.

2.5 LOCAL GROUND BUS/BAR

A. Size to handle #6 through #14 AWG copper ground wire.
B. Length as required for circuits.
C. Manufacturer:
   1. Sq. "D" #PK***GTA Series.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive Work.

3.2 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.
B. Install enclosures and cabinets plumb. Anchor securely to wall and structural supports at each corner.
C. Install cabinet fronts plumb.
D. Install per NEC and as required for proper clearance. Coordinate with panels.
E. Provide and install terminal cabinets as shown on drawings or as required by the National Electrical Code (NEC).
F. Provide and install terminal cabinets wherever required for a complete and operating distribution system whether shown on drawings or not.
G. Install local ground bus/bar in each terminal cabinet/enclosure that houses surge suppression equipment or other equipment and bond to cabinet enclosure via mounting screws or #6 AWG copper ground wire.
H. Ground local ground bus to "SYSTEMS" ground bus/bar with minimum #6 AWG copper ground wire. Increase size if so, required on drawings.
I. Install enclosures.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 01, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:
   1. Wall switches.
   2. Wall dimmers.
   3. Receptacles.
   4. Device plates and decorative box covers.

1.3 REFERENCES

A. NEMA WD 1 - General Purpose Wiring Devices.
B. NEMA WD 5 - Wiring Devices, Special Purpose
C. NEMA WD 6 - Wiring Device Configurations.

1.4 SUBMITTALS

A. Submit Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
   1. Submit product data on all types of wiring devices including plates and engraving.
B. Submit Manufacturer's Instructions:
   1. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
   2. Include instructions for storage, handling, protection, examination, preparation, operation, and installation of product.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.7 EXTRA MATERIALS

A. Provide a minimum of two (2) screw drivers of each type of tamper proof screw used on project.
B. Turn over to owner. Submit receipt in O&M manual.

PART 2 – PRODUCTS

2.1 GENERAL

A. All devices shall be Specification Grade as minimum.
B. General purpose wiring devices shall meet NEMA standard WD-1, Wiring Devices, General Purpose. Special purpose devices shall conform to the requirements of NEMA standard WD-5, Wiring Devices, Special Purpose.
C. All wiring devices shall bear UL labels.
D. All devices of one type (i.e., all snap switches, all duplex receptacles, etc.) shall be by the same Manufacturer. "Hazardous Location" and special purpose devices as may not be available from the same manufacturer shall constitute the only exception to this requirement of single source.
E. Corrosion resistant devices shall be as specified for normal usages and fabricated of yellow color melamine plastic. Where "Weatherproof" type is indicated for exterior or wet locations, provide matching self-closing cover, with gasketed seals at plate/wall junctions and for cover.
F. Provide factory packaged wiring devices having high impact strength molded plastic bodies.
G. Except where specifically required in these specifications use of interchangeable type or combination switch-receptacle-pilot devices is not acceptable and shall be removed.

2.2 WALL SWITCHES

A. Manufacturers:
   1. Legrand
   2. Leviton
   3. Hubbell
B. General:
   1. Snap switches for general use shall be maintained contact types, and shall be single-pole, double-pole, three-way, or four-way as required for the specific switching arrangements shown on the drawings. They shall be quiet tumbler operation types, having silver alloy contacts, and meeting all NEMA performance standards. Color to match plates unless specifically noted otherwise in specifications and/or on drawings.
   2. Switches shall be toggle or key-operated types, as indicated on the drawings. All key- operated switches shall be keyed alike.
   3. Where switches are denoted as having pilot lights, pilot lights shall glow when the switches are "ON". Provide pilot light switch with lamp and miniature step-down transformer. The pilot light shall have a red lens, and the lamp shall be long-life type.

4. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be amber. All units shall be front relampable.
5. Snap switches installed in hazardous locations shall be UL listed for the type of location (class and division).
6. Voltage and ampere rating of switches shall be marked on switch and shall conform to voltage of system to which applied.

C. Description: NEMA WD 1, heavy-duty, AC only general-use snap switch.
D. Voltage Rating: 120-277 volts, AC.
E. Current Rating: 20 amperes minimum.
F. Ratings: Match branch circuit and load characteristics.

2.3 WALL DIMMERS

A. Manufacturers:
1. Legrand
2. Leviton
3. Hubbell

B. Description: NEMA WD 1, semiconductor dimmer for incandescent lamps, type as indicated on Drawings.
C. Device Body: Plastic with rotary knob or linear slide as called for on drawings.
D. Voltage: 120 volts or as required to match application.
E. Power Rating: Match load shown on Drawings; 600 Watts minimum.
F. Accessory Wall Switch: Match dimmer appearance.
1. Same manufacturer and style as dimmer switch.

2.4 RECEPTACLES

A. General:
1. All receptacles shall be of standard NEMA configuration, as indicated on the drawings, and shall comply with the respective ANSI C73 series standard for the NEMA configuration. Color to match plates unless specifically noted otherwise in specifications and/or on drawings.
2. Duplex receptacles shall have integral UL listed self-grounding clips. Similar, single receptacles shall be provided for plug-in connections of Industrial Fluorescent light fixtures on the same switching circuit. Receptacle faces to be impact resistant nylon.
3. Weatherproof duplex receptacles shall be provided in all exterior locations and shall be Ground Fault Circuit Interrupting (GFCI) types, with weatherproof cover plates allowing use of receptacle with cover in closed position.
4. Special purpose receptacles for specific equipment shall be grounding types, having the number of poles, voltage, and ampere ratings, and NEMA configurations required by the equipment. For each special purpose receptacle, provide an identical mating plug equipped with cord grip, secured to cord.
5. Duplex receptacles shall have back and side wired screw pressure terminals.

B. Description: NEMA WD 1; heavy-duty general use receptacle.
C. Configuration: NEMA WD 6; heavy-duty, general use type as specified and indicated.
D. Convenience Receptacle: Type 5-20.

E. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.
F. Manufacturers:
   1. Legrand
   2. Leviton
   3. Hubbell

2.5 COVER PLATES

A. All wiring devices shall be provided with standard size one-piece cover plates of suitable configuration for the number and type of devices to be covered.
B. Metallic cover plates shall be used in interior spaces, except as noted below, and shall be fabricated of corrosion-resistant #302 stainless steel, having a nominal thickness of .04", and a brushed finish. Screws securing the plates shall have flush (when installed) heads with finish to match plates. Metallic cover plates shall meet all requirements of the National Electrical Code and Federal Specifications.
C. Cover plates for switches located in corrosive atmospheres (where vapor-proof is not indicated) shall be equal to Hubbell #17CM81/#17CM82/#17CM83/#17CM84 one piece neoprene with matching press switch.
D. Cover plates for exterior receptacles shall be gasketed covers with hinge allowing plug and cord to be plugged in and activated with cover closed.
E. Cover plate engraving, where required, shall be accomplished by cover plate manufacturer in accordance with instructions given on the drawings. Metallic plates in ivory, beige, gray, and white shall be engraved with black fill. Red, brown, and black plates shall be engraved with white fill.

2.6 COLOR

A. Devices connected to normal power and located in finished interior spaces shall be of color selected by Architect from the following list of standard colors: ivory, beige, gray, white, brown, and black.
B. Cover plates for devices connected to normal power and located in finished interior spaces shall be of color selected by Architect from the above list of standard colors or #302 SS.
C. All devices and cover plates in paneled walls shall have finish to match paneling.
D. Receptacles and switches connected to the emergency branch of the power system shall be ‘RED’. Cover plates for such devices shall be stainless steel and engraved with “STANDBY POWER”.
E. Receptacles connected to the computer power distribution branch shall be ‘GREY’ in color, with trim plate to match other normal power receptacles.
F. Contractor shall modify any given catalog numbers as required to procure devices and plates of the proper color.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify conditions under provisions of Division 01 - General Requirements and any other applicable supplemental requirements/conditions.

B. Verify outlet boxes are installed at proper height.
C. Verify wall openings are neatly cut and will be completely covered by wall plates.
D. Verify floor boxes are adjusted properly.
E. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install devices plumb and level.
C. Install switches with OFF position down.
D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
E. Do not share neutral conductor on load side of dimmers.
F. Install receptacles with grounding pole on bottom.
G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
H. Electrical boxes shall be cleaned and completely free of any debris, dust, etc. prior to the installation of wiring devices.
I. Where 2 or more switches or receptacles are to be installed adjacent to one another, provide a multi-gang box and combination multi-gang coverplate. Provide proper NEC barriers in boxes which serve devices for both the Normal and Emergency Systems.
J. Provide device coverplates for every device installed. Cover plates shall be installed so that they appear straight with no gaps between plate edges and the wall. Maintain vertical and horizontal to within 1/16 of an inch.
K. In finished areas, provide same type of plate for all surface mounted devices as for recessed mounted devices.
L. In any room, where new and existing construction is present, all receptacles, switches, and coverplates which are existing to remain shall be changed, as required to match new work.
M. Wiring devices shall not be installed in exposed masonry until cleaning of masonry with acids has been completed.
N. All receptacles and switches shall be grounded by means of a ground wire from device ground screw to outlet box screw and branch circuit ground conductor. Strap alone will not constitute an acceptable ground.
O. All wiring devices, relays, contactors, pushbuttons, selector switches, pilot lights, etc. shall be installed in approved enclosures rated for the appropriate NEMA classified environment.
P. All devices shall be installed so that only one wire is connected to each terminal.
Q. Once construction is substantially completed, replace all damaged, burned, or scorched wiring devices.
R. Receptacles shown to be floor mounted shall be installed in floor boxes (with cover-plates) which are approved for this use.
S. Connect wiring devices by wrapping conductor around screw terminal.

T. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
U. Install protective rings and split nozzle on active flush cover service fittings.
V. Install local room area wall switches at door locations on the lock side of the door, approximately four inches from the jamb. Where locations shown on the drawings are in question, provide written request for information to A/E prior to rough-in.

3.4 NEUTRAL CONDUCTOR CONNECTIONS

A. At each receptacle "in" and "out" phase and neutral conductors shall have an additional conductor for connection to device. The practice of "looping" conductors through receptacle boxes shall not be acceptable.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under other Sections of these specs to obtain mounting heights specified and indicated on Drawings.

3.6 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.
B. Operate each wall switch with circuit energized and verify proper operation.
C. Verify that each receptacle device is energized.
D. Test each receptacle device for proper polarity.
E. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION

SECTION 26 28 19
ENCLOSED DISCONNECT SWITCHES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 01, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Provide all labor, materials, and equipment necessary to properly install switches as shown on the drawings and as required by codes.
B. Coordinate with Division 23 Contractor and specifications as to who is to provide disconnect switches for mechanical equipment. Provide all disconnect switches not being provided by Division 23 Contractor.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver switches in factory wrapped packaging to the site. Handle switches carefully to prevent damage. Store in a clean, dry space protected from dirt, water, and physical damage. Do not install damaged switches.

1.4 QUALITY ASSURANCE

A. The manufacturer of switches shall be the same as that of the panelboards.

1.5 SUBMITTALS

A. Submit catalog cut sheet on each type of disconnect switch to be used on this project.

PART 2 – PRODUCTS

2.1 CONSTRUCTION

A. Switches shall be heavy duty types with visible, quick-make, quick-break blades.
B. Units for 2-speed motors shall be 6-pole in a single enclosure. Use of two 3-pole units will not be acceptable.
C. Provide ground bus and where required, a solid neutral bus.
D. Switches shall be fusible or non-fusible as denoted on the drawings or as required by the equipment served from the switch. Fusible switches shall have rejection type fuse holders.
E. Terminal lugs shall be rated for 75 degrees Centigrade.
F. Enclosures, unless otherwise noted, shall be NEMA 1 for indoor locations and NEMA 4SS for outdoor locations as a minimum. Provide NEMA 4SS at any locations where a NEMA 3R is noted on the drawings.

G. The enclosure shall be interlocked with the switch handle such that the enclosure door or cover cannot be opened with the switch in the "ON" position. The switch handle shall be capable of being padlocked in the "OFF" position but not in the "ON" position.
H. Finish for NEMA I units shall be standard baked gray enamel finish over a rust inhibiting phosphate primer.

2.2 DISCONNECT SWITCHES

A. Disconnect switches installed between any variable speed drive type of unit (VFD, AFD, USD, etc.) and its respective motor(s), shall have auxiliary break before break (open) interlock control contact.
B. Disconnect switches installed to disconnect HVAC equipment are to be fusible type with fuses as recommended by HVAC manufacturer.

2.3 RATING

A. The size, number of poles, and fusing for each switch shall be as denoted on the drawings. As a minimum, no less than one pole for each ungrounded conductor shall be provided. Switches shall be rated 250 VAC or 600 VAC as required by the circuit to which it is connected.
B. Switches serving motors with more than one set of windings shall have the number of poles necessary to disconnect all conductors to all windings in a single switch. Switches serving motor loads shall be horsepower rated of sufficient size to handle the load.

2.4 SERVICE ENTRANCE EQUIPMENT

A. Switches used as service entrance equipment shall be listed and labeled by UL for use as service equipment.

2.5 ENCLOSED CIRCUIT BREAKERS

A. Molded Case Circuit Breakers: NEMA AB1, plug-on type for 250V or less, bolt-on type for over 250V, thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Breakers shall be HID rated. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
B. Thermal-magnetic, molded case, with inverse time-current overload and instantaneous magnetic tripping, unless otherwise shown. Breakers shall be calibrated for 40 degrees C or shall be ambient compensating.

2.6 MANUFACTURERS:

A. Square D (Basis of Design
B. G.E.
C. Eaton
D. Siemens

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install all switches in accordance with the manufacturer's written instructions, NECA's "Standard of Installation", the applicable requirements of the National Electrical Code, and recognized industry practice.
B. All switches shall be firmly anchored to walls and supporting structures (where used) using appropriate installation. Switches shall be installed with the turning axis of their handles approximately 5'-0" above finished floor unless otherwise indicated. Provide rigid steel (galvanized for exterior use) mounting stands, brackets, plates, hardware, and accessories for a complete installation.
C. Switches shall be mounted in accessible locations chosen where the passageway to the switch is not likely to become obstructed. Where a switch serves as the disconnecting means for a load, the switch shall be located as close as practical to the load with the switch handle within sight of the load.
D. Provide and install lugs on disconnect switch as required to accept conductors called for on drawings.
E. Disconnect switches shall not be mounted on equipment, unless specifically noted or required and meet all applicable codes, etc. If switches are noted or required to be mounted on equipment, they shall have vibrator clips on fuses and be connected to conduit system with liquid tight flexible conduit.
F. Coordinate all requirements for controls between variable speed drive units and its respective motor with drive specification, manufacturer, provider, and installer. Provide auxiliary contacts, relays, etc. as required.

END OF SECTION

SECTION 26 29 13
MOTOR CONTROL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 01, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. This section of the specification covers factory-assembled, metal-enclosed motor control units for distribution and control of power from incoming line terminals to outgoing feeder terminals, installed and tested in place.
B. Motor control units shall include all protective devices and equipment as listed on drawings or as included in these specifications, with necessary interconnections, instrumentation, and control wiring.

1.3 FURNISHING OF EQUIPMENT

A. Unless specifically noted otherwise, automatic motor starters for all equipment requiring them shall be furnished under the section or division where equipment is specified and installed under this Section of the specifications.
B. Provide all labor, materials, and equipment necessary to properly install all motor starters. Provide motor starters for all new motors to be wired, where starters are not elsewhere specified under work of that Division which provides the motored equipment.
C. Unless specifically noted otherwise manual motor starters shall be furnished and installed under this section of the specifications.
D. Disconnect switches for 120V fractional HP exhaust fans to be provided by Division 23 contractor at exhaust fan. Any other required disconnect switch to be provided and installed by Division 26 contractor.

1.4 CONTROL ITEMS

A. Unless specifically noted otherwise all control, alarm and interlock wiring required for proper operation of equipment furnished by any other Contractor and the required raceways shall be furnished and installed under the Division where the equipment is specified.
B. Where required by electrical drawings, Division 23 specifications, and/or mechanical drawings this contractor shall connect power feeder to mechanical equipment via control devices furnished by Division 23 contractor. (i.e., starters, line voltage, T-stats, line voltage switch, control relays, etc.).
C. Provide and install power circuits to all control devices requiring them (i.e., 120V dampers, control panels, control devices, etc.) whether shown on drawings or not. Coordinate requirements of all Divisions and/or Sections of these Specifications prior to bid.

1.5 SUBMITTALS

A. Shop Drawings and Product Data:
   1. Shop Drawings, individually mounted AC Manual Starter
      a. Shop Drawings shall clearly indicate:
         i. Frame sizes and Interrupting Capacity of manual starter and/or disconnect unit.
         ii. Horsepower rating at rated voltage of manual starter and/or disconnect unit.
         iii. Electrical ratings.
         iv. Single line diagram for power and control connections with numbered terminals and all required accessories.
         v. All required accessories.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:
   1. Square D
B. Accepted Substitutions:
   1. General Electric
   2. Siemens
   3. Eaton

2.2 GENERAL

A. Motor starters shall be manual, magnetic, or combination type as denoted on the drawings.
B. Pilot lights shall have long-life lamps rated 7500 hours minimum.
C. Enclosures shall be NEMA 1 for indoor locations and NEMA 4SS for outdoor or wet locations except where indicated as NEMA-4X.
D. Multi-speed or stop type controllers shall have thermal overload relays in each ungrounded conductor for each speed or step.
E. Where multi-speed motors are scheduled on the drawings, the motor controls shall be compatible with the type of motor and have adjustable time deceleration for transition from high to low speeds.

2.3 INDIVIDUALLY MOUNTED AC MANUAL STARTERS

A. Where manual motor starter switch is called for on drawings, it shall be a combination across-the- line manual type starter with overloads and disconnect rated in accordance with NEMA Standards, sizes, and horsepower rating. Final rating of overloads shall be field set and recorded. Unit shall be mounted on NEMA 1 enclosures, unless otherwise noted.
B. Manual motor starter switch shall include green "run" pilot light and shall be surface or flush mounted as noted on drawings.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine area to receive motor-control units to assure adequate clearance for motor control unit installation.

3.2 INSTALLATION

A. Install motor control units in accordance with manufacturer's written instructions, and NEC.
B. All starters and their respective enclosures shall be firmly anchored to walls and supporting structures (where used) using appropriate hardware. Provide supporting (Unistrut type) channels on walls constructed of gypsum board or where otherwise necessary to provide a mechanically secure and permanent installation. Starters shall be installed with their turning axis of their handles approximately 5'-0" above finished floor. Provide rigid steel (galvanized for exterior use) mounting stands, brackets, plates, hardware, and accessories for a complete installation.
C. Starters shall be mounted where shown on the drawings. Where the starter also provides the code- required disconnecting means for a load, the starter shall be located within sight of the load and as close as feasible.
D. Provide fusing for all fusible switches.
E. Provide properly sized heater elements for every starter overload relay. The element shall be sized using the nameplate full load running current of the actual equipment supplied to the job.
F. Provide a heater element selection chart on the inside of each starter door.
G. Provide spare pilot light lamps to the Owner. Provide 2 of each type and size load.
H. Provide nameplate for each control units.

3.3 ADJUSTMENT AND CLEANING

A. Adjust operating mechanisms for free mechanical movement.

END OF SECTION

SECTION 26 36 23
MANUAL TRANSFER SWITCH

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. The transfer switch shall be provided as described herein and shown on Drawings. The transfer switch shall be capable of switching all classes of load and shall be rated for continuous duty when installed in a nonventilated enclosure.
B. Transfer switch shall be a true 4-pole type. The normal and emergency full load current and voltage ratings at 60 cycles shall be as called for on Drawings.

1.3 REFERENCES

A. IEEE Institute of Electrical and Electronics Engineers
B. NEC National Electrical Code
C. UL Underwriters Laboratories

1.4 QUALITY ASSURANCE/TESTS

A. As a precondition for approval, transfer switch shall be listed by Underwriters Laboratories in their Electrical Construction Materials Catalog under UL 1008 Standard for Transfer Switch Equipment and accepted for use on emergency systems.
B. When conducting temperature rise tests to paragraph 99 of UL 1008, the manufacturer shall include post-endurance temperature rise tests to verify the ability of the transfer switch to carry full rated current after completing the overload and endurance tests.
C. The switch shall meet or exceed the voltage surge withstand capability in accordance with IEEE Standard C37.90.1 and the impulse withstand voltage test in accordance with NEMA Standard ICS 1-109.

1.5 SHOP DRAWINGS

A. Submit shop drawings and product data clearly indicating:
    1. Cabinet dimensions.
    2. Wiring diagrams.
    3. Interrupting or withstanding current rating.
    4. All electrical characteristics and data as required to show compliance with these Specifications.

PART 2 – PRODUCTS

2.1 GENERAL

A. The transfer switch shall be double throw manually actuated.
B. The transfer switch shall be capable of transferring successfully in either direction with 70 percent of the rated voltage applied to the switch terminals.
C. The transfer switch shall be equipped with a safe manual operator designed to be operated in the loaded condition and to prevent injury to operating personnel.
D. Transfer switch maximum dimensions shall be as shown on drawings.
E. Acceptable Manufacturers:
    1. The transfer switches shall be manufactured by:
        a. Square D (Basis of Design)
        b. G.E.
        c. Eaton
        d. Siemens

PART 3 – EXECUTION

3.1 INSTALLATION

A. The transfer switch shall be installed as shown on the Drawings in accordance with the manufacturer's recommendations and all applicable codes.
B. Provide color-coded cam-lock connectors for connection of a portable generator using portable power cables. Mount in bottom of switch, provide weatherproof covers. Connectors shall be rated equal to the rating of the switch.

END OF SECTION

SECTION 26 41 00
LIGHTNING PROTECTION for STRUCTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding for lightning protection.
B. Air terminals and interconnecting conductors.

1.2 RELATED SECTIONS

A. Section 07 52 00 - Roofing systems.

1.3 REFERENCES

A. LPI-175 - Lightning Protection Installation Standard
B. LPI-177 – Inspection Guide for LPI Certified Systems
C. NFPA 780 – Lightning Protection Code
D. UL 96 – Standard for Lightning Protection Components
E. UL 96A – Standard for Installation Requirements for Lightning Protection Systems.

1.4 SYSTEM DESCRIPTION

A. Lightning Protection systems: Provide conductor system protecting roofs consisting of air terminals on roofs, roof-mounted mechanical equipment, chimneys, stacks, steeple, parapets, and penthouse roofs; bonding of structure and other metal objects; grounding electrodes; interconnecting conductors, and irrigation pumps and structure.

1.5 SUBMITTALS

A. Section 01 33 00 – Submittals Procedures for submittals.
B. Shop Drawings:
   1. Indicate layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects.
   2. Include terminal, electrode, and conductor sizes and connection and termination details.
C. Product Data: Provide dimensions and materials of each component and include indication of listing in accordance with UL 96.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under Provisions of Section 01 33 00.
B. Record the actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 780.

B. Perform work in accordance with UL 96A and provide master label.
C. Perform work in accordance with LPI-175 and provide LPI certification.
D. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in lightning protection equipment with minimum three years documented experience and member of the Lightning Protection Institute.
B. Installer: Authorized installer of manufacturer with minimum three years documented experience and certified by the Lightning Protection Institute.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.10 COORDINATION

A. Coordinate work with roofing, exterior, and interior finish installations.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Air Terminals: Provide either solid copper or aluminum with adhesive bases for single-ply roof installations.
B. Air Terminal for Chimney: Lead-coated copper
C. Decorations: Ball
D. Grounding Rods: Solid copper
E. Ground Plate: Copper
F. Grounding down conductors and grounding ring electrodes: Copper.
G. Conductors except those noted above copper or aluminum.
H. Connectors and Splicers: Bronze

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 780, UL 96A, and LPI-175.
B. Connect conductors using exothermic welding process.
   1. Protect adjacent construction elements and finishes from damage.
C. Bond exterior metal bodies on building to the lightning protection system and provide intermediate level interconnecting loops 60' (18 m) on center.
D. Do not install copper lightning protection materials on aluminum roofing, siding, or other aluminum surfaces.
E. Do not install aluminum lightning protection materials on copper surfaces.
F. Protect copper components installed within 24" of the top of a chimney or vent emitting corrosive gases by a hot-dipped lead coating or equivalent.
G. Down conductors shall be routed concealed in PVC sleeves installed in the structure.

H. Connect conductor to metal bodies of conductance located within 6' by secondary conductor.
I. Provide lightning protection for buildings, covered walkways, press boxes, scoreboards, and all other structures required by NFPA 780.

3.2 FIELD QUALITY CONTROL

A. Obtain the services of Underwriters Laboratories, Inc. to provide inspection and labeling of the lightning protection system in accordance with UL 96A.
B. Perform inspection and testing in accordance with NFPA 780.
C. Provide owner with an Underwriters Laboratories final certification of the lightning protection system.
D. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements.
    1. Refer to Section 01 91 00 - Commissioning, for further details.

3.3 DEMONSTRATION AND TRAINING

A. Training of the Owner’s operation and maintenance personnel is required in cooperation with the Owner's Representative.
    1. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems.
    2. Schedule the instruction in coordination with the Owner's Representative after submission and approval of formal training plans.
    3. Refer to Section 01 91 00, Commissioning, for further contractor training requirements.
B. Provide demonstration and training for all types of lightning protection systems installed in this project.

END OF SECTION

SECTION 26 43 00
SURGE PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 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.

1.2 SUMMARY

A. Section includes requirements for surge protective devices.

1.3 REFERENCES

A. The latest edition of the following references shall apply to the work of this section:
1. ANSI/IEEE C62.33 Standard Test Specifications for Varistor Surge Protective Devices
2. ANSI/IEEE C62.41 IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
3. ANSI/IEEE C62.45 IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits
4. NFPA 70 National Electrical Code
5. NFPA 780 Standard for Installation of Lightning Protection Systems
6. UL 96A Standard for Lightning Protection Components
7. UL 1363 Standard for Safety Relocatable Power Taps
8. UL 1449, 3rd Edition Standard for Safety for Surge Protective Devices

1.4 REGULATORY REQUIREMENTS

A. Equipment Certification: Surge protective devices shall be listed by Underwriters Laboratories shall bear the UL seal and be marked in accordance with referenced standard. Surge protective devices shall be UL listed and labeled for intended use.
B. Surge protective devices shall be installed and located in accordance with requirements of all applicable National Fire Protection Association (NFPA) codes (including NFPA 70 and NFPA 780).
C. Comply with all standards and guides as listed under “References” above.

1.5 DESIGN REQUIREMENTS

A. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building electrical and electronics systems from the effects of line induced transient voltage surge and lightning discharge as indicated on Drawings or specified in this Section for systems with voltages between 120 VAC and 480VAC (single phase or three phase).
B. Equipment specified covers Surge Protective Devices (SPD).

C. Provide surge protective devices for the following equipment:
   1. On each main electrical service panel at each building.
   2. On distribution and branch panels as called for on Drawings or in these Specifications.
   3. All electronic communications equipment installed under Divisions 27 and 28 including, but not limited to, fire alarm, intercom, security, television, premise distribution, and sound systems.
   4. Site lighting pole light circuits.
   5. Additional locations as required by NFPA 780.
   6. At point of use locations (receptacles, plug-in units) as required.
   7. On all automatic transfer switches (ATS).
   8. On input to each UPS system.

1.6 SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract Documents and Section Submittals.
B. Submit Product Data for each type of surge protective device:
   1. Dimensions.
   2. Means of mounting.
   3. Compliance with UL Standards referenced.
   4. Compliance with IEEE Standards referenced.
   5. Design type (Hybrid, MOV).
   6. Internal fusing.
   7. Recommended overcurrent protection.
   8. Size of wire leads.
   9. Visual failure indicator.
   10. Warranty.
   11. Performance data showing compliance with performance as specified herein.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance (O & M) data as called for in Section 26 01 00 Operation and Maintenance Manuals.
B. O & M data to include:
   1. All accepted shop drawings, product data, and/or cut sheets.
   2. Installation, connection, and maintenance information on each type of surge suppression.
   3. Procedure and/or timetable for recommended periodic inspection of devices to determine continued usefulness.

1.8 QUALITY ASSURANCE

A. All surge protective devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment.
B. The surge protective device manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor. Factory representatives are to accept installation prior to Substantial Completion.

1.9 COORDINATION/PROJECT CONDITIONS

A. Verify proper grounding is in place.
B. Verify proper clearances, space, etc. is available for surge protective devices.
C. Coordinate so that proper overcurrent device, as recommended by manufacturer, is installed to feed each surge protective device.

1.10 WARRANTY

A. All surge protective devices shall be warranted to be free from defects in materials and workmanship for a period of ten years.
B. Any surge protective device which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced by the manufacturer and installer at no cost to the Owner.

1.11 DEFINITIONS/ABBREVIATIONS

A. VPR: UL Voltage Protection Rating
B. MCOV: Maximum Continuous Operating Voltage
C. SCCR: Short Circuit Current Rating
D. IN: Inominal

PART 2 – PRODUCTS

2.1 GENERAL

A. Surge protective devices shall be designed for the specific type and voltage of electrical service and shall provide clamping action for both normal (L-N) and common (N-G) mode protection.
B. Surge protective devices shall be of a hybrid design, and include circuitry with tight, wave- tracking clamping characteristics.
C. Surge protective devices shall be designed to withstand a maximum continuous operating voltage of not less than 115 percent of nominal RMS line voltage.
D. Surge protective devices shall contain internal safety fusing to disconnect the surge protective device from the electrical source if the surge protective device fails, in order to prevent catastrophic failure modes.
E. Surge protective devices shall be fail safe, shall allow no follow-through current, shall have repeated surge capability, shall be solid state, shall be self-restoring, and shall be fully automatic.
F. Surge protective devices shall be UL 1449 listed under UL Category Code VZCA and shall be accepted for the location in which they are installed.

2.2 SERVICE ENTRANCE SURGE PROTECTIVE DEVICES

A. General: Provide service entrance surge protective devices on each main electrical service panel at each building and/or structure. Surge protective devices shall meet or exceed the following (in addition to requirements under ‘General’ above):
   1. Surge protective devices shall be tested per UL 1449 requirements to determine voltage protection rating (VPR).

2. Surge protective devices shall be sequential surge tested as per IEEE C62.45, and shall withstand 1000 test cycles at 10 kA, Cat. C3 test criteria.
3. Enclosure:
   a) UL listed
   b) Fire retardant
   c) NEMA 1 or 3R as required for each location.
   d) Flush, Switchboard and/or Surface mounted as required for each location.

B. Modular Design:
1. Replaceable module design. The panel mounted surge protective device shall be designed with replaceable modules for purposes of in-service replacement.
2. The surge protective device shall be designed with redundant back-up surge protection in the event of a module failure.
3. Module status indicators shall be provided to indicate individual module status. When a module has failed, the module LED status indicator shall indicate said failure.
4. Unit status indicators shall be provided to indicate the status of the complete surge protective device. The LED status indicators shall be located on the hinged front cover to redundantly indicate module or unit failure.
5. Minimum Surge Capacity:
   a) 240,000 amps. per phase.
6. Voltage Protection Ratings (VPR) and Maximum Continuous Operating Voltage. Comply with the following maximum voltages for UL 1449 testing requirements:

240 kA Unit	L-L	L-N	L-G	N-G	MCOV	In
120/208 V, 3ph, 4W, wye					150V	
UL 1449	1200V	700V	700V	700V		20 kA
277/480 V, 3ph, 4W, wye					320V	
UL 1449	2000V	1200V	1200V	1200V		20 kA

7. Short Circuit Current Rating:
   a) 100,000 amps.
8. Manufacturers
   a) 240 kA Units

1. LEA International PV400 Series for applied voltage in enclosure as required on Drawings, as specified above, and/or as required by applicable codes.
2. Advanced Protection Technologies TE/xxXAS/25 Series for applied voltage in enclosure as required on Drawings, as specified above, and/or as required by applicable codes.
3. Atlantic Scientific ZoneMaster 240 All Mode Series for applied voltage in enclosure as required on Drawings, as specified above, and/or as required by applicable codes.

2.3 SECOND LEVEL SURGE PROTECTIVE DEVICES AND UPS/ATS SYSTEMS.

A. General. Provide second level surge protective devices on each second level of the distribution system (including sub panels) and on all major electronic equipment including UPS Systems and ATS Systems. Surge protective devices shall meet or exceed the following (in addition to requirements under 'General' above):
   1. Surge protective devices shall be tested as per UL 1449 requirements to determine voltage protection ratings (VPR – 3 kA).
   2. Surge protective devices shall be sequential surge tested as per IEEE C62.45, and shall withstand 1000 test cycles at 3 kA, Cat. B3 test criteria.
   3. Enclosure:
      a) UL listed.
      b) Fire retardant.
      c) NEMA 1 or 3R as required for each location.
      d) Flush, Switchboard and/or Surface mounted as required for each location.

B. Non-Modular Design:
   1. Status indicators shall be provided to indicate individual module status. When a module has failed, the module LED status indicator shall indicate said failure. The LED status indicators shall be located on the front cover to redundantly indicate module or unit failure.
   2. Minimum Surge Capacity:
      a) 100 kA per phase.
   3. Voltage protection rating (VPR) and maximum continuous operating voltage. Comply with the following maximum voltages for UL 1449 testing requirements:

100 kA Unit	L-L	L-N	L-G	N-G	MCOV	In
120/208 V, 3ph, 4W, wye					150V	
UL 1449	1000 V	700V	700V	600V		20 kA
277/480 V, 3ph, 4W, wye					320V	
UL 1449	2000 V	1200V	1200V	1200V		20 kA

   4. Short Circuit Current Rating: 100,000 amps.
   5. Manufacturers:
      a) 100 kA Units:
         1. Advanced Protection Technologies Series TE/***XDS/10 for applied voltage in enclosure as required on drawings, as specified above, and/or as required by applicable codes.
         2. LEA International SP100 Plus Series for applied voltage in enclosure as required on Drawings, as specified above, and/or as required by applicable codes.
         3. Atlantic Scientific Zone Sentinel Series for applied voltage in enclosure as required on drawings, as specified above, and/or as required by applicable codes.

2.4 EXTERIOR LIGHTING POLES CIRCUITS

A. Provide surge arrester in pole handhole.
B. Surge arrester shall be UL listed as a Type 1 surge arrester.

2.5 SERVICE SURGE ARRESTER

A. Service surge arrester shall be UL listed as Type 1 surge arrester and as required to comply with Local Authority Having Jurisdiction and UL 96A requirements.
B. This suppressor shall be connected on the line side of service to each building and where required to meet UL 96A.
C. 50 kA per phase rating.
D. Minimum short circuit current rating: 200,000 amps
E. Enclosure:
    1. NEMA 4X polycarbonate
F. Manufacturers:
    1. Advanced Protection Technologies SPDEE Series for applied voltage
    2. Atlantic Scientific Zone Defender Curve Series for applied voltage

2.6 POINT OF USE LOCATION (120 VOLT)

A. UL 1449 listed.
B. 20 Amp, 120V rated. All components must be 20 Amp rated.
C. Surge protection devices shall be tested per IEEE C62.41 for Categories A and B.
D. Normal mode (L - N), and common mode (L+N-G) protection.
E. Internal fusing.
F. Hybrid design.
G. Indicators for normal operation and failure indication.
H. Enclosure:
    1. Fire retardant high impact, phenolic or plastic housing or metal enclosure.
I. Clamping voltage UL 1449, Line to Neutral, Category B impulse at (3 kA, 8 x 20 µs): 350V @ 120V.
J. Maximum Surge Capacity: 26,000 Amps.
K. Maximum continuous operating voltage: 115 percent of line voltage.
L. Provide hardwire connection or add 20-amp receptacle device to hardwired devices to match equipment being protected and maintain UL Listing. Device shall be a feed-through design. Parallel connected devices are not acceptable.
M. Manufacturers:
    1. Leviton 51020-WM

2.7 POWER PLUG-IN UNITS

A. UL 1449 Listed.
B. 15 Amp, 120V rated. All components must be 15 Amp rated.
C. Surge protection devices shall be tested per IEEE, C62.41 for Categories A and B.
D. Normal mode (L - N), and common mode (L+N-G) protection.
E. Internal fusing. Resettable circuit breaker.
F. Hybrid design.
G. Operational indicator lamp.
H. Enclosure:

1. Fire retardant high impact, phenolic or plastic housing or metal enclosure.

I. Clamping voltage UL 1449, Line to Neutral, Category B impulse at (3 kA, 8 x 20 µs): 350V @ 120V.
J. Maximum Surge Capacity: 13,000 Amps.
K. Maximum continuous operating voltage: 115 percent of line voltage.
L. Manufacturers:
   1. Control Concepts SP Series
   2. Leviton
   3. Wiremold

PART 3 – EXECUTION

3.1 GENERAL

A. Provide, install, and connect surge protective devices at first piece of electrical equipment (panel, switchboard, ATS, etc.) that the electrical service encounters as it enters the facility.
B. Provide, install, and connect surge protective devices at each branch panel as noted on drawings.
C. Provide, install, and connect surge protective devices at each Automatic Transfer Switch (ATS) and Uninterruptible Power Supply (UPS) in project whether shown on Drawings or not.
D. Provide, install, and connect surge protective devices in pole near hand hole of all exterior lighting poles whether shown on Drawings or not.
E. Provide, install, and connect surge protective devices at location where Divisions 27 and 28 equipment is connected to line voltage (120V). Provide cords and receptacles as required to connect surge protective devices to equipment being protected and maintain UL listing.
F. Provide surge protective devices at panel feeding exterior site lighting circuits for each panel feeding site lighting.

3.2 INSTALLATION OF SURGE PROTECTIVE DEVICES

A. Surge protective devices for other than Divisions 27 and 28 equipment shall be installed as close as practical to the electric panel or electronic equipment to be protected, consistent with available space.
B. Surge protective devices for Divisions 27 and 28 equipment power source shall be coordinated with the individual specification section contractor. Locate in terminal cabinet with surge protective devices and bond together.
C. Surge protective devices shall be close nipped to the device being protected in a position near the neutral bus which will minimize lead length between surge protective devices and the buses or control breaker to which the surge protective device connects. Suppressor leads shall not extend beyond the surge protective device manufacturer's recommended maximum lead length without specific acceptance of the Engineer.
D. Location shown on Drawings is diagrammatic only. Provide flush mount trim for surge protective device units at flush mounted panelboards. Provide NEMA 4X enclosures for TVSS units in exterior locations.

E. Surge protective devices shall be installed in a neat, workmanlike manner. Lead dress shall be as short and as straight as possible and be consistent with recommended industry practices for the system on which these devices are installed.
F. Supplementary grounding and bonding connections required between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using #6 AWG core copper conductor and accepted connections unless otherwise noted. Referenced to a common earth ground.
G. Surge protective devices shall be installed in a manner that allows simple replacement within short periods of downtime.
H. Surge protective devices other than point of use type and those for exterior lighting poles shall be installed with a means of disconnecting the suppressor at the panel. At the main service entrance location, provide a dedicated 30-amp, 3 phase CB, 100,000 AIC for the surge protective device. At the distribution secondary and/or subpanels location, provide dedicated 20 amp or 30-amp, 3 phase CB, for the surge protective device. Labels disconnect or CB "Surge Protector." Fused disconnects may be substituted for the CB, with the acceptance of the Engineer. Contractor to change rating of CBs noted above as required to properly provide system as recommended by manufacturer.

END OF SECTION

SECTION 26 51 13
INTERIOR LIGHTING FIXTURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Light fixtures furnished under this Division shall be furnished complete with lamps and all necessary trim and mounting hardware and installed as shown on the drawings.
B. Light fixtures shall be neatly and firmly mounted, using standard supports for outlets and fixtures.
C. Lamps shall be included in the system guarantee for a period of thirty (30) days after final acceptance of the building.

1.3 SECTION INCLUDES

A. Interior luminaires and accessories.
B. Ballasts.
C. Lamps.
D. Luminaire accessories.

1.4 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.
B. ANSI/NFPA 101 - Life Safety Code.
C. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.5 SUBMITTALS

A. Submit Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
1. Shop drawings shall be submitted for all fixtures that require modifications either as specified or as required to fit this project architectural field conditions (i.e. luminous ceiling, wall/slot fixtures, special fixtures).
2. Shop drawings shall be complete showing all dimensions and installation instructions required for this project's conditions.
B. Submit Product Data: Provide dimensions, ratings, and performance data. Product data shall be submitted for all light fixtures showing:
    1. Dimensions
    2. UL Label
    3. Fusing
    4. Luminaire Disconnect
    5. Metal gauge

6. Lens/louver thickness
7. Finish
8. Voltage
9. Lamps

1.6 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data: Include replacement parts list.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Conform to requirements of NFPA 101.
C. Conform to requirements of ADA.
D. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.9 PRODUCT STORAGE AND HANDLING

A. Physically protect fixtures against damage as recommended by manufacturer.

1.10 MAINTENANCE MATERIALS

A. Provide to Owner:
   1. Ten (10) of each size/type of fuses.
   2. Six (6) of each type of lamps.
   3. One carton or 24, whichever is greater, in manufacturer's carton of 4 foot T-8 lamps.

PART 2 – PRODUCTS

2.1 LUMINAIRES/FIXTURES

A. Furnish products as specified in schedule on Drawings.
B. Install lamps and specified accessories at factory.
C. All light fixtures shall adhere to UL Test Standard #1571 and Article #410-65C of the National Electrical Code. All manufacturers shall provide the required thermal protection as required.

2.2 LAMPS

A. Manufacturers
   1. Sylvania, GE, or Phillips.
B. All light sources shall be LED.

C. All fixture types shall be as scheduled on the drawings.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrate and supporting grids for luminaires.
B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and NEC
B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
C. Support luminaires larger than 2 x 4-foot (600 x 1200 mm) size independent of ceiling framing.
D. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
F. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure.
G. Install recessed luminaires to permit removal from below.
H. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
I. Recessed luminaires not rated for contact with insulation (Type IC) shall not be installed within three inches of any insulation or as required by the NEC. All recessed luminaires installed within three inches of insulation shall be identified for contact with insulation and bear the UL Type IC label.
J. Install wall mounted luminaires and exit signs at height as indicated on Drawings, or as required by ADA, Local Codes and State Codes. Where conflict exists between what is shown on drawings and what is required by codes, install fixture as required by codes.
K. Install accessories furnished with each luminaire.
L. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
M. Bond products and metal accessories to branch circuit equipment grounding conductor.
N. Install specified lamps in each luminaire and exit sign.
O. Where ceiling mounted fixtures are called for in the Light Fixtures Schedule and on the drawings, this Contractor shall provide fixture trims and supports as required to match type of ceiling system which will be furnished. No ceiling fixtures shall be ordered until the Ceiling System Installer has given written acceptance of the method and location of fixture hanging and fixture type.
P. Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Ceiling framing members must be securely attached to each other and to the building structure as required by all applicable codes and standards.
Q. All interior and exterior light fixtures shall not have any labels exposed to normal viewing angles. This includes manufacturer labels and UL labels. All labels shall be concealed within the body of the fixture and/or luminaire. No manufacturers name or logo shall appear on the exterior of any light fixtures unless accepted in writing by the engineer.

R. Miscellaneous (provide and install complete):
   1. Low voltage transformers for all low voltage light fixtures.
   2. Tents as required for fixtures in fire rated ceilings as per applicable codes.
   3. Thermal protection for all fixtures with tents or fixtures surrounded by insulation as per applicable codes.
   4. Heat removal or air supply slot covers for all fixtures requiring them as determined by mechanical engineer.

S. Ceiling surface mounted fluorescent fixtures installed in exposed ceiling areas are to be suspended from ceiling structure with minimum 3/8" all-thread rods and 1-1/2" x 1-1/2" Kindorf channels, full length of fixture/row. Mount outlet box at structure with flexible connection to fixture.

T. Coordinate fixtures installed in mechanical rooms with piping and ductwork prior to installation and relocate fixtures as required to provide proper illumination and access.

U. Electrical contractor shall remotely locate all transformers called for in these specifications in a well ventilated and easily accessible space to comply with all codes. Revise circuitry as shown on plans as required to facilitate transformer/fixture location.

V. Voltage for all fixtures shall match the voltage of the lighting circuit fixture is connected to. Coordinate with electrical drawings.

W. All light fixtures shall have label near lamp socket, out of view of public stating maximum wattage of lamp allowed in fixture. Maximum wattage to be stated is wattage as shown on schedule of lighting equipment herein. Circuits are based on these wattages, circuitry, etc. Any failure to comply with this requirement shall be responsibility of contractor. Location of labels must meet acceptance of lighting designer, architect, and engineer.

X. Verify all fixtures have a luminaire disconnect. Provide luminaire disconnect in any luminaires where factory failed to install luminaire disconnect.

3.3 ADJUSTING

A. Aim and adjust luminaires as directed.
B. Adjust exit sign directional arrows as indicated.
C. Relamp luminaires that have failed lamps at Substantial Completion.

3.4 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.
B. Remove dirt and debris from enclosure.
C. Clean photometric control surfaces as recommended by manufacturer.
D. Clean finishes and touch up damage.

3.5 DEMONSTRATION

A. Provide demonstration of luminaire operation.

3.6 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.7 CLEAN-UP

A. Luminaires:
   1. Clean free from dust and dirt. Wash lens and glassware using cleaner such as "Windex" and dry with absorbent paper. Clean plastic per manufacturer's recommendations; do not wipe. Lenses which are kept in original containers until immediately prior to final inspection may not require cleaning. Clean "Alzak" aluminum surfaces (reflectors, fixture cones and the like) per manufacturer's recommendations being careful to remove fingerprints and smudges.
   2. It is the Contractor's responsibility to remove any UL labels or manufacturer’s labels from areas of fixture exposed to view and relocate label to non-obtrusive area on fixture.

END OF SECTION

SECTION 26 52 13
EMERGENCY LIGHTING EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Light fixtures furnished under this Division shall be furnished complete with lamps and all necessary trim and mounting hardware and installed as shown on the drawings.
B. Light fixtures shall be neatly and firmly mounted, using standard supports for outlets and fixtures.
C. Lamps shall be included in the system guarantee for a period of thirty (30) days after final acceptance of the building.

1.3 SECTION INCLUDES

A. Emergency lighting units.
B. Emergency exit signs.
C. Emergency fluorescent lamp power supplies.

1.4 REFERENCES

A. FS W-L-305 - Light Set, General Illumination (Emergency or Auxiliary)
B. NFPA 101 – Life Safety Code
C. NEMA WD1 - General-Purpose Wiring Devices.
D. ADA - Americans with Disabilities Act of 1990.
E. ANSI C78.379 - Electric Lamps - Incandescent and High - Intensity Discharge Reflector Lamps - Classification of Beam Patterns.
F. ANSI C82.1 - Ballasts for Fluorescent Lamps - Specifications.
G. ANSI/NFPA 70 - National Electrical Code.
H. Florida Building Code (FBC)
I. Florida Fire Prevention Code (FFPC)

1.5 SUBMITTALS

A. Submit Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
    1. Shop drawings shall be submitted for all fixtures that require modifications either as specified or as required to fit these projects architectural field conditions (i.e., specialty exit signs).
    2. Shop drawings shall be complete showing all dimensions and installation instructions required for this project's conditions.

B. Submit Product Data: Provide dimensions, ratings, and performance data. Product data shall be submitted for all fixtures showing:
   1. dimensions
   2. UL Label
   3. fusing
   4. metal gauge
   5. lens/louver thickness
   6. finish
   7. voltage
   8. lamps
   9. batteries

1.6 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data: Include replacement parts list.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Conform to requirements of NFPA 101.
C. Conform to requirements of ADA.
D. Conform to requirements of FBC.
E. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.9 PRODUCT STORAGE AND HANDLING

A. Physically protect fixtures against damage as recommended by manufacturer.

1.10 MAINTENANCE MATERIALS

A. Provide to Owner:
   1. Ten (10) of each size/type of fuses.
   2. Six (6) of each type of lamps.

1.11 WARRANTIES

A. All fixtures furnished under this Division shall be covered by a warranty of not less than five (5) years from date of final completion against defects. Warranty shall include payment for normal labor costs of replacement of inoperative in-warranty fixtures.

PART 2 – PRODUCTS

2.1 LUMINAIRES/FIXTURES

A. Furnish products as specified in schedule on Drawings.
B. Install ballasts, lamps, and specified accessories at factory.
C. All light fixtures shall adhere to UL Test Standard #1571 and Article #410-65C of the National Electrical Code. All manufacturers shall provide the required thermal protection as required.

2.2 SELF-CONTAINED EMERGENCY POWER EXIT SIGNS

A. Type: Exit signs with integral battery-operated emergency power supply, including power failure relay, test switch, AC ON pilot light, battery, and fully automatic two-rate charger.
B. Battery: Sealed nickel cadmium cell, requiring no maintenance or replacement for 10 years under normal conditions. Batteries to have a 9-year warranty and provide for 90-minute capacity.
C. Exit sign fixture shall be suitable for use as emergency lighting unit.
D. Exit sign shall have universal mount, universal arrows, down light, stencil face. Arrows shall be as shown on drawings.
E. Exit signs to have long life LED lamps for normal and emergency operation; integral battery; battery charger; transformer; test switch; and LED charge monitor light.
F. Transformer shall be dual rated for 120 or 277 volts.
G. Furnish all lamps required.
H. Charger shall comply with UL 924.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install units plumb and level.
B. Adjust units as required to align with building lines and with each other. Secure to prohibit movement.
C. Adjust exit sign directional arrows as indicated. Re-adjust at project completion as required by authority having jurisdiction.
D. Install illuminated exit signs as shown on drawings, as herein specified, or as required by applicable codes.
E. Connect exit signs, inverter/battery units to local lighting circuit ahead of all switches.
F. Install suspended exit signs using pendants supported from swivel hangers.
G. Mount all exit signs at 7'-6" AFF to bottom of fixture or as required to meet ADA requirements. Provide all mounting accessories/hardware as required for proper mounting including pendant/swivel hangers.

END OF SECTION

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 01, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Light fixtures furnished under this Division shall be furnished complete with lamps and all necessary trim and mounting hardware and installed as shown on the drawings.
B. Light fixtures shall be neatly and firmly mounted.
C. Lamps shall be included in the system guarantee for a period of thirty (30) days after final acceptance of the project.
D. Provide and install concrete base as noted on drawings. Construct concrete base per applicable section and/or division of the specifications.

1.3 SECTION INCLUDES

A. Exterior luminaires and accessories.
B. Poles.

1.4 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code
B. IES RP-8 - Roadway Lighting
C. IES RP-20 - Lighting for Parking Facilities
D. ASCE 7-10 - Minimum Design Loads of Buildings and Other Structures
E. IES – Illuminating Engineering Society
F. NESC - National Electrical Safety Code
G. FBC - Florida Building Code

1.5 SUBMITTALS

A. Submit point to point photometric analysis of the entire job site to the property line. Utilize photometric data obtained from submitted fixtures only. Verify that all submitted fixture types and light levels are compliant with all local codes, ordinances, and the Authority Having Jurisdiction. Submittal will not be reviewed by the A/E without this narrative data.
B. Submit Product Data: Provide dimensions, ratings, and performance data. Product data shall be submitted for all light fixtures showing:
    1. Dimensions
    2. UL label
    3. Fusing
    4. Luminaires disconnect.
    5. metal gauge

6. lens thickness
7. finish
8. voltage
9. lamps
10. lightning arrester, surge arrester/, and/or surge protection device

C. Submit drawings on concrete base complete with rebars, etc.

1.6 PROJECT RECORD DOCUMENTS

A. Submit record documents to accurately record actual locations of each luminaire.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data: Include instructions for maintaining luminaires.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' experience.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of the following:
1. ANSI/NFPA 70
2. FBC and ASCE 7-10
3. IES
4. NESC

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site.
B. Accept products on site. Inspect for damage.
C. Protect poles from finish damage by handling carefully.
D. Store and handle solid wood poles in accordance with ANSI O5.1.

1.11 COORDINATION

A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

PART 2 – PRODUCTS

2.1 GENERAL

A. All lighting fixtures mounted outdoors subject to dampness and insects shall have gasketing material between lens door and frame to completely seal interior of fixture. Knockouts and holes in fixtures housing shall be closed and sealed. All fixtures shall be complete with lamps, shielding, brackets, concrete bases, anchor bolts and all necessary fittings and accessories for a complete installation.

B. Furnish products as specified on Drawings.
C. All exterior light fixtures shall not have any labels exposed to normal viewing angles. This includes manufacturer labels and UL labels. All labels shall be concealed within the body of the fixture and/or luminaire. No manufacturer's name or logo shall appear on the exterior of any light fixtures unless accepted in writing by the engineer.
D. All light fixtures shall adhere to UL Test Standard #1571 and NEC 410.115(C). All manufacturers shall provide the required thermal protection as required.
E. Pole luminaires, poles, and concrete bases shall comply with applicable requirements of IES, NESC, ASCE, FBC, .and including but not limited to their requirements for illumination, uniformity, construction, wind loading, pole setback, breakaway, installation, glare criteria.
F. All site lighting fixtures/luminaries that may spill light onto adjacent properties shall have glare control shield installed on all fixtures/luminaries as required to meet the glare control requirements of applicable codes and standards. Add required glare control shield to order/model number of all site lighting fixtures.

2.2 FIXTURES

A. All light sources shall be LED.
B. All fixtures and poles shall be as scheduled and detailed on the drawings.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine excavation and concrete foundation for lighting poles.
B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

A. Install all fixtures in accordance with manufacturers' written instructions, NEC, IES, ASCE, FBC, and NESC.
B. Install lighting poles at locations indicated.
C. Install poles plumb. Provide double nuts to adjust plumb. Grout around each base.
D. Install lamps in each luminaire.
E. Bond luminaires, metal accessories and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrodes at each pole. See Section Grounding and Bonding.
F. Where ceiling mounted fixtures are called for in the Light Fixtures Schedule and on the drawings, this Contractor shall provide fixture trims and supports as required to match type of ceiling system which will be furnished. No ceiling fixtures shall be ordered until the Ceiling System Installer has given written acceptance of the method and location of fixture hanging and fixture type. Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Clips identified for use with the type of ceiling framing member(s) and fixture(s) shall also be permitted.

G. All exterior post/pole mounted light fixtures shall have hand hole near base. Hand hole shall provide easy access to light fixture fusing and lightning protection ground lug. Lightning protection ground lug shall be provided inside post/pole, electrically in contact with pole, for connection to ground rod. Provide and install ground wire from ground lug to ground rod, concealing ground wire through post/pole base. Anchor bolts to be galvanized.
H. Pole installation shall comply with wind loading criteria stated in ASCE 7-10 and Florida Building Code. Use V velocity = 140 mph; and the formulas and tables presented in ASCE 7-10.
I. Provide soil compacting and/or treatment to assure wind loading can be achieved for direct buried poles.
J. Ductseal shall be installed to seal all conduits entering exterior light fixtures from underground.
K. Lightning arrester and in-line fusing to be located at handhole location of pole for easy access.
L. Verify all fluorescent fixtures have a luminaire disconnect. Provide luminaire disconnect in any luminaires where factory failed to install luminaire disconnect.

3.3 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.4 ADJUSTING

A. Aim and adjust luminaires to provide illumination levels and distribution as directed.
B. Re-lamp luminaires which have failed lamps at Date of Substantial Completion.

3.5 GLARE CONTROL

A. Provide, install, and adjust glare control shields to prevent light glare on adjacent properties.

3.6 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.
B. Remove dirt and debris from enclosure.
C. Clean photometric control surfaces as recommended by manufacturer.
D. Clean finishes and touch up damage.
E. Luminaires:
   1. Clean free from dust and dirt. Wash lens and glassware using cleaner such as "Windex" and dry with absorbent paper. Clean plastic per manufacturer's recommendations; do not wipe. Lenses which are kept in original containers until immediately prior to final inspection may not require cleaning. Clean "Alzak" aluminum surfaces (reflectors, fixture cones and the like) per manufacturer's recommendations being careful to remove fingerprints and smudges.
   2. It is the Contractor's responsibility to remove any UL labels or manufacturer’s labels from areas of fixture exposed to view and relocate label to non-obtrusive area on fixture.

END OF SECTION

SECTION 27 05 00
COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Common work results for communications systems including general project requirements, other related specification sections, communications references, standards, definitions, abbreviations and acronyms, quality control requirements, communication submittals to include shop drawings, product and material data sheets, project record documentation, testing, certification, and other items required, for complete functioning communications system.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. Florida Building Code, 2010 Edition.
C. NFPA 70 (National Electrical Code, 2017 Edition).
D. Telecommunications Standards:
   1. ANSI/TIA/EIA standards and BICSI methodologies (TDMM and CO-OSP). Reference to term “telecommunications network”, is hereinafter referred to as Information Transport System Installation (ITSI).
   2. Methodologies refers to BISCI manuals for telecommunications design and CO-OSP.
E. American Standards for Testing Materials (ASTM).
F. Underwriters Laboratories (UL).

1.3 REFERENCES, DEFINITIONS, AND ACRONYMS

A. See Section 01 42 00 – References for additional reference standards, abbreviations, definitions, and acronyms.
B. See BICSI Dictionary, 3rd Edition for additional work meanings for communications work.
C. Structured Cabling System Description:
   1. Information Transport System includes copper and optical fiber, and equipment owned by outside providers carrying Owner information. Pathways are not limited to Owner’s system but may include those owned by third parties. Information Transport System may be referred to as “the network.” Elements of Information Transport System to be handled uniquely within overall Information Transport System will be specifically addressed (e.g., fire alarm cabling). This term replaces telecommunication network in building codes, standards, or methodologies.

2. Inside Cable Plant: Part of Information Transport System running within building. Inside Cable Plant elements includes workstation outlet assembly, cabling to workstation from network rooms, backbone cabling within buildings, backbone cabling running between physically contiguous buildings network racks and hardware (routers, switches, hubs, firewalls, etc.), patch panels, punch blocks fiber distribution panels patch cords, and cross-connect cables/wires. Inside Cable Plant will be referred to as "ISP."
3. Outside Cable Plant: That part of Information Transport System running between buildings, from building to a definable exterior point, between definable exterior points, or from a non-Owner source to Owner's building or definable exterior point, including termination punch blocks, fiber distribution panels, interior splices for outside to inside optical fiber transition, and other initial device into which outside cable attaches. The Outside Cable Plant does not include backbone cable running between physically contiguous buildings unless cabling enters OSP pathway element (e. g. OSP conduits, maintenance holes, etc.). Outside Cable Plant includes underground cabling and aerial cabling. Outside Cable Plant may be referred to as "OSP."

C. Specific Communication System Elements:
1. Alien Crosstalk: Emissions from one or more adjacent cables affecting wire pairs in other cables.
2. Attenuation: Decrease in magnitude or signal power loss propagated between two points.
3. Cable: Assembly of one or more insulated conductors or optical fibers, within enveloping sheath.
4. Campus: Includes buildings owned or leased by Owner with direct physical cable connection to contiguous campus through Owner's owned or leased conduits, including pathways.
5. Dead pairs: Unused copper pairs terminating within splice case, but without being spliced to outgoing cable.
6. Conductor, usually a rod, pipe, or plate (or group of conductors) in direct contact with earth for purpose of providing low-impedance connection to the earth.
7. Grounding electrode conductor: Conductor used to connect grounding electrode to equipment grounding conductor, or to grounded conductor of circuit at service equipment, or at the source of separately derived system.
8. Hand-box: Rectangular or square underground pathway element similar to small maintenance hole, which cannot be fully entered, that allows for pulling point or splice point in pathway.
9. Handhole: Round underground pathway element similar to handbox, which cannot be fully entered, that allows for pulling point in pathway.
10. Identifier: Information that links specific element of Information Transport System infrastructure with its corresponding record.
11. Infrastructure (Information Transport System): Collection of Information Transport System components, excluding equipment that together provides basic support for distribution of information within or between buildings.
12. Linkage: Connection between record and identifier or between records.
13. Maintenance holes: Underground pathway element large enough for person to fully enter work, used to provide access to underground cable to pull, splice, and maintain. Formerly known as manhole.
14. Media (Information Transport System): Wire, cable, or conductors used for Information Transport System.

15. Outlet box: Metallic or nonmetallic box used to hold Information Transport System outlets/connectors or transition devices.
16. Outlet/connector (Information Transport System): Connecting device in work area on which horizontal cable or outlet cable terminates.
17. Pathway: Facility for placement of Information Transport System cable.
18. Record: Collection of detailed information related to specific element of Information Transport System infrastructure.
19. Report: Presentation of collection of information from various records.
20. Space (Information Transport System): An area used for housing installation and termination of Information Transport System equipment and cable, e.g., equipment rooms, network rooms, work areas, and maintenance holes/handboxes/handholes.
21. Splice: Joining of conductors in splice closure, meant to be permanent.
22. Splice box: Box, located in pathway run, intended to house cable splice.
23. Splice closure: Device used to protect splice.
24. Termination position: Discrete element of termination hardware where information Transport System conductors are terminated.
25. Wire Map: Method used to identify wiring errors.
26. Work area (workstation): Building space where the occupants interact with Information Transport System terminal equipment.

D. Communications System Acronyms:
1. ACR: Attenuation-to-Crosstalk Ratio.
2. ADA: Americans with Disabilities Act.
3. AFF: Above finished floor.
4. ANSI: American National Standards Institute.
5. ASTM: American Society for Testing and Materials (ASTM International)
6. AWG: American Wire Gauge
7. BICSI®: Building Industry Consulting Service International.
8. dB: Decibel.
9. EIA: Electronic Industries Alliance.
10. ELFEXT: Equal Level Far-End Crosstalk.
11. EMC: Electromagnetic Compatibility.
12. EMI: Electromagnetic Interference.
13. FCC: Federal Communications Commission.
14. FEXT: Far-End Crosstalk.
15. FOTP: Fiber Optic Test Procedure.
16. Freq: Frequency.
17. GE: Grounding equalizer (replacing TBBIBC).
18. Gnd: Ground.
19. HB: Handbox.
20. HH: Handhole.
21. HVAC: Heating, Ventilation, and Air Conditioning.
22. Hz: (Hertz) or MHz (Megahertz).
23. IDC: Insulation Displacement Connectors.
24. IEEE: Institute of Electrical and Electronics Engineers.
25. ISO: International Organization for Standardization.
26. ISP: Inside Cable Plant.
27. IDF: Intermediate Distribution Frame: Location of building distribution equipment room(s).

28. MDF: Main Distribution Frame: Location of campus wide central equipment room).
29. Martin County School District (MCSD): Owner.
30. Mbps: Megabits per second.
31. MDF. Main Distribution Frame also referred to as Main Equipment Room.
32. MH: Maintenance Hole.
33. MM: Multimode fiber optic cable.
34. NEC: National Electrical Code, NFPA 70.
35. NESC: National Electric Safety Code, C2-1997.
36. NEXT: Near End Cross Talk.
37. NFPA: National Fire Protection Association.
38. OSHA: Occupational Safety and Health Administration.
39. OSP: Outside Cable Plant.
40. OTDR: Optical Time Domain Reflectometer.
41. PSACR: Power Sum Attenuation to Crosstalk Ratio.
42. PSELFEXT: Power Sum Equal Level Far End Cross Talk.
43. PSFEXT: Power Sum Far End Crosstalk.
44. PSNEXT: Power Sum Near End Crosstalk.
45. PR: Pair.
46. RCDD®: Registered Communications Distribution Designer.
47. RFI: Radio Frequency Interference.
48. RH: Relative Humidity.
49. SM: Single Mode Fiber Optic Cable.
50. TBB: Telecommunication Bonding Backbone.
51. TBBIBC: Telecommunication Bonding Backbone Interconnecting Bonding Conductor.
52. TE: Telephone Equipment (Wall Mounted Equipment Rack).
53. TGB: Telecommunications Grounding Busbar.
54. TIA: Telecommunications Industry Association.
55. TMGB: Telecommunications Main Grounding Busbar.
56. TR: Telecommunications Room (MDF or IDF).
57. UL: Underwriters Laboratory.
58. UPS: Uninterruptible Power Supply.
59. WAO: Work Area Outlet.

E. ABBREVIATIONS
1. dB: Decibel: sound level or channel attenuation.
2. “, in, inch(es), ft, foot: us length.
3. mm, cm, m or km: metric length
4. W: Ohm(s): wire resistance.
5. µ: wavelength (nm) Nanometer.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 Submittal Procedures.
B. Comply with Section 01 35 33 – Security Procedures for submittal of installer’s personnel information for security badging requirements.
C. Project Record Documents
1. Submit one (1) mylar reproducible set of Project Record Drawings and one electronic set of Project Record Drawings in AutoCAD Release 10 or later edition “DWG” rewritable file extension format.

2. Submit complete updated hard copy of project record drawings and specifications maintained on project site during construction.
3. See specific communication sections for additional requirements.

D. Operation & Maintenance Manuals:
1. Prior to the Substantial Completion Inspection, complete Operation & Maintenance (O&M) Manuals.
2. Submit O&M Manuals to Owner at Substantial Completion Inspection.
3. Instruction manuals shall contain sufficient information to permit Owner's personnel to operate system without assistance from Contractor.
4. Provide O&M Manuals covering equipment and materials furnished.
5. O&M Manuals shall contain information necessary for operation, maintenance, parts procurement, and parts replacement for SCS.
6. Information shall include detailed documentation for firmware configuration.
7. Provide 8-1/2" x 11" loose leaf 3-ring binders with clear vinyl overlay designed to receive identification inserts with identification on front cover and back splines as follows:
   a. Operating & Maintenance Manual, Project Name, and Contractor.
   b. On front page, enclosed in 3-ring clear plastic sheet protector, provide the following:
      (1) Project Name.
      (2) Contractor Name.
      (3) Contractor's Project Manager.
      (4) Contractor's Project Number.
      (5) Owner's Project Number or Purchase Order Number.
   c. Contact list with name, address, contact person, phone number, and fax number for each of the following:
   d. Structured Cabling System Contractor.
   e. Conduit subcontractor.
8. Manufacturers of Equipment and local supply source(s) for repair parts.
9. Index: On the second page, enclosed in a 3-ring clear plastic sheet protector, provide index indicating section numbers and titles.
10. Sections shall be separated with tabbed section divider with number and title (typed) as follows:
    a. Section 1 – Cuts Sheets: Manufacturer's original data/cut sheets for each system component.
    b. Section 2 – Equipment List: Typed list of each item of equipment with brief description, serial number, and part number, enclosed in 3-ring clear plastic sheet protector.
    c. Section 3 – Factory Manuals: Manufacturer's printed Installation and Operating Manuals for each item of LAN equipment. Provide 3-ring zip-lock pockets for each manual not factory 3-ring punched. Do not include manuals loose or inserted in binder pockets.
    d. Section 4 - Warranties: Copy of Contractor's warranty and Manufacturer's printed warranty for each item of equipment. Enclose in 3-ring clear plastic sheet protector.
    e. Section 5 – Transmittal of Loose Items: Copy of transmittal to Owner's Project Manager for loose items such as patch cords, wire management rings, spare parts, with receipts signed-off by Owner's Project Manager. Enclose in 3-ring clear plastic sheet protector.

f. Section 6 - Documentation of Training: Documentation of training signed-off by Owner's Project Manage (insert in manuals at Final Completion inspection). Enclose in 3-ring clear plastic sheet protector.
g. Section 7 - Cable Tests: Executive summary of test results for Category 6, fiber optic, ITV, and voice backbone cabling.

1.5 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.
B. Telecommunications installer shall have RCDD (Registered Communications Distribution Designer) on staff with minimum of 3 years of experience with specified manufacturers' hardware and cabling.
C. Telecommunications installers shall have experience with installation of specified manufacturers' hardware and cabling.
D. Telecommunications installers shall use BICSI registered installers. Seventy-five percent or more of installers shall be BICSI Installer Level II. Up to twenty-five percent of installers may be BICSI Installer Level I. Workers not involved in installing cable elements (e.g., laborers delivering/moving materials, installing grounding by electrician, or workers installing pathway elements) do not have to be registered.
E. Team leads shall be BICSI registered technicians. Provide statements in bid documents of experience for proposed team leads. Statements shall include industry-specific training and certifications with dates verifying active status on registrations/certifications, project experience, experience with Category 6 and shielded cabling, and experience as a team lead.
F. Only installers trained and certified by manufacturer shall be allowed to install copper products. Installers shall possess highest levels of certification available by manufacturer for specific structured cable solution being installed.
G Only installers trained and certified by fire stop manufacturer shall be allowed to install fire stop products. See Section 07 84 00 – Fire Stopping.
H. Only installers trained and certified for cable testing and wiring by manufacturer shall be allowed to terminate and test optical fiber. Other installers specified above may pull or place optical fiber cable under supervision of installer trained and certified by manufacturer. Submit proof of registration/certification of proposed installers to include narrative on levels of registration/certification of installers.
I. Owner reserves right to reject unregistered or uncertified installers performing work for which they are not certified. Installer shall be responsible for loss of work, delays in schedules, or extra cost from use of unregistered/uncertified workers. Additional cost and effort to maintain installation schedule shall be communications system installer's responsibility.
J. Provide required documentation for new workers after submittal of initial documentation on installers. Owner may periodically check installer identification and registrations/certifications during installation.

1.6 PROJECT CONDITIONS

A. Security and Work Coordination:
   1. SCS construction area shall be protected and secured from unauthorized access.
   2. Workplace safety and security is SCS installer's responsibility.

3. Contact Contractor/CM or Owner's Project Manager, if project has no Contractor/CM, of conditions preventing safe, timely or complete installation of telecommunications systems.
4. Failure to provide notification to Contractor/CM or Owner's Project Manager shall be deemed acceptance of working conditions.
5. Comply with Section 01 31 00 – Project Coordination. Access to project including SCS installer's approved parking and "lay-down areas", access to buildings, maintenance holes, handholes, handboxes, utility poles, underground spaces, and pathways shall be coordinated with Owner's Project Manager.
6. Contractor/CM or SCS installer, if project has no Contractor/CM, shall provide traffic control and signage to maintain safe working environment.
7. Work area access, road closures, parking spaces closures, and work outside of Owner's normal operating hours shall be coordinated with Owner's Project Manager.
8. Owner's continued occupation of existing facilities shall not be interrupted by SCS installer's work activities.
9. Active cable plant associated with specific work and active cable plant beyond construction area shall not be disrupted.
10. Unusual circumstances (e.g., voice cutovers) may occur if prior written notification and approval is granted by Owner's Project Representative. Disruptions, if needed, shall be at Owner's convenience and approved schedule.

B. Owner shall not be responsible for delays or additional compensation due to SCS installer's unsafe working practices or unacceptable work.

1.7 WARRANTY

A. Communications Installer shall provide warranties or guarantees in accord with Section 01 78 00 – Closeout Submittals and as noted herein.
B. Communications CAT 6 and fiber optic cabling shall adhere to warranty requirements of Siemens System 6 or Ortronics NetClear GT2 warranty which may not be manufactured by either systems manufacturer but shall be inclusive with manufacturer's and installer's warranties for complete and functional communications system.
C. Manufacturer and authorized communications installer shall provide twenty (20) year warranty for category 6 structured cabling system for end-to-end channel model installation covering applications assurance, margin compliance claimed by manufacturer over category 6 channel specifications for transmission parameters across entire frequency range of 1-250 MHz in accord with manufacturers catalogs and literature, cable, connecting hardware and labor cost for repair or replacement.
D. Manufacturer shall provide 20-year Channel Performance Warranty for complete communications system. System shall be either Siemon Systems 6 solution or Ortronics NetClear GT2 solution.
   1. Manufacturer's shall warranty worst-case performance data for installed cabling system, and performance data indicated in warranty documents/certificate.
   2. Twenty (20) year warranty for Cat 6 structured cabling system shall provide for end-to-end channel model installation which covers applications assurance, cable, connecting hardware, and labor cost for repair or replacement.

3. Warranty shall indicate compliance with Margin claimed by manufacturer's over Cat 6 channel specifications on transmission parameters across entire frequency range of 1-250 MHz as indicated in manufacturer's catalogs and product literature.

E. SCS installer shall provide 3-year warranty for communications system installation to include materials and labor warranty for replacement of defective installation or equipment including cables, jacks, patch cords, patch panels, devices, and cabling.

F. Date of warranty period shall begin from date of project's substantial completion and acceptance by Owner.

PART 2 – PRODUCTS – NOT USED

PART 3 – PRODUCTS – NOT USED

END OF SECTION

SECTION 27 05 28
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Surface metallic raceways, surface nonmetallic raceways, fittings, device and cover brackets, communication systems utility columns, outlet boxes, Poke-thru, floor boxes, pull and junction boxes for communications systems.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.
C. National Electrical Manufacturers Association (NEMA):
   1. NEMA WD 6 - Wiring Devices - Dimensional Requirements, 2002 Edition.
   2. NEMA VE 1 - Metallic Cable Tray System; National Electrical Manufacturers Association; 2002 Edition.
D. Telecommunications/Electronics Industry Association (TIA/EIA): TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev. A, 1998, and relevant Addenda (ANSI/TIA/EIA-569).
E. Underwriters Laboratories (UL): UL 5 - Surface Metal Raceways and Fittings; Underwriters Laboratories Inc; 1996.
F. National Electrical Contractors Association (NECA): NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2000.
G. National Electrical Manufacturers Association (NEMA):
   1. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2003.
   2. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2003.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 Quality Control. Comply with Reference Standards indicated.
B. Provide products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Product Data: Submit manufacturer’s descriptive literature for each system component specified in this section.
C. Shop Drawings:
   1. Submit raceway layouts, each system component required for complete system, raceway lengths, device types, locations and identify circuits.

2. Indicate cable tray type, dimensions, support points, and finishes.
3. Indicate box, outlets, systems furniture, and service pole locations.
4. Provide manufacturer's catalog data for fastening systems.

D. Comply with Section 01 78 00 – Closeout Submittals: If variations from approved shop drawings occur during installation of raceway system, submit final as-built drawings indicating such variations.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.
B. Store products in manufacturer's unopened packaging until installation.
C. Maintain storage area conditions for products in accord with manufacturer's written instructions.

PART 2 – PRODUCTS

2.1 APPROVED MANUFACTURES

A. Approved manufacturers are listed herein. Other manufacturers may submit for approval per Section 01 25 13 – Product Substitution Procedures.

2.2 SURFACE METALLIC RACEWAYS

A. Surface Metallic Raceways:
   1. Acceptable product: Wiremold 4000 System by The Wiremold Company, 60 Woodlawn St., West Hartford, CT 06110. Tel: 800-621-0049, 860-233-6251; Fax: 860-232-2062; Website: www.wiremold.com.
   2. Product description: Two-piece system of galvanized steel, nominal 0.040" (1.27 mm) metal thickness, having total assembled cross-section dimension 4.75" (120 mm) high by 1.75" (44 mm) deep, having cross-section area 7.5 square inches (48.38 sq cm), consisting of base, snap-on cover, and removable longitudinal barrier, dividing raceway interior into two equal spaces.
   3. Surface-mount locations shall use shallow, wall-mount boxes with outlets on the sides of box.
   4. Finish: ScuffCoat grey or ivory color as selected.
B. Fittings:
   1. Factory-formed units to complete indicated configuration of raceway systems, including external corner units, internal corner units, flat units, blank end units, and elbows.
   2. Couplings: one per raceway unit.
   3. Wire clips: One per two-foot intervals (61 cm) of indicated raceway configuration.
   3. Replacement longitudinal barrier: One section per 8 linear feet (2.44 m) of indicated raceway configuration.
   4. Material: Same material and metal thickness as linear raceway components.
   5. Finish: Matching linear raceway components.
C. Device Brackets and Plates:
   1. Factory-formed brackets and plates allowing installation of indicated power, data, and communications devices, both single-gang and two-gang, either vertically or horizontally in raceways.
   2. Finish: Color matching linear raceway components.

2.3 SURFACE NONMETALLIC RACEWAY SYSTEMS

A. Surface Nonmetallic Multi-Channel Raceway System
1. Approved Product: Wiremold Access 5000 System by The Wiremold Company, 60 Woodlawn St., West Hartford, CT 06110. Tel: 800-621-0049, 860-233-6251; Fax: 860- 232-2062; Website: www.wiremold.com.
    2. Corner Units:
        a. Supply factory-formed cover and trim cover units for internal and external corners of indicated raceway layouts:
        b. Finish corner units to match linear cover and trim cover units.
    3. Fittings:
        a. Provide factory-formed fittings in rigid PVC compound with base to eliminate mitering for indicated configurations and service requirements.
B. Finish: White.
C. Surface Nonmetallic Single Channel Raceway System
    1. Approved Product: Wiremold Eclipse PN03, PN05, PN10 Series by The Wiremold Company, 60 Woodlawn St., West Hartford, CT 06110. Tel: 800-621-0049, 860-233-6251; Fax: 860-232-2062; Website: www.wiremold.com.
    2. Surface mount boxes:
        a. Wiremold Large Data Box, four port, PDB4TJ.
    3. Corner Units:
        a. Supply factory-formed cover and trim cover units for internal and external corners of indicated raceway layouts:
        b. Finish corner units to match linear cover and trim cover units.
    4. Fittings:
        a. Supply factory-formed fittings specified in manufacturer’s product data for indicated configurations and service requirements.
        b. Finish: White.

2.4 INDOOR SERVICE POLES AND COMPONENTS

A. Approved Product: Wiremold Tele-Power Pole Multi Outlet Assembly by The Wiremold Company, 60 Woodlawn St., West Hartford, CT 06110. Tel: 800-621-0049, 860-233-6251; Fax: 860-232-2062; Website: www.wiremold.com.
B. Main Body: Aluminum with clear anodized finish in single unit lengths as required.
C. Cover Plates: Match pole finish.
D. Convenience Receptacle Configuration: NEMA WD 6; Type 5-15. Furnish 4 per column.
E. Foot: Suitable for floor finish as indicated.
F. Provide concealed top clamp to fasten pole to inverted “T” grid ceiling suspensions member.
G. Accessories:
    1. Trim plates for closing ceiling opening to match poles.
    2. Flexible cable assembly with connector for branch circuit connections.
H. Fabrication:
    1. Provide full-sized opening at top of pole.

2.5 BOXES

A. Manufacture: The Wiremold Company: 60 Woodlawn St., West Hartford, CT 06110. Tel: 800- 621-0049, 860-233-6251; Fax: 860-232-2062; Website: www.wiremold.com.
B. Outlet Boxes.
   1. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   2. Nonmetallic Outlet Boxes: NEMA OS 2.
C. Poke Thurs.
   1. Two 20A duplex receptacles and up to four communications devices:
      a. Wiremold RC4 Flush Poke-Thru
   2. One 20A duplex receptacle and up to two communication devices
      a. Wiremold RC7 Flush Poke-Thru
   3. No other products are acceptable.
D. Floor Boxes.
   1. Wiremold AC Series Raised Floor Boxes.
   2. Wiremold 880 Floor Boxes for Wood Floors.
E. Pull Boxes and Junction Boxes.
   1. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Verification of Conditions: Verify that substrates are prepared and ready to receive products specified.

3.2 SURFACE RACEWAY INSTALLATION

A. Raceway shall be mounted in unobtrusive manner. Horizontal raceway shall be used at baseboard elevation, under or over chair rails, or along ceiling.
B. Where possible, raceway shall extend vertically up or down from WAO. Installer shall discuss placement of raceway prior to installation with Owner’s Project Manager.
C. Secure surface-mount raceway with screws. Do not use adhesive attachments.

3.3 COMMUNICATION SYSTEM FURNITURE POLES

A. Install utility columns plumb and fasten support to structure.
B. Use pre-manufactured knockouts for work area outlets. WAOs shall be installed flush or with minimal profile. Surface-mount boxes shall not be used on utility poles.
C. Neatly cut openings in ceiling panels and install trim plates.

3.4 BOX INSTALLATION

A. Install boxes securely, in neat and workmanlike manner, per NECA 1.
B. Install in locations indicated, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.
C. Set wall mounted boxes at elevations to accommodate mounting heights at 18” (45.72cm) above finished floor, unless otherwise noted.

D. Set wall mounting boxes for wall phones at 46” (1.17m) to center of box, if installed over counter or other low obstruction.
E. Set wall mounting boxes for wall phones at 48” (1.21m) to center of box if unobstructed access is available.
F. Boxes indicated on Drawings are approximate locations unless dimensioned.
G. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
H. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6” (15.24 cm) from ceiling access panel or from removable recessed luminaire.
I. Install boxes to preserve fire resistance rating of building elements, using materials and methods specified in Section 07 84 00.
J. Work area outlet boxes on opposite sides of a fire-rated wall shall not share the same stud space.
K. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
L. Use flush mounting outlet box in finished areas.
M. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
N. Do no install flush mounting box back-to-back in walls; provide minimum 6 inches (mm) separation. Provide minimum 24” (60cm) separation in acoustic rated walls.
O. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
P. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
Q. Do no fasten boxes to ceiling support wires.
R. Support boxes independently of conduit.
S. Use gang box where more than one device is mounted together. Do no use sectional box.
T. Do not install work area outlets in standard AC outlet shaped openings within floor boxes.
U. Set floor boxes level.
V. Large Pull Boxes: Use enclosure with removable cover in interior dry locations, surface- mounted cast metal box in other locations. Hinged lids may be used, if provided with a means to fasten securely open.

3.5 ADJUSTING

A. Adjust floor boxes and poke-thru flush with finish flooring material.

3.6 CLEANING

A. Remove dust, debris, and other material from product installation.
B. Clean exposed surfaces and restore finishes.

END OF SECTION

SECTION 27 05 29
HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Hangers and supports, wire baskets, cable trays and accessories for communications systems.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.
C. National Electrical Manufacturers Association (NEMA):
   1. NEMA WD 6 - Wiring Devices - Dimensional Requirements, 2002 Edition.
   2. NEMA VE 1 - Metallic Cable Tray System; National Electrical Manufacturers Association; 2002 Edition.
D. Telecommunications/Electronics Industry Association (TIA/EIA): TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev. A, 1998, and relevant Addenda (ANSI/TIA/EIA-569).
E. Underwriters Laboratories (UL): UL 5 - Surface Metal Raceways and Fittings; Underwriters Laboratories Inc; 1996.
F. National Electrical Contractors Association (NECA): NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2000.
G. National Electrical Manufacturers Association (NEMA):
   1. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2003.
   2. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2003.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 Quality Control.
B. Provide products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Product Data: Submit manufacturer’s descriptive literature for each system component specified in this section.
C. Shop Drawings:
   1. Submit raceway layouts, each system component required for complete system, raceway lengths, device types, locations and identify circuits.
   2. Indicate cable tray type, dimensions, support points, and finishes.
   3. Indicate box, outlets, systems furniture, and service pole locations.

4. Provide manufacturer's catalog data for fastening systems.

D. Comply with Section 01 78 00 – Closeout Submittals: If variations from approved shop drawings occur during installation of raceway system, submit final as-built drawings indicating such variations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.
B. Store products in manufacturer's unopened packaging until installation.
C. Maintain storage area conditions for products in accord with manufacturer's written instructions.

PART 2 – PRODUCTS

2.1 APPROVED MANUFACTURES

A. Approved manufacturers are listed herein. Other manufacturers may submit for approval per Section 01 25 13 – Product Substitution Procedures.

2.2 WIRE BASKET CABLE TRAY

A. Approved Products:
   1. FieldMate Wire Basket Cable Tray by The Wiremold Company: 60 Woodlawn St., West Hartford, CT 06110. Tel: 800-621-0049, 860-233-6251; Fax: 860-232-2062; Website: www.wiremold.com.
   2. Cablofil, Inc: www.cablofil.com: Wire Cable Tray.
   3. Copper B-Line, Inc: www.b-line.com:
      a. Cent-R-Rail Systems.
      b. Cable Tray Systems.
      c. Wire Basket Cable Support.
   4. GS Metals Corp: www.flextray.com: FLEXTRAY Cable Management System.
   5. Cable Management Solutions, Inc.
      a. Floor and Overhead Snake Tray.
      b. Snake Canyon.
      c. Wall Snake.
      d. Ladder Snake
B. Accessories:
   1. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, and connectors.
   2. Provide bushings or rubber edge trim as needed. Products shall be free of sharp edges or points that may damage cables.
   3. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, and connectors.

2.3 HANGARS AND SUPPORTS

A. Approved Cable Support Manufacturer: ERICO International Corporation, 34600 Solon Rd., Solon, OH 44139. Tel: 440-248-0100; Fax: 440-349-2996; Website: www.erico.com.
   1. CableCat Adjustable Cable Support (CAT425 series slings).
   2. CableCat Cable Support (CAT64 series).

B. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
C. Anchors and Fasteners:
   1. Obtain permission from Owner's Project Manager before using powder-actuated anchors.
   2. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
   3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
   4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
   5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
   6. Solid Masonry Walls: Use expansion anchors or preset inserts.
   7. Sheet Metal: Use sheet metal screws.
   8. Wood Elements: Use wood screws.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Verification of Conditions: Verify that substrates are prepared and ready to receive products specified.
B. Install hangars, supports and components in accord with Drawings, Shop Drawings and manufacturer's printed installation instructions.

3.2 CABLE TRAY SYSTEM

A. Install cable tray securely, in neat and workmanlike manner, per NECA 1.
B. Cut cable tray using manufacturer's equipment, if available from manufacturer. Smooth rough or jagged edges and points.
C. Arrange supports to prevent misalignment during wiring installation.
D. Fasten support to building structure and surfaces.
E. Cable tray elements shall be supported with manufacturer's hardware to provide minimal profile. Suspension shoes and brackets shall be used in place of trapeze struts. Sharp corners and threaded rod shall not extend below the basket.
F. Install cable trays maintaining following minimum clearance:
   1. 12" (304mm) of unobstructed clearance above cable tray's highest plane
   2. 6" (152mm) from source of EMI.
   3. 12" (304mm) from heat source exceeding 104° F (40° C).
G. If cables rise to ceiling space of floor above network room greater than 12' (3.4m), install cable tray to relieve vertical weight from cables on each floor. Secure cables with Velcro-type straps as needed to relieve vertical weight strain.
H. Continuous support elements shall be bonded from ground to TMGB/TGB with grounding wire. Sections may be bolted together or tied together with grounding jumpers if support structure is approved by manufacturer as a grounding conductor.
I. Provide pull strings in cable trays.
J. Provide fittings or gaps with bonding jumpers to accommodate expansion and deflection where cable tray crosses expansion joints.

K. Cable tray shall not penetrate fire-rated barriers. Cable tray shall end within 18" (45.6cm) of fire-rated barriers. Cables shall use firestop assemblies or sleeves to penetrate fire-rated barriers.
L. Cable tray shall be installed only in main corridors and hallways. Cable tray shall not be installed in Communications Rooms if room enclosure is fire or smoke rated.
M. Cable tray shall be single tiered wire basket installed to allow 12" (30.4cm) of open space above and to one side of tray. Cable tray shall be 2" (5.1cm) deep wire basket tray with appropriate width dimensions as required by volume of cable planned for installation at time of construction, and account for 20 per cent future growth.
N. Cable tray shall not be filled more than 50% capacity. Cable tray shall extend up to communications room wall to provide access to racks and walls in "T" design. Small rooms may use single, straight cable tray in line with rack, provided it extends parallel to face of rack.
O. Use at least 2- 4" (101mm) conduits in lieu of cable tray where installation passes through rated walls. Additional conduits may be required as cable volume dictates. Determination of conduits requirements shall be coordinated with Owner's Project Manager.
P. Install cable tray products within network rooms for vertical strain relief as needed while maintaining 50% additional capacity within support structure. Secure cables with Velcro-type straps at minimum of 36" (91.5cm), or as recommended by manufacturer to relieve vertical weight strain.
Q. Use appropriate hardware and parts to attach tray to permanent building structure (concrete columns or deck, structural steel, or other immovable structures capable of supporting cable tray). Parts shall be specifically designed and where possible UL-listed for final installed configuration.

3.3 HANGARS AND SUPPORT DEVICES

A. Attachment Devices.
   1. Obtain Owner's project Manager's permission before using powder-actuated anchors.
   2. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
   3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
   4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
   5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
   6. Solid Masonry Walls: Use expansion anchors or preset inserts.
   7. Sheet Metal: Use sheet metal screws.
   8. Wood Elements: Use stainless steel wood screws.
B. Install cable supports above concealed ceilings using rigid support to structural element or by attaching directly to structural element.
C. Install hangers and supports as required to support electrical system components adequately and securely, in neat and workmanlike manner, per NECA 1.
   1. Do not fasten support to pipes, ducts, mechanical equipment, or conduit.
   2. Installer may use existing threaded rods for other utilities, if pre-approved by Owner's Project Manager and is capable of supporting additional load and maintaining clearances.
   3. Do not drill or cut structural members.

4. Installation of hangars and supports to suspended ceiling grid support system in not allowed.

D. J-hooks or sling-type supports may be installed with suspended ceiling grid wire with manufacturer clamps, provided:
   1. Wire is painted orange prior to installation, to differentiate from ceiling grid support wires.
   2. Wire is not used to support ceiling grid, as required by the NEC.

E Weld support members or use hexagon-head bolted fasteners to present neat appearance with adequate strength and rigidity. Use spring lock washers under nuts.

F. Support Category 5e cables with J-hook type or sling-type supports in concealed ceiling spaces.

G. Support Category 6 cables with Cat 6 rated “J” hooks with wide base if supporting more than eight cables.

H. J-hook and sling-type supports shall be installed every 4-5’ (1.2-1.5m) on center for runs exceeding 30’ (9.12m). Runs from main or secondary corridors into classrooms and offices do not require support.

I. Close J-hook supports with manufacturer provided bars and not with cable ties. Do not use cable ties to strap cable to J-hook supports. Install cables under such strain as to require tying to supports.

3.4 CLEANING

A. Clean cable trays and supports of dust and debris.

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 27 21 33
DATA COMMUNICATIONS WIRELESS ACCESS POINTS

PART 1 – GENERAL

1.1. SCOPE OF WORK

A. Wireless transmitters, enclosure, dual data copper cables from communications rooms, two- port surface mount box, and data cable modules, attachments, and accessories for wireless communications system.
B. Single 2-port surface-mount or recessed box at locations indicated for wireless node connectivity. Locations indicated on walls suspended ceiling as surface-mount box or as standard faceplate. Locations concealed above ceiling shall be in surface-mount boxes.
C. Wireless access points below ceilings enclosed in unmarked plastic box with screw cover. Wireless access points above drop ceilings are not enclosed.
D. Wireless access points at exterior locations located in concealed heated plastic box with latch cover.
E. Installation of 110V electrical outlet at wireless access points.

1.2. REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2011 Edition.
B. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
C. IEEE 802.11-2012 Edition.

1.3. SUMBITTALS

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. Comply with Section 01 33 00 – Submittal Procedures.
C. Comply with Section 01 78 00 – Closeout Submittals.
D. Provide manufacturer’s product data sheets, product installation instructions and warranty.
E. Provide manufacturer’s certification of installer’s qualifications.

1.5 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.
B. Comply with ANSI/TIA/EIA standards and as noted in Section 01 42 00 – References.
C. Installer shall be certified by manufacturer as authorized installer.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturers:
   1. Siemon Corporation, Citicorp Center, 153 East 53rd St., New York, NY 10022-4611; Tel; 1 800 743-6367; website; www.siemon.com.
   2. Cisco Systems, Inc., 170 West Tasman Dr., San Jose, CA 95134-1706; Tel: 408-526- 4000, 800-553-6387; Website: www.cisco.com.
   3. Panduit Corp., 18900 Panduit Dr., Tinley Park, IL 60487; Tel: 800-777-3300; Fax: 708- 532-1811; Website: www.panduit.com.
   4. Other manufacturers shall comply with Section 01 25 13 – Product Substitution Procedures for product approval.

2.2 MATERIALS

A. Wireless access point (WAP) enclosure.
   1. Cisco Aironet 3600e Access Point:
      a. External antenna for use in indoor environments.
      b. AIR-CAP3602E-AK9 – Dual Band Controller.
   2. Cisco Aironet 3600i Access Point:
      c. Internal antenna for use in indoor environments.
      d. AIR-CAP3602I-AK9 – Dual Band Controller.

B. Patch Antenna.
   1. Cisco AIR-ANT2566P4W-R, 2.4-GHz/5-GHz MIMO, 4-Element Patch Antenna.
      a. VSWR: 2:1 or less.
      b. Gain: 6 dBi in both bands.
      c. Polarization: Linear, vertical.
      d. Azimuth Plane 3-dB Beamwidth: 2.4 GHz band: 105°, 5 GHz band: 125°
      e. Elevation Plane 3-dB Beamwidth: 2.4 GHz band: 70°, 5 GHz band: 60°.
      f. Size: 6.3” (16cm) wide x 11” (27.9 cm) long x 1.2” (3.05 cm) deep.
      g. Weight: 1.4 lbs. (0.64kg).
      h. Cable Length: 3’ (91.4 cm) plenum rated.
      i. Connector: RP-TNC.
      j. Environment: Indoor/Outdoor.
      k. Operating Temperature: -22° F (-30° C) to 158° F (70° C).
   2. Duplex 110V outlet.
   3. Capacity for dual data outlet surface mount box.
   4. Heater elements for exterior installations.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install dual data outlet for each wireless access point location. If installed within enclosure box, use 2-port surface mount box per Section 27 15 00 - Communications Cabling.

B. Install wireless access points above drop ceiling whenever possible.
C. Coordinate final placement of wireless access points with Owner's Project Manager.

END OF SECTION

SECTION 28 13 10
ACCESS CONTROL SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 01, General Requirements, are included as a part of this Section as though bound herein.

1.2 PERFORMANCE REQUIREMENTS

A. Purpose:
   1. Provide electronic card access control system an extension of the existing AiTronix/DSX.
   2. Electronic card access shall be located at designated perimeter doors leading to each of the program areas with electric re-strike rim exit device, controlled by card access system.
   3. Electronic card access control system shall include all necessary components, wiring for power and control to sensors, card access controls, door hardware devices, uninterruptible power supply system (UPS) and capable of interfacing with existing AMAG software for a complete operable and fully integrated system that is capable of control through the internet.
   4. Raceway system shall consist of conduit, J-hooks, sleeves, boxes and wiring for an automatic card access system.
   5. Electronic card access system shall be independent from Section Intrusion Detection System and shall be an internet-based control system, connected to MCSD main security control center.
   6. The system shall shunt the alarm system to allow passage through the doors when access card is swiped then rearm the alarm system when the door closes. On egress a passive infrared sensor shall shunt the alarm and unlock the door allowing for passage out of the building then resetting the alarm when the door closes.

B. The System shall include but not be limited to:
   1. Main Cabinet shall be surface mounted steel construction, AMAG Panel Model # 2100 installed on a plywood backboard. Main cabinet shall be installed in the MDF Room, including all required power supplies, batteries, integral charger and the software for a complete fully operational system.
      a. Backboard: Plywood, 1/2 inch thick, AC Grade, covered with two coats of UL Classified, fire retardant intumescent paint, light gray color, painted front, rear, and all four sides.
      b. Backboard shall be clearly labeled with the name of the backboard manufacturer, UL classification of the Fire-Retardant Coating with the NFPA 255 Coating Flame Index and the APA Grade of the plywood. Backboard shall be securely fastened to the wall in order to support any and all attached equipment.
   2. Each cabinet shall feed a minimum of eight controlled devices (readers).
   3. Surge suppression for the 120 VAC power supply.

4. Card readers.
5. The distribution cabinet must be within 300 feet of the controlled devices.
6. Raceway shall not exceed 400 feet without a pull box.
7. Grounding.
8. Raceway, fittings, wire, and wire fittings.
9. A 2-inch raceway from the main cabinet to the next building and floor distribution cabinet.
10. Wire and cable labeling.
11. Programming Software that is capable of interfacing with AMAG system.
12. Electrical power required to comply with all functions and operations required for the system.

C. Access Card Locations: Provide a card reader/controlled device at the following locations:
   1. All designated perimeter doors at the discretion of MCSD Site Security and/or Electrical Engineer.
   2. Other doors may be installed to include.
      a. Principal's Office
      b. Bookkeeper's Office
      c. AV Storage
      d. CCTV Studio Area
      e. Custodial Receiving
      f. MDF Room
      g. Other areas as defined in the plans specific review process.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
   1. The Contractor shall use personnel who are manufacturer-certified, thoroughly trained and experienced with the specified requirements and methods needed for the proper performance of the work.

B. Manufacturer Qualifications:
   1. Manufacturer shall have completed a minimum of five projects of equal scope to systems described herein and shall have been in the business of supplying and installing specified type of systems for a minimum of five years.

C. Fabricator Qualifications Mockups:
   1. Fabricator shall have completed a minimum of five projects of equal scope to systems described herein and shall have been in the business of supplying and installing specified type of systems for a minimum of five years.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Shop Drawings shall be prepared in latest version of AutoCAD 2006 or later format with electronic copies submitted along with full sized Shop Drawings.

2. Shop Drawings shall indicate typical wire connections and cable types, keypad locations, and all main and remote panels. Provide wiring schematics including point-to-point, terminal strips, connections to batteries, and power supplies, including the estimated anticipated wiring lengths required for all connection points (i.e., zone and system communications bus runs) within the system. Indicate interfaces to equipment furnished by others.
3. Submit dimensioned Shop Drawings indicating mechanical layout of all card access equipment, including cabinets and interconnecting conduit for the main panel, typical remote panel, keypad, and indicator locations, identifying all parts by manufacturer and part number.
4. Shop Drawings shall be accompanied by engineering documentation including:
   a. Floor Plans indicating all components, raceways, and terminal boxes and cabling.
   b. Riser diagram indicating all connections in a manner following the floor plan layout.
   c. Cabling diagram indicating the Contractor's designed routing and number of cables in specific raceways or conduits, from the main panel connecting to other sub-panels, modules, or devices. Diagram shall include length, in wire feet, and capacitance calculation charts for all cables.

B. Warranty Requirements:
1. Contractor shall warranty that all materials furnished shall be free from defects of material for a period of one year excluding specific items of work that require a warranty of a greater period that may be set forth in this Specification. Contractor shall warranty that workmanship for a period of one year from date of Final Completion, excluding specific items of work that require a warranty of a greater period that may be set forth in this Specification. Immediately upon receipt of written notice from the Owner, the Contractor shall repair or replace at no expense to the Owner, any defective material or work that may be discovered before final acceptance of work or within the warranty period; any material or work damaged thereby; and adjacent material or work that may be displaced in repair or replacement. Examination of or failure to examine work by the Owner shall not relieve Contractor from these obligations.

PART 2 – PRODUCTS

2.1 MATERIALS, PRODUCTS, EQUIPMENT, MANUFACTURED UNITS

A. Raceways
1. General:
   a. Provide raceways (conduits, wireways, pull boxes, J-hooks, outlet boxes, etc.) in compliance with the requirements of the card access manufacturer, Section Conduit for Electrical Systems, and Section Outlet Boxes.
2. Conduit:
   a. Provide conduit sized and based on fill in accordance with the NEC. Minimum size of conduit is to be 1 inch.
   b. Provide pull cords in all raceway installed without cable.
3. J-Hooks:
   a. Provide J-hooks in accordance with the NEC, EIA/TIA requirements for structured cabling systems. All cable supports shall be UL listed.

i. Design Selection: Enrico Caddy or J-Hook

4. Boxes:
   a. Provide boxes sized as required by the system manufacturer and the NEC for cables and/or devices installed.

B. Conduit and Boxes
1. Provide and install the building and floor distribution cabinets for each building according to the following criteria:
   a. There must be one of these main cabinets within 300 feet of a door access reader.
   b. Each cabinet shall feed a minimum of eight controlled devices (access readers) and the cabinet can be located on any floor in an MDF or IDF room. It does not have to be located on the same floor as the controlled devices.
   c. The main cabinet can serve as the distribution cabinet for its area of eight door access readers.
   d. Minimum conduit size shall be 1 inch. No conduit shall be installed more than 150 feet without a pull box.
2. Provide 1-inch conduits if needed from the distribution cabinets and distribute to feed the junction and mounting boxes for each device.
   a. If a separate 120V feed is needed at any device, a separate conduit will be needed.
   b. Each separate 1-inch feed will supply no more than one Controlled Device/Card Reader Feed locations however if multiple devices are being installed in the same area, conduit sizes will need to be increased.
3. Provide and extend conduit to feed 2-inch x 4-inch x 2 1/8-inch flush mounted boxes with single gang mud ring and weatherproof covers; mounted with the opening vertical, at all designated card reader locations.
   a. Locate to the strike side of single doors, and as designated for double doors, and gates.
   b. Center 42 inches above finished floor/grade.
   c. Exact location to be determined during plan review.
4. Provide a 2-inch x 4-inch x 2 1/8-inch card access feed junction box with cover at the interior side of all designated card access door locations.
   a. If the area location has removable ceiling tiles, the box shall be located above the tile.
   b. If the location has a structure of fixed ceiling material, then flush mount the box with a square to round mud ring and cover.
   c. Both boxes from a) and b) above shall be connected. Also, if door is a double door an additional single gang box will be installed, connected, and centered on the top of the door frame.
5. Provide a 1-inch conduit from the AMAG control box to the closet network switch if conduit is determined to be needed.
6. Cable:
   a. Provide at each card reader location, a single home run cable to the locations to be identified in the drawings. The cable for the Card Access System shall be Belden # 658AFS or manufacturer recommended equivalent.
   b. Provide between Access Control Panel and Access Control Terminal Cabinet one (1) Belden # 9502 cable or manufacturer recommended equivalent.

c. Card Access system cables installed in interior, exterior and/or underground raceways shall comply with the applicable section of the NEC.

7. Power Feeds:
   a. Provide a double duplex, dedicated 120-volt clean power receptacle adjacent to the lower portion of the main terminal cabinet and each distribution cabinet.
8. Surge Suppression:
   a. Provide surge suppression equipment listed by Underwriters' Laboratories, bearing the UL seal, and marked accordingly. Surge suppression equipment is to be UL listed and labeled for the intended use.

PART 3 – EXECUTION

3.1 FIELD QUALITY CONTROL

A. Training of the School's administrative and maintenance personnel is required in cooperation with the District's Representative.
   1. Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections, and to assist in field testing.
   2. Report results in writing.
B. Startup Service:
   1. Engage a factory-authorized service representative to perform startup service in accordance with the manufacturer's requirements.
      a. Complete installation and startup check according to manufacturer's written instructions.
      b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
      c. Report results in writing.
C. Adjusting:
   1. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to site during other-than-normal occupancy hours for this purpose. These visits are not considered as "warranty calls."

3.2 ERECTION TOLERANCES

A. Install system in accordance with NECA "Standard of Installation" and Divisions 26, 27, and 28.
B. Permanently label all conduits as to plan room number destination, at all terminal cabinets.
C. Install 200 lb. strength pull string throughout the conduit system.
D. The Card Access System shall be independent and shall not interconnect with or be used by any other system.
E. Mount all junction boxes located above the ceiling with the opening facing down unless mounted to the wall above the ceiling, and with a reasonable immediate access pathway provided.

1. Note: The requiring of removing of a light fixture or other similar ceiling equipment is not a reasonable access pathway.

F. All conduit runs shall be as direct as possible in order to save on wiring costs and to reduce poor performance due to cable loss.
G. Refer to Section Door Hardware for Card Access Door preparation.
H. The Contractor shall be advised that the circuit routing for the card access system may not be shown on the project drawings and that he is responsible to install all raceways, wiring and cabling for a complete and fully functional system.
I. General:
   1. The Contractor shall provide and install the card access system (including raceways, pull and back boxes, and wire) in accordance with the Card Access System manufacturer's requirements.
   2. The Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-tapped cabling is not acceptable.
   3. Where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes.
   4. Device to device wiring is only to be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device.
   5. Termination of devices is to be in accordance with manufacturer's requirements.
   6. Install Card Access System wiring with at least 12 inches of separation from line voltage power wiring on parallel runs. Wiring crossing power circuits shall be at right angles. For metal enclosed electric light or power or Class 1 circuits, separation may be reduced as described in the National Electrical Code. Increase separation if so required to comply with EIA/TIA referenced standards.
   7. Each Card Access System outlet shall have splice-free cables homerun to the respective control panel in the associated Main/Intermediate Distribution Frame (MDF/IDF) at the communication equipment room (CER), communication closet (CC), or communication panel (CP) as indicated on the drawings. Each cable shall be tagged at each end.
   8. Provide a minimum of three hundred (300) access cards in addition to the original compliment required by the owner.

3.3 DEMONSTRATION

A. Training of the School's Administrative and Maintenance Personnel is required in cooperation with the District's Representative:
B. Engage a factory-authorized service representative to train school administrative and maintenance personnel to adjust, operate, and maintain Card Access System. Refer to Division 01 Section Closeout Procedures for information regarding Demonstration and Training.

END OF SECTION

SECTION 28 16 00
INTRUSION DETECTION SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 01, General Requirements, are included as a part of this Section as though bound herein.

1.2 GENERAL

A. The work described herein and, on the drawings, consists of all labor, materials, equipment, and services necessary and required to provide and test an extension of the existing Intrusion Detection System. Any material not specifically mentioned in this specification or not shown on the drawings but required for proper performance and operation shall be provided.
B. The drawings and specifications herein comply to the best of the Engineer's knowledge with all applicable codes at the time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the Engineer's attention at least seven (7) days prior to bid. No changes in contract cost will be acceptable, after the bid, for work and/or equipment required to comply with the Authority Having Jurisdiction.

1.3 DESCRIPTION OF SYSTEM

A. The Contractor shall furnish and install a complete and operating Intrusion Detection System. The system shall include but not be limited to:
    1. Door Contacts
    2. Motion Detectors
    3. Acoustic Glassbreak Sensors
    4. LCD Keypads
    5. I/O Modules
    6. Auto Dialer
    7. Connection to Telephone System
    8. Programming
    9. Control Panels
    10. Power Supplies
    11. Battery Backup
    12. Raceway/Outlet System, Wire, Cable, Etc., complete with all basic materials
    13. Wire and cable Labeling
    14. Terminal Blocks
    15. Terminal Cabinets
    16. Terminations

17. Grounding
18. Surge Suppression
19. Firestopping
20. Sensors
21. Programming

B. The Intrusion Detection System is to include all equipment, materials, and labor as required to provide, install, and test a complete system as described herein.
C. Furnish and install a complete solid-state microprocessor-based security system. Each control panel shall be addressable and support up to 192 addressable devices. Activation shall cause a digital dialer to send in an alarm to the central monitoring station. The input power shall be 120 volts, AC. The control panel shall be supervised on the input power line with automatic switch over to battery backup. Provide battery backup sized for minimum 12 hours of continuous operation. Provide unit that will monitor input power and send "loss of AC power alarm" to central station after time delay. Panel shall be capable of remote programming (Upload and Download).
D. At least one keypad shall be provided for each panel whether shown on the drawings or not.
E. End of the line resistors (EL) shall be located in the control panel. All zone loops will be equipped with an EL. All field devices shall be home run to the control panel(s).
F. Surge suppression required. This Contractor shall provide surge suppression in conformance with Section Surge Suppression Equipment of the specification.
G. All equipment will become the property of the Owner.
H. The system supplier shall provide, at no cost to the owner a central station monitoring service and be available 24 hours per day and 365 days per year until the date of Final Completion at which time the Owner will take over monitoring of the system.
I. The system shall be wired so that after system is turned "on," exit from the building and entry to the building can be done through designated doors. There shall be a warning tone generated on the keypad during in/out time delay. The system shall have adjustable in/out time delay from 5 to 45 seconds.
J. Provide system complete with minimum 100 event memory logger.
K. Wiring/conduit connections/routing, etc. is not shown on drawings. Provide and install all wire, conduit, boxes, electrical basic materials, etc., as required for a complete and operating system.
L. System cables to be installed in conduit.
M. System devices to be individually annunciated at system control panel.

1.4 STANDARDS, CODES, REFERENCES AND REGULATORY REQUIREMENTS

A. Reference Section Reference Standards and Regulatory Requirements
B. The equipment and installation shall comply with the current or applicable provisions of the following Standards:
   1. All requirements of EIA/TIA.
   2. All requirements to Federal Communications Commission.
   3. National Fire Protection Association Standards:
   4. NFPA 70 - National Electrical Code

5. NFPA 72 - National Fire Alarm Code
6. NFPA 101 – Life Safety Code
7. UL 13 - Power Limited Circuit Cables
8. UL 444 - Communications Cables
9. UL 1449 3RD Edition Standard for Safety for Surge Protective Devices
10. UL Standard 681, latest edition - Burglar Alarm Systems, Installations, Classification and Certification of
11. UL Standard 609, latest edition - Burglar Alarm Units and Systems, Local

C. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.
D. Surge Suppression:
   1. Equipment Certification: When available by any one manufacturer, all surge suppression equipment shall be listed by Underwriters' Laboratories, shall bear the UL seal, and be marked in accordance with referenced standard. Such surge suppression equipment shall be UL listed and labeled for intended use.
E. Comply with all standards and guides as listed under "References" above.

1.5 RELATED SECTIONS/DIVISIONS/DOCUMENTS

A. All applicable sections of Division 00 and Division 01.
B. All applicable sections of Division 26
C. Section Surge Suppression (120V AC to 480V AC).

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten (10) years' experience and with service facilities within 50 miles of Project.
B. Supplier: Authorized distributor of control equipment manufacturer.
C. Installer: The intrusion detection system installer shall be an authorized dealer of the equipment manufacturer. Installer shall carry spare parts and a service organization to provide emergency service. Service and installation modification capability shall be available locally. At the request of the Design Professional, installer shall provide proof that:
   1. Contractor is an authorized dealer of the equipment manufacturer.
   2. Contractor has installed at least four systems within the last year and they are working satisfactorily.
   3. Contractor has a service organization to provide emergency service.

1.7 SUBMITTALS

A. Submit in accordance with Sections Common Work Results and Submittals.
B. In addition to requirements of Common Work Results and Submittals, the Contractor shall submit:
   1. Shop Drawings:

a. Indicate system wiring diagram showing each device and wiring connection required.
b. Submit riser diagram and layout shop drawing with terminal-to-terminal wiring diagrams of all units.
c. 1/8" plans of all buildings showing each device and circuitry.
d. Site plan showing distribution between buildings.

2. Submit Product Data: Provide electrical characteristics and connection requirements. Submit for acceptance the following product data specifications on:
   a. Control Unit
   b. Power Supplies
   c. Batteries
   d. Door Contacts
   e. Motion Detectors
   f. Acoustic Glassbreak Sensors
   g. I/O Modules
   h. Telephone Dialer
   i. LCD Keypads
   j. Wiring
   k. Surge Suppression Equipment
3. Submit Test Reports: Indicate satisfactory completion of required tests and inspections. Submit manufacturer's inspection report.
4. Submit Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.8 PROJECT RECORD DOCUMENTS

A. Submit record documents to record actual locations of initiating devices, signaling appliances, end-of-line devices, wire and conduit.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit Operation Data: Operating instructions.
B. Submit Maintenance Data: Maintenance and repair procedures.

1.10 WARRANTY

A. Provide a manufacturer’s warranty on control panel for two (2) years and three (3) years from date of Final Completion.

PART 2 – PRODUCTS

2.1 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for the intended use and shall be provided by a single manufacturer.
B. Provide all components, equipment, parts, accessories, and associated quantities required for complete installations. All components may not be specified herein.
C. All devices/components/products shall be suitable for use intended.
D. Materials shall be a product of one manufacturer, installed as a complete system.
E. Wiring shall be color coded, copper of size as required by accepted system manufacturer.
F. Automatic telephone dialer shall be provided for connection to monitoring services agency via telephone wires. Dialer shall contain batteries for emergency operation.
G. All electrical components shall have built-in surge protection.
H. System shall be GE Interlogix NetworX 8E Pinpoint System.
I. Provide applicable back box, enclosures, etc. for each device as required to facilitate installation in location shown on drawings.
J. Provide a suitable computer, as required, for the operation of the intrusion detection system until Final Completion at which time operating system will be loaded onto the owner's server for his use.

2.2 RACEWAYS

A. General:
   1. All raceways (conduit, wireways, pullboxes, outlet boxes, etc.) shall comply with applicable requirements of sections within these specifications.
   2. All raceways (conduit, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of the manufacturer of the Intrusion Detection System.
B. Conduit: Comply with Section Conduit except as noted below:
   1. Pull Cords: Install pull cords in all raceway runs that are installed without cable.
   2. Size: Minimum size shall be 3/4" conduit.
C. Boxes:
   1. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.
   2. Boxes shall be sized as required by the system manufacturer and NEC for cables and/or device installed.

2.3 TERMINATION CABINETS

A. Terminal cabinets are to comply with applicable sections of these specifications.

2.4 "SYSTEMS" AND "LOCAL" GROUND BUS

A. Bus to comply with applicable sections of these specifications.

2.5 WIRE/CABLE

A. Provide wire/cable as recommended by manufacturer for proper operation of system and as required to comply with all sections of these specifications.

2.6 ALARM CONTROL PANEL

A. Control Panel: Modular construction with surface wall-mounted enclosure.
B. Power Supply: Adequate to serve control panel modules, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours.
C. System Supervision: Provide electrically supervised system, with supervised alarm initiating and alarm signaling circuits. Component or power supply failure places system in alarm mode.
D. Initiating Circuits: Supervised addressable loop with alarm and trouble indication.
E. Signal Circuits: Supervised signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode and does not disable that circuit from transmitting alarm. Use supervised fire zone.
F. Remote Station Signal Transmitter: Electrically supervised, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.
G. Local Alarm: Sound alarm if telephone tie is cut.
H. Surge Protection: Provide on power supply and all circuits entering/leaving building housing main control panel.
I. Entry and Exit Time Delays: Programmable (time).
J. Trouble Sequence of Operation: Upon trouble signal, trouble alarm light is to be activated.
K. Alarm Sequence of Operation: Actuation of intrusion detecting device places system in alarm mode, which causes the following operations:
    1. Sound and display local alarm signaling devices with non-coded signal.
    2. Transmit non-coded signal to remote station equipment.
    3. Indicate location of actuated building on control panel and each keypad.
L. Alarm Reset: Key-accessible reset function resets alarm system out of alarm if alarm initiating circuits have cleared.
M. Control Panel, provided in a “commercial can”, shall be GE Interlogix NetworX Model NX-8E with NX-2192E Point ID Interface Card.
N. Power Supplies shall be GE Interlogix NetworX Model NX-320E Smart Power Supply and Bus Extender

2.7 I/O MODULES

A. Single input addressable module shall be GE Interlogix NetworX Model SI-ID
B. 4 input/4output module shall be GE Interlogix NetworX Model 4140-ID

2.8 KEYPAD

A. The system arming shall be accomplished with an intelligent keypad interface with the capacity for 99 users.
B. The system shall have a lockout feature after an invalid code has been entered twice.
C. The keypad shall indicate status and wait state for arming and disarming, have a duress code and shall provide audible indication during the delayed entry or exit period.
D. Keypad shall be GE Interlogix NetworX Model NX-148 LCD Keypad

2.9 DOOR CONTACTS

A. Recessed mounting.
B. Self-locking magnetic contact suitable for use in metal doors.
C. Provide single input addressable module for each door contact.

2.10 MOTION DETECTOR

A. Passive infrared motion detector (PIR).
B. Adaptive Signal Processing – 3D signal processing with gliding focus mirror optics analyzes size, speed, shape, and adaptive alarm threshold.
C. Coverage: Four 50-foot curtains. Adaptable pattern with supplied inserts.
D. Housing material: Flame retardant ABS
E. Operating Voltage: 8 to 27V (as supplied by NX-2192)
F. Current draw: 250 µA typical avg. 3mA with LED momentarily on
G. Environmental Limits:
   1. Operating temperature: 0° to 131°F (-18° to 55°C)
   2. Relative humidity: 10% to 90% noncondensing.
H. Dimensions: 2.9"W x 2.2"D x 5.1"H
I. Motion detectors shall be addressable and shall be GE Interlogix NetworX Model AP750-ID

2.11 ACOUSTIC GLASSBREAK SENSOR

A. Shatterpro's Pattern Recognition Technology™ for superior detection and false alarm immunity.
B. Protects all glass types up to a standard thickness of 1/4" (0.64cm) including plate, wired, tempered and laminated glass. Senses through light blinds and unlined drapes.
C. Sensor shall have a detection radius of 20 feet.

D. Housing material: Flame retardant ABS
E. Operating Voltage: 8 to 27V (as supplied by NX-2192)
F. Current draw: 250 µA typical avg. 3mA with LED momentarily on
G. Microphone: Omni-directional electret
H. Environmental Limits:
   1. Operating temperature: 14° to 120°F (-10° to 50°C)
   2. Relative humidity: 10% to 90% noncondensing
I. Dimensions: 3.13"W x 1.7"D x 4.2"H
J. Acoustic glass break sensors shall be addressable and shall be GE Interlogix NetworX Model 5845-ID

2.12 SIGNAL DEVICES

A. Alarm Bells: NFPA 72G, electric 8-inch motor bell with operating mechanism behind dome. Sound Rating: 92 dBA at 10 feet (3 M). Unit to be rated for exterior wet locations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions. Provide all interconnections, etc. required.
B. Use 16 AWG minimum size conductors for detection and signal circuit conductors. Install all wiring in conduit. Increase size in conductors as required to keep voltage drop to levels acceptable to manufacturer.
C. Make conduit and wiring connections to door hardware devices.
D. Install all conduit concealed.
E. Install recessed magnetic switch on doors on plans that are indicated to receive door contacts.
F. Install motion detectors at locations indicated on drawings.
G. Install Glassbreak sensors at locations indicated on drawings.
H. Install keypads at locations indicated on drawings.
I. Install alarm bells at locations indicated on drawings.
J. Install main control panel as indicated on plans in Systems Room.
K. Where location of a required device is not shown on drawings install as directed by owner.
L. Wire each device to control panel and connect/program system to comply with the zoning specified herein or on drawings.
M. All system cables and power wiring shall be kept physically isolated from each other at all points. Lace and form wires from components to terminals and fasten securely.
N. Wires and cables in equipment cabinets and service cabinets shall terminate on terminal strips or on connectors provided with equipment. All terminals must be permanently marked with room numbers. Cable splicing is not acceptable. Contractor shall coordinate exact location of all components of the system and their function with Owner/Architect prior to any rough-in of installation.

O. Coordinate with Owner for names, and instructions to be recorded on dialer.
P. Upon completion of installation of the system, it shall be checked by factory authorized representatives with result of the checkout reported in writing. The written report shall precede or accompany contractor's request for acceptance inspection.
Q. All door contact and motion detector wiring will be home run, pinpoint enunciated, to the security system panel in the building.
R. Four conductor wire shall be used throughout for door contacts, etc. All wiring shall meet or exceed the requirements of the system manufacturer.
S. All wiring shall be run in conduit.
T. Install equipment, cables, and contacts as required to comply with all applicable requirements of the references and/or regulatory requirements called for under PART 1 of this section of specifications, as a minimum installation requirement. Exceed this minimum requirement when called for herein.
U. Install all electrical basic materials per applicable sections of these specifications.
V. Install system equipment panels in locations shown; arrange to provide adequate ventilation and access.
W. Properly ground system per applicable sections of these specifications.
X. Support raceways, backboards, and cabinets under the provisions of Section Supporting Devices, and/or as required by manufacturer's instructions.
Y. Install raceways to conform to applicable sections of these specifications.
Z. Install system wiring and/or raceways away from any surface that may become hot, including, and not limited to, hot water piping and heating ducts.
AA. Install system wiring with at least 12 inches of separation from line voltage power wiring on parallel runs. Wiring crossing power circuits shall be at right angles. For metal enclosed electric light or power or Class 1 circuits, separation may be reduced to six (6) inches. Increase separation if so required to comply with EIA/TIA referenced standards.
BB. All raceways shall meet requirement for raceway per applicable requirement of sections within Division 26 of these specifications.
CC. Raceway shall not be shared by power or any other electrical wiring that is not part of the low voltage Intrusion Detection System.
DD. Bend raceway with minimum inside radius of 6 times the internal diameter. Increase bend radius to 10 times for raceway larger than 2-inch size. Provide proper bend for all changes of direction. Pull and splice boxes shall not be used in lieu of a bend.
EE. Install raceways so no more than two 90^{o} bends are in any raceway section without pullbox. Install additional pullboxes as required to maintain maximum of two 90^{o} bends between pullboxes and/or termination points.
FF. Label all raceway at both ends to indicate destination and Intrusion Detection System source room. Also indicate length of raceway and this labeling/identification shall be fully documented in as-built (record) drawings.
GG. Install polyethylene pulling string in each empty conduit over 10 feet in length or containing a bend.
HH. Fire Stop:
1. Where conduit penetrates a fire rated wall, floor, etc., firestopping shall be provided.

2. Provide permanent firestopping seals after cable installers have pulled risers and distribution cables.
3. Meet all requirements for UL assembly involved. Provide firestopping UL listed for assembly, conduit, and/or cable involved.

I. Pullboxes, Junction Boxes, Outlet Boxes:

1. Install per applicable sections of these specifications and all applicable codes/standards.
2. Boxes shall be placed above accessible ceilings and in an exposed manner and location, and readily accessible. Boxes shall not be placed in a fixed false ceiling space unless immediately above a suitably marked and rated hinged access panel.
3. A pull box shall be placed in a conduit run where:
   a. the length is over 100 feet.
   b. there are more than two 90^{o} bends, or
   c. if there is a reverse bend in the run
4. Boxes shall be placed in a straight section of conduit and not used in lieu of a bend. The corresponding conduit ends should be aligned with each other. Conduit fittings shall not be used in place of pull boxes.
5. Outlet boxes shall be installed at devices requiring outlet box per applicable codes/standards.
6. Provide bushed nipple at devices receiving cable without raceway/conduit.
7. Every pullbox shall have a hinged cover. Install appropriate access panel to allow cover to open.
8. Size:
   a. Where a pullbox is required with raceway(s) smaller than 1-1/4 trade size, an outlet box may be used as a pullbox.
   b. Where a pullbox is used with raceway(s) of 1-1/4 trade size or larger, the pull box shall:
      i. Straight Pull-Through:
         a) have a length of at least 8 times the trade size diameter of the largest raceway.
      ii. Angle and U-Pulls:
         a) have a distance between each raceway entry inside the box and the opposite wall of the box of at least 6 times the trade size diameter of the largest raceway, this distance being increased by the sum of the trade size diameters of the other raceways on the same wall of the box; and
         b) have a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:
            1) six times the trade size diameter of the raceway; or
            2) six times the trade size diameter of the larger raceway if they are of different sizes.
      iii. Raceway entering the wall of a pullbox opposite to a removable cover:
         a) have a distance from the wall to the cover of not less than the trade size diameter of the largest raceway plus 6 times the diameter of the largest conductor.
9. No box shall be smaller than that required by NEC 314.28 (A), (1) and (2).

10. Grounding:
    a. Provide and install complete grounding system as required to comply with all sections of these specifications and applicable codes.
    b. Connect Terminal Cabinet rack to "systems" ground bus with #6 green insulated copper ground wire.
    c. Connect metal conduit (via grounding bushing) to "systems" ground bus.
    d. Connect cable shields to "systems" ground busbar.
    e. Connect surge suppression equipment to "systems" ground busbar.
11. Surge Suppression:
    a. General
        i. Provide and install surge suppression devices as specified for each system circuit conductor, at both ends at each terminal block terminating conductors between buildings.
        ii. Provide and install surge suppression devices as specified in Section Surge Suppression Equipment for 120-volt source to all equipment. Install online side of each control panel.
        iii. Extreme care shall be taken by contractor to assure a properly surge protected system.
        iv. Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.
        v. Installation of surge protection equipment and it's grounding must be per manufacturer's recommendations to assure short and proper ground paths.
    b. Equipment Selection
        i. Contractor to coordinate with suppliers and installers of all equipment being protected and provide surge suppression equipment which meets these specifications on respective equipment, wires, etc.
    c. Equipment Installation
        i. Install surge suppression equipment per manufacturer’s recommendation at each wire terminal as noted under Part 1.
        ii. Install in surge suppression equipment terminal cabinets, etc. as required to facilitate installation of surge protection equipment and terminal points. Increase size of terminal cabinets (from that shown on drawings) to size required to facilitate installation of surge suppression equipment and terminal blocks.
        iii. Locate surge suppression equipment in terminal cabinet nearest each equipment cabinet.
        iv. Coordinate with Section Surge Suppression Equipment Contractor to assure that surge suppression for 120VAC power circuit and surge suppression required by this section are all installed in same terminal cabinet and bonded together.
12. Ground Installation
    a. Ground Bus Connections.
        i. Provide "local" ground bus in each terminal cabinet housing surge protection equipment (with lugs, etc. as required).

ii. Bond "local" ground bus to terminal cabinet with minimum #6 copper wire.
iii. Connect terminal cabinet "local" ground bus to "systems" ground bus installed per Section Grounding and Bonding with minimum #6 copper insulated wire (unless otherwise noted) in conduit.

b. Note that "systems" ground bar is also to be used for power transformation ground (480V to 208V) where applicable.

c. Surge suppression equipment grounding.
i. Connect each surge suppressor to local ground bus in terminal cabinet with wire sized as recommended by manufacturer. Where "M" block type terminations/surge suppressors are used, bond ground rail to local ground bar with wire as recommended by manufacturer.
ii. Coordinate with Section Surge Suppression Equipment contractor to assure that 120VAC power source/supply surge suppressor is also grounded to same local ground bus as surge suppressors provided in this section.

d. Conductors.
i. Conductors shall meet requirements of Section Building Wire and Cable.
ii. Bends in excess of 90 degrees in any grounding conductor shall not be permitted. A radius of 6 inches or greater shall be maintained on all bends.
iii. Do not bundle unprotected conductors with protected conductors.
iv. Conductors shall be kept as short as possible.
v. Conductors shall be secured at 12" intervals with an accepted copper clamp.
vi. Grounding conductors shall be properly connected to the building service ground by accepted clamps.

e. Grounding Connectors
i. Connectors, splicers, and other fittings used to interconnect grounding conductors, bond to equipment or grounding bars, shall be accepted by NEC or UL for the purpose.
ii. All connectors and fittings shall be of the Nicopress crimp or compression set screw type.
iii. Special treatment to fittings, lugs, or other connectors of dissimilar material shall be applied to prevent electro-galvanic action.

3.2 FIELD QUALITY CONTROL

A. Field inspection and testing to be performed.
B. Test in accordance with NFPA 72.

3.3 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems.
B. Include services of technician to supervise installation, adjustments, final connections, system testing, and Owner training.

3.4 DEMONSTRATION

A. Provide systems demonstration.
B. Demonstrate normal and abnormal modes of operation and required responses to each.
C. Be prepared to demonstrate to Design Professional compliance of these specifications by all major items or pieces of equipment, as well as compliance with specifications for entire system at time of turnover. The Contractor shall demonstrate the operation of the system to the Owner during the final inspection.
D. Provide a technician to instruct Owner's personnel in operation and maintenance procedures of system. Instruction scheduled at Owner's convenience. Provide a minimum of two four-hour training courses to the Owner's personnel at times designated by the Owner.
E. All systems shall be inspected in a fully operational state by a representative of the Department of Risk Management before acceptance by Owner.

3.5 AS-BUILT DRAWINGS

A. Prior to acceptance inspection, the Contractor shall furnish complete as-built drawings of the security system. Compile in book form complete as-built drawings and service manuals with schematics of all components used in the system. As-built drawings to include layout diagrams with appropriate later connection information. Complete cable routings and exact locations of all devices incorporated into the system.

END OF SECTION

SECTION 28 20 00
CAMERA SURVEILLANCE SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 01, General Requirements, are included as a part of this Section as though bound herein.

1.2 SYSTEM TO INCLUDE

A. Furnish and install a complete Camera Surveillance System (CSS) including but not limited to all cameras, monitors, lenses, housings, controls, video boosters, cable compensators, digital video recorders, matrix controllers, converters, multiplexers, cabling, interface software/equipment, mounting hardware, etc. for a complete and operating system to provide the functions specified herein.
B. Provide a clear picture free from any interference or distortion from any camera to its assigned monitor or monitors.
C. All components shall be solid state, except camera monitor picture tubes.
D. Provide system complete, including but not limited to:
   1. Cameras/housing/lenses
   2. Conduit/wire
   3. Terminal cabinets/enclosures with terminal boards
   4. Monitors
   5. All power supplies.
   6. Matrix switchers
   7. Fiber optic system converters with cable, transmitter/receiver
   8. Pan-tilt-zoom equipment, controls, switchers, controllers.
   9. Network Video Recorder (NVR)
   10. Patch panels and patch cables.
   11. Media converters
   12. Interface software/equipment

1.3 SYSTEM DESCRIPTION/FUNCTION/OPERATION

A. General:
   1. Cameras shall be mounted at approximate locations as indicated on the drawings. Each camera shall be equipped with an appropriate lens to provide the best field of view at each individual location and as specified herein.
   2. An indoor or an outdoor enclosure and an enclosure mount shall be provided for each camera location indicated on the drawings and as specified herein.
   3. Network Video Recorders (NVR) shall be provided to record scenes from any and all selected cameras. NVR units shall be provided to allow the selected viewing and video recording of each camera in the system.
   4. The video output of each camera shall be fed back for viewing to the fiber optic converter (FOC) locations as shown on the drawings.

5. The video viewing monitors in the control location shall allow the sequential or matrix viewing of each camera scene and selected scene of any camera in the system simultaneously to the monitors.
6. Each camera in the system shall have an individual generated and positioned on-screen camera identification number.
7. All video equipment shall be installed with removable video, power, and remote-control cable connectors to facilitate easy removal and replacement if required.
8. Video/pan/tilt/control signals shall be by fiber optic technology from building to control rack in Administration Building.
9. Coordinate all requirements in this section of the specifications with applicable sections of these specifications as required to provide a complete and operating system as described herein, including but not limited to:
   a. Door hardware devices.
10. Cameras as noted or scheduled shall have complete pan, tilt and zoom Control from console.
11. Provide a suitable computer, as required, for the operation of the CSS until the date of Final Completion at which time provide all software to the owner for installation on his server.

B. System to include:
1. 20" call-up color monitors (Administration)
2. 9" color matrix monitors (Rack Mounted)
3. 16 channel network video recorders (as required to support the number of cameras)
4. remote controls for digital video recorders (as required for each recorder)
5. Number of cameras as shown on Drawings.
6. system controllers

1.4 REFERENCES AND REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Furnish Products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.5 SUBMITTALS

A. Submit under provisions of Section Submittals.
B. Shop Drawings:
1. Submit plan (on AutoCAD 2006) of building and site showing:
   a. Location of each device.
   b. Raceways.
   c. Quantity and type of wire/cable.
   d. Typical outlet wiring diagram.
   e. Detail drawing of each terminal board/cabinet.
   f. Detail drawing of rack, equipment cabinet, console, etc.
   g. Indicate electrical characteristics and connection requirements, including system wiring diagram.

C. Product Data: Provide showing electrical characteristics and connection requirements for each component.
D. Qualifications: Submit qualifications of system installer.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
F. Submit labeling scheme and sample of label.
G. Contractor shall submit test reports, manufacturer's specification sheets and any other information necessary to determine compliance with material and equipment specifications described herein.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section Operation and Maintenance Manuals.
B. Operation Data: Include instructions for adjusting, operating, and extending the system.
C. Maintenance Data: Include repair procedures and spare parts documentation.
D. Test Data. Record of results for all outlets tested.
E. Data sheets showing all field labeling used for termination blocks, cable runs, and outlets.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of the General and Supplemental Conditions of the Contract and Section Common Work Results for Electrical Systems.
B. Submit plan (on AutoCAD Release 2006) of building and site showing actual locations and sizes of raceways, outlets, terminal boards, terminal cabinets, etc.
C. Record actual type and size of cables installed.
D. Record "to and from" locations coordinated with cable labeling for all cables at each terminal board or cabinet.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 5 years' experience.
B. Supplier: Authorized distributor of specified manufacturer with minimum 3 years' experience.
C. Installer: Authorized installer of specified manufacturer with service facilities within 50 miles of Project.

1.9 MAINTENANCE SERVICE

A. Furnish service and maintenance of premises wiring for one year from Date of Final Completion.

1.10 WARRANTY

A. Provide a manufacturer's warranty for a period of three (3) years for date of Final Completion.

PART 2 – PRODUCTS

2.1 GENERAL

A. Provide all components, equipment, parts, accessories, and associated quantities required for complete installations. All components may not be specified herein.
B. All devices/components/products shall be suitable for use intended and meet all stated performance requirements for system specified in this section.
C. Provide suitable lens for each camera.

2.2 RACEWAYS

A. All raceways, conduits, supports, etc. comply with applicable section of three specifications.
B. Bushings: Provide insulating bushings on ends of all raceway.
C. Pull Cords: Install pull cords in all raceway runs that are installed without cable.
D. Minimum size 3/4”.

2.3 BOXES

A. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.

2.4 TERMINATION BACKBOARDS

A. Material: A/C grade exterior plywood.
B. Size: 8 ft. high with width as shown on drawings unless otherwise noted or required in these specifications.
C. Finish: Paint both sides and all edges of terminal board with gray paint having a flame spread rating of Class A as a minimum.

2.5 TERMINATION CABINETS AND/OR ENCLOSURES

A. Terminal cabinets and/or enclosures are to comply with applicable sections of these specifications.

2.6 "SYSTEMS" GROUND BUS

A. Bus to comply with applicable sections of these specifications.

2.7 CAMERAS

A. TruVision™ Megapixel IP Color Camera.
    1. General Requirements:
        a. The camera shall be a 2 Megapixel CMOS Progressive Scan IP Camera having real-time video streaming at up to 1280 x 720p for ideal video capturing under challenging conditions. Day/Night functionality to capture images in various lighting scenarios, NTSC, PoE, SDHC Card Slot.
        b. Frame Rate: 10 fps (1600 x 1200), 15 fps (1280 x 720), 30 fps (704 x 480)

c. Video Bit Rate: 32 kbps to 8Mbps, adjustable
d. Sensitivity: Color – 0.68 lux @ F1.4; Mono – 0.13 lux @ F1.4
e. S/N Ratio: > 50 dB
f. Lens (box): Megapixel 1.3: 2.8-8mm F1.2, Auto Iris DC

2. Electrical Specifications:
   a. Voltage Input: 24 VAC, ±10% /12 VDC, ±10%, PoE (IEEE 802.3af)
   b. Power Consumption: 4 watts max.
   c. Power Supply: 48 VDC .38A Wall Mount Power Supply
   d. IO Connection: Screw Terminal
3. Mechanical Specifications
   a. Connectors:
      i. VIDEO OUT: RJ45
      ii. Power: PoE
   b. Dimensions (with housing):
      i. 24VAC Models - approximately 6.25" x 2.57" sq
      ii. 24VAC Models - approximately 1.32 lbs.
4. Environmental Specifications:
   a. The camera shall operate between the temperature limits of -10 to +60 degrees Celsius.
5. Agency Approval Requirements
   a. The camera shall be UL Listed and CSA Certified.
   b. The camera shall comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules.
6. Manufacturer:
   a. Interlogix TVC-M2110-1-N
   b. TVC-M-WM: Box and Clamshell Housing Wall Mount
   c. TVC-OH: Box Outdoor IP 66 Clamshell Housing

B. UltraView™ Dome IP Camera
1. General Requirements:
   a. The camera shall be a high-res, vandal-resistant, varifocal lens network camera having 4CIF resolution at up to 30 fps, true day/night, IR-corrected varifocal lenses, and polycarbonate dome with captive shroud for easy installation, vandal resistance and to conceal camera position.
   b. Scanning System: 525/60 (NTSC), 625/50 (PAL) 2:1 Interlace
   c. Effective Pixels (H x V): 704 x 480 (NTSC and PAL)
   d. Frame Rates: 30, 15, 7.5, 3.5, 2 and 1
   e. S/N Ratio: > 50 dB
   f. Lens: 2.8 to 10.5 mm Al f1.2 IR corrected
2. Electrical Specifications:
   a. Input Voltage: PoE, 12 VDC or 24 VAC
   b. Power Consumption: 7 W PoE; 8 W (DC); 12 W (AC)
3. Mechanical Specifications
   a. Body shall be die-cast aluminum. Dome shall be 3.5 mm thick polycarbonate.
   b. Connectors:
      i. Ethernet Out: 10/100 Mb (RJ 45 connector)
   c. Dimensions (with housing):
      i. 24VAC Models - approximately 5.22 x 4.11"
      ii. 24VAC Models - approximately 3.1 lbs.

4. Environmental Specifications:
   a. The camera shall operate between the temperature limits of -30 to +50 degrees Celsius.
5. Agency Approval Requirements
   a. The camera shall be UL Listed and CSA Certified.
   b. The camera shall comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules.
6. Manufacturer:
   a. Interlogix UVD-IP-XP3DNR-VA2

2.8 MOUNTS

A. Provide mounts as required for each specific application.

2.9 FIBER MEDIA CONVERTER AND PoE INSERTER

A. The media converter will integrate two remote network technologies in a single product – 100Base-FX to 10/100Base-TX Media Conversion with Power Sourcing equipment and a PoE Injector for wireless access points, IP-based surveillance cameras or IP phones.
   1. The media Converter shall be capable but not limited to the following:
   2. Auto-negotiation for 10/100Base-TX half-duplex or 10/100Base-full-duplex
   3. 100Base-FX interface for up to 2km (multi-mode fiber 50µm/125µm) on MC100FX- TX-PoE
   4. 48V/0.4A DC power supply
   5. Maximum frame size to 1600bytes
   6. Auto MDI/MDI-X function
   7. Store and Forward Mechanism
   8. Auto loop back test function
B. Interface:
   1. Copper: 1-port 10/100Base TX RJ45 TP interface with PoE injector function Auto-negotiation, Auto MDI/MDI-X
   2. Fiber: 1-port 100 Base-FX Multi-mode, 50/125 µm or 62.5/125 µm optic fiber.
   3. Fiber Port Type: SC
   4. Cable Distance: 2 km
C. Electrical:
   1. Power Requirement: 48V DC, 0.38 A
D. Manufacturer:
   1. Interlogix MC100FX-TX-PoE

2.10 SMALL FORMAT PLUGGABLE TRANSCEIVER MODULE

A. Provide a module specifically designed to accommodate high-performance optical fiber, including integrated duplex data link over single mode. Compliant with SFP Multisource Agreement capable of easy installation without interrupting host equipment operating online.
B. Environmental specifications:
   1. Temperature: 0 – 70 degrees C.
   2. Relative Humidity: 5% - 95% non-condensing

C. Electrical:
   1. Input Voltage: 3.3 VDC
D. Manufacturer:
   1. Interlogix SPF100FX1310TSC2KM

2.11 FIBER OPTIC CONNECTOR

A. The optical connector must be Corning Type SC. The connector must be glued, crimped and covered with a Strain Relief Boot. Provide with appropriate power supplies and accessories.
   1. Repeatability: less than .02 dB.
   2. Insertion Loss: 0.5 dB (typical).
   3. Durability (Mating cycles): 1000.

2.12 FIBER OPTIC CABLE

A. Fiber Specification:
   1. Multimode: size 50µm; core 125µ; Buffer 250µ.
   2. Maximum attenuation (dB/Km): 2.0
   3. Minimum bandwidth (MHz/Km): 300
   4. Minimum bend radius: 3 inches
   5. Typical loss per fiber (per camera): 5.7dB
B. Fiber Installation:
   1. The fiber will be installed in conduit (outside and inside). The company must install the connectors properly to avoid unnecessary signal loss. The installer's company must have a complete installation kit with the appropriate tools such as: Crimp tool, special Epoxy glue, a 100x Microscope for inspection and alignment, a Fiber Cleave tool, two Polishing pads, a Polishing tool and three #7/#3/#0.3 polishing film.

2.13 24-PORT PoE SWITCHER/CONTROL SYSTEM

A. General Requirements
   1. The video switcher/controller shall be a microprocessor-controlled matrix switching system designed for closed circuit television applications. This video switcher shall be 24 gigabit fiber copper PoE and stacking switch.
B. Environmental Specifications:
   1. Temperature: Unit shall operate between the temperature limits of 0 to 50 degrees C, relative humidity 20% to 90% non-condensing.
   2. Mounting: Rack mounted
C. Electrical
   1. Power Consumption: Full load 110v, 39 watts, 132.99 BTU
   2. Input Voltage 100-240VAC, 50/60 Hz, Auto Sensing
D. Hardware Specifications:
   1. Copper Ports: 24 10/100/1000Base-T RJ-45 Auto-MDI/MDI-X ports with IEEE 802.3af PoE injector
   2. Dimensions: 17.32 x 11.81 x 1.75”
   3. Weight: 9.92 lbs.
   4. Switch Fabric: Store and Forward

E. Agency Approvals.
   1. System shall be UL Listed and CSA Certified and comply with FCC Rules.
F. Manufacturer:
   1. Interlogix GE-DSSG-244-PoE

2.14 NVR 16 IP CHANNEL NETWORK VIDEO RECORDER (NVR)

A. The Network Video Recorder (NVR) is to be a TruVision™ NVR 20 (TVN 20) designed to support video streams from IP video Cameras. IP camera support includes resolutions from standard to 5 megapixels from Interlogix and third-party IP camera manufacturers. The NVR 20 also supports Interlogix UltraView™ Encoder 10 H.264 for integrating existing analog cameras.
B. Additionally, the system shall provide automated alarm handling. Recording options are to include Continuous, Motion, and Alarm or combined scheduled recording modes. Motion recording utilizes an IP camera's built-in motion detection events. Alarms are to be triggered from any of the 16 on board alarm inputs or from alarm inputs that reside on the IP Camera.
C. Software shall allow remote access to the full capabilities of the recorder via Web browser or TruVision Navigator. The TVN 20 shall allow for easy configuration via IP device auto-discovery tools, and embedded processor technology allowing administration as a network appliance. Software is to be installed on the machine of the owner's choice.
D. The NVR shall include, but not be limited to the following:
   1. Recording Capabilities:
      a. Continuous, Motion or scheduled recording modes
      b. Event recording based upon native IP camera activity detection or via unit alarm input.
      c. Video is stored in the native IP camera format.
      d. Audio recording with capable IP cameras
      e. Redundant camera recording or independent storage groups for different durations.
   2. IP Camera Support:
      a. Up to 16 IP cameras based upon model.
      b. CamPlus™ 2 IP, UltraView IP plus TruVision 1.3- and 2.0-megapixel cameras
      c. H.264 Axis, Arecont, ACTi and other IP camera manufacturers (VGA and Megapixel)
      d. UltraView Encoder 10 single-channel H.264 Encoder.
   3. Hardware:
      a. Compact rack mountable – 2RU
      b. Up to 16TB of internal storage front accessible drives
      c. GB Ethernet connectivity
      d. 16 on-board alarm inputs and 4 configurable alarm outputs
      e. Local USB archiving.
   4. System Configuration and Install
      a. TruVision device finder (discovery of select TruVision DVRs/NVRs and IP cameras)
      b. IP camera auto-discovery in TVN 20 browser
      c. Configuration and viewing via TVN 20 browser or TruVision Navigator software.

d. No IP camera licensing.

5. Ethernet communications
   a. The NVR shall support LAN/WAN Ethernet access.
   b. The NVR shall support simultaneous Ethernet access by not less than two workstations connected to the LAN/WAN.
   c. The NVR shall support Windows 2000, Windows XP, and Windows Vista
   d. The NVR shall not stop recording during any Ethernet access, nor shall it be possible to remotely issue a command via Ethernet to stop the recording.
6. User Rights: (3-levels)
   a. Administrator, Operator and Guest

E. Manufacturer
   1. Interlogix TruVision™ TVN-2016-8T

2.15 20-INCH LCD COLOR VIDEO MONITOR

A. General Requirements
   1. The color CSS monitor specified shall use a 20-inch diagonal LCD display.
   2. This monitor shall be S-VHS compatible.
   3. All user adjustments shall be accessible from the front panel.
   4. The monitor shall be capable of reproducing a minimum of 500 lines of horizontal picture resolution.

B. Electrical Specifications
   1. The monitor shall operate to specifications within the line voltage range of 105 to 130VAC 60Hz.
   2. Nominal power consumption shall be 65 watts with current requirements not to exceed 1.5 amps.
   3. The monitor shall accept a 1.0-volt peak to peak, negative sync, composite video input signal.
   4. Audio input shall be 390mV RMS (-6dB) high impedance into two RCA phono jacks where one may be used as bridged output or 775mV RMS(0dB) high impedance into EIAJ 8-pin VCR connector.

C. Mechanical Specifications
   1. POWER ON/OFF switch shall be push button with separate green LED pilot light.
   2. Connectors:
      a. Two rear BNC connectors shall allow termination or loop-through of the video signal.
      b. Two rear RCA Phono jacks shall provide for audio input/output.
   3. Power cord including plug.
   4. Dimensions:
   5. Weight: lbs.

D. Environmental Specifications
   1. Temperature limits:
      a. Operating 32 to +104□F
   2. Humidity specifications: less than 85% relative, non-condensing.

E. Agency Approval Requirements
   1. The CSS monitor shall be UL Listed and CSA Certified.

F. Manufacturer:
   1. GE KLC-20 HS with KLC-WM3 wall mount bracket.

2.16 UPS SYSTEM

A. UPS system with 90 minutes of battery back-up for all CSS equipment in console or rack.

2.17 ACCESSORIES

A. Provide and install all accessories to rack mount equipment.

2.18 POWER SUPPLIES

A. Provide and install all required power supplies to match cameras and equipment. Connect to UPS via surge suppression devices. Locate power supplies in equipment rack.
B. Manufacturer: UTC Fire & Security PS48VDC.38A-US or Owner approved equal.

2.19 WALL PLATES

A. Plates to match and meet specifications in wiring device section of these specifications for wiring device plates.
B. Coordinate with other sections of these specifications and provide proper plate for each installation.
C. Color/finish: Comply with Section Wiring Devices.

2.20 CONSOLE

A. The installer's company will design, provide and install a functional and scaled console with all the equipment inside.

PART 3 – EXECUTION

3.1 GENERAL

A. Install in accordance with manufacturer's instructions.
B. Install raceways to conform to applicable sections of these specifications.
C. Finish paint termination backboards with durable gray paint having flame spread rating higher than Class C. prior to installation of telephone equipment.
D. Support raceways, backboards, and cabinets under the provisions of Section Supporting Devices.
E. Install termination backboards and cabinets plumb and attach securely to building wall at each corner. Install cabinet trim plumb.
F. Install recessed cabinets flush with wall finishes, and stub 3 empty 3/4-inch conduits to accessible location above ceiling at each location.
G. Install polyethylene pulling string in each empty conduit over ten feet in length or containing a bend.
H. Mark all backboards and cabinets with the legend "CSS" under the provisions of Section Identification for Electrical Systems.
I. Raceway for CSS wiring shall not be shared by power or any other electrical wiring that is not part of the low-voltage telecommunications systems.

J. Install CSS wiring with at least (12) inches of separation from line voltage power wiring on parallel runs. Wiring crossing power circuits shall be at right angles. For metal-enclosed electric light or power or Class 1 circuits, separation may be reduced to six (6) inches.
K. Install CSS wiring and/or raceways away from any surface that may become hot, including, and not limited to, hot water piping and heating ducts.
L. Bend raceway with minimum inside radius of 6 times the internal diameter. Increase bend radius to 10 times for raceway larger than 2-inch size. Provide 10 times bending radius for all fiber optic cable raceway. Provide proper bend for all changes of direction. Pull and splice boxes shall not be used in lieu of a bend.
M. Each CSS outlet shall have a separate, splice-free cable homerun to the local CSS terminal board or cabinet.
N. Label all raceway at both ends to indicate destination and source room. Also indicate length of raceway.
O. All conduit, boxes, jacks, and cable shall be installed as shown on the drawings. Any exceptions to the conduit routing shall be brought to the attention of the engineer before installation.
P. Use branch video cable for circuits less than 500 feet (175 m); use main video cable for circuits longer than 500 feet (175 m). Provide equalizing amplifier for circuits longer than 100 feet (350 M).
Q. Provide raceway, boxes, etc. system as shown on the diagrams and as specified in other sections.
R. In finished areas, conceal conduits and flush mount boxes.
S. Complete installations shall be as recommended by equipment manufacturer. Verify wiring and power requirements.
T. Final connections, balancing, adjustments, testing, etc. shall be factory trained technicians. When system is complete it shall be demonstrated to owner's representative who shall be given complete instructions, part, manuals, and maintenance information.
U. Provide and install system complete including all accessories, conduit/wire, relays, etc. for a complete and operating system.
V. Coordinate work on graphic panel with drawings and other sections of these specifications.
W. Power for all cameras shall be provided via conduit system to cameras from console.

3.2 RACEWAYS, ETC.

A. General: Provide raceway for all telephone wiring.
B. Minimum size:
    1. Unless specifically noted otherwise on drawings, minimum raceway size for telephone wiring shall be as called for in Part 2 - Products. Increase size if:
        a. So, indicated on drawings.
        b. Required by cable/wire installer.
        c. Required for cable/wire installed in raceway.
C. Each CSS outlet shall have independent/individual raceway to respective terminal board/cabinet.
D. Special Raceway Systems: Special raceway systems may be specified for some portions of the system. Refer to the drawings and other sections of these specifications to determine where or if such systems are used.

E. Pull Boxes: Provide pull box(es) in all conduit runs that:
   1. Exceed 100 feet in length, or
   2. Require more than two 90-degree bends, or
   3. Require a reverse bend.
   4. Install boxes in straight raceway sections. Boxes shall not be used in lieu of a raceway bend.
   5. Every box shall have a hinged cover. Install appropriate access panel to allow cover to open.
   6. Install all boxes in easily accessible locations.
   7. Size per NEC 314.28 (A) (1) and (2).
   8. Pull boxes to conform to applicable sections of these specifications.

F. Pathways/raceways at terminal board locations shall be neatly racked on a Kindorf Type rack secured to wall above and below terminal boards.

G. Where cable tray exceptions have been granted, conduit shall be installed from the wall outlet junction box directly to the tray, allowing no loose cable between conduit and tray.

H. Fire Stop.
   1. Where conduit penetrates a fire rated wall, floor, etc. fire stopping shall be provided.
   2. Provide permanent fire stopping seals after cable installers have pulled risers and distribution cables.

3.3 OUTLETS

A. General: Install CSS outlets where indicated on the drawings.

B. Outlets: Install per applicable section of these specifications (i.e., outlet boxes, indoor service poles, floor boxes, etc.).

C. Wall Plates: Install a blank cover plate similar to that specified for wall receptacles for all CSS outlets which will not have a telephone installed, per Section Wiring Devices.

D. Common Wall: Install outlets with at least 12 inches on-center spacing, or a wall stud, between outlets on both sides of a common wall; 24" minimum in rated wall.

3.4 CABLES/WIRES

A. Install cables/wires in accordance with manufacturer's instructions.

B. All cables/wires shall be labeled at each end and at access points along the cable run if the cable run exceeds 50 feet.

C. At a minimum, the label attached to each cable/wire shall indicate:
   a) end points (terminations by room or area designation number) of the individual cable;
   b) type of cable;
   c) date of cable installation;
   d) criticality of cable (i.e., associated with an alarm or life safety system); and d) a unique cable number, assigned sequentially with no gaps.

D. Three copies of a cable record document containing the cable information required on the cable label shall be delivered to the Owner.

3.5 FIBER OPTIC SYSTEM

A. Camera Side: Transmitter.
   1. The cable between the camera and the fiber transmitter must be retractable and should combine the video, zoom lens controls, and low power in the same jacket. The housings must include compression glands.
   2. The transmitter must be mounted inside a box. Each transmitter must have a stand- alone power supply. This power supply cannot power any other device.

B. Monitoring side: RECEIVER
   1. The receiver to be in Rack version. (Plug-In Type).
   2. Provide and install power supplies.

3.6 POWER OUTLETS

A. Terminal Boards or Cabinets: Provide one (1) duplex isolated ground receptacles at each terminal board; mount at 7 ft. 6 in. AFF or in each terminal cabinet.

B. Connect each outlet required above to 20amp, 1P circuit breaker in nearest 120-volt panel (unless specifically shown otherwise on drawings). Provide handle lock-on clip on each circuit breaker.

C. Each outlet to be 20 amp, 120V rated.

D. Connect outlets per NEC and other sections of these specifications.

3.7 TERMINAL BOARDS

A. General.
   1. Terminal boards shall be installed secure to wall with bottom of board at 6" above floor.

B. Layout. Unless specifically shown otherwise on drawings: 1.4'W x 8'H at locations indicated on drawings.

C. Power.
   1. See "Power Outlets" above.

D. Grounding.
   1. Ground each terminal board by extending 1 AWG #6 green insulated copper conductor in 3/4" non-metallic conduit from a junction box at terminal board to the nearest accessible acceptable building grounding electrode system as defined in NEC Article 800-100. Where "SYSTEMS" grounding bus/bar (refer to Section Grounding and Bonding) is provided in same room as terminal board, the bus/bar may be used for grounding point if acceptable to telephone system installer and all applicable codes.
   2. Locate junction box where directed by telephone installers.
   3. Coil a minimum 6 ft. length of conductor pigtail and leave inside junction box.

3.8 TERMINAL CABINETS

A. Install terminal cabinets to conform with applicable sections of these specifications.

3.9 LABELS

A. All CSS components must be easily identifiable for any person that may need to locate telecommunications equipment, facilities, or circuit information.
B. Provide and install permanent cable markers on all cables, etc., at terminal strips, terminal cabinets and at console.
C. All labels must be printed (not handwritten) and applied on all specified CSS components. The label shall be of a type which can be easily applied to CSS components. Label sheets with adhesive backing and a durable surface side is recommended for cables, other components can follow this format, but the contractor must provide details on how labeling will be accomplished, for approval.

3.10 EXTERIOR CAMERAS

A. Exterior cameras shall be mounted in an exterior weatherproof camera housing which shall be complete with a sunshield, and safety chain. Provide 120-volt circuit to exterior cameras.

3.11 CONNECTION

A. All connections (interior/exterior) to be made with liquid-tight flexible conduit securely terminated at both ends.

3.12 TESTING

A. Perform all testing where necessary or specified to assure a fully functional system. Replace and/or repair and retest components that fail performance standards.
B. Test all cables/outlets.

3.13 INTERFACE WITH OTHER PRODUCTS

A. Interface installation of closed-circuit television system with security access and intrusion detection systems (via fire alarm system).

3.14 MANUFACTURER'S FIELD SERVICES

A. Supervise final wiring connections and system adjustments.

3.15 ADJUSTING

A. Adjust manual lens irises (if applicable) to meet lighting conditions.

3.16 DEMONSTRATION

A. Demonstrate system operation and provide 4 hours of instruction with manufacturer’s training personnel.
B. Conduit walking tour of Project and briefly describe function, operation, and maintenance of each component.

3.17 FINAL

A. As built drawings shall be given to operation persons at time of instruction, in addition to those to be supplied as general requirements of the job.

3.18 SURGE PROTECTION

A. Provide, install, and connect new surge suppression equipment as specified in Section Surge Suppression, including protection of equipment power source, cable/wire entering or leaving each and every building. Ground lugs, #6 copper ground wire in 3/4"c. to building service ground.

3.19 TESTING, GUARANTEE AND SERVICE

A. See General Requirements Division 01, and Section Common Work Results for Electrical.
B. Upon completion, the system shall be adjusted, tested, and left in perfect operating condition.

END OF SECTION

SECTION 28 31 00
ADDRESSABLE FIRE ALARM-DETECTION SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. The work described herein and, on the drawings, consists of all labor, materials, equipment, and services necessary and required to provide and test an automatic fire detection and alarm system. Any material not specifically mentioned in this specification or not shown on the drawings but required for proper performance and operation shall be provided.
B. Drawings and specifications comply to the best of the Engineer's knowledge with all applicable codes at the time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the Engineer's attention at least seven (7) days prior to bid. No changes in contract cost will be acceptable, after the bid, for work and/or equipment required to comply with the Authority Having Jurisdiction.
C. Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. Contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer’s recommendations. Provide and install firestopping where penetrations are made through rated walls and floors. Firestopping is to be performed under Division 7 Section Firestopping.
D. This Specification describes a fully addressable, common fire alarm system, with remote power supplies, remote voice evacuation panels for various buildings and portables.
E. Contractor shall provide and install the fire alarm system (including all equipment, wiring, etc.) in accordance with the manufacturer’s recommendations.
    1. Installation of devices shall be in accordance with the manufacturer’s requirements as well as the requirements of the Contract Documents. Recommendations by the Manufacturer for the proper installation of the fire alarm system and its equipment shall not preclude the requirement for the Contractor to comply with the requirements of the Contract Documents.

2. Termination of fire alarm circuits shall be in accordance with the manufacturer's recommendations, applicable requirements of the National Electrical Code (NFPA 70), National Fire Alarm Code (NFPA 72), ADA, other applicable Codes, and the Contract Documents.
3. Fire alarm Installer shall be responsible for ensuring that prior to bidding the project the Electrical Contractor understands the raceway requirements for the project. Claims by the Contractor after award of the project in regard to additional raceway required either by the fire alarm system manufacturer's recommendations for proper installation of the system and its associated equipment, or for compliance with the requirements of the Contract Documents, shall not be allowed.
4. Contractor shall note that the drawings show fire alarm remote panels (FARP) in various locations. FARP's are intended to be equipment (remote control panels, power supplies, voice evacuation panels, addressable modules, power, grounding, and any other equipment or materials) necessary for a remote extension of the fire alarm system. FARP's shall be connected to the campus FACP via a signal line circuit (SLC) and other circuits specifically recommended by the fire alarm manufacturer and required to meet the intent of the project documents. An individual FARP shall provide the necessary circuitry (notification appliance circuits (NAC), initiating device circuits (IDC), DC power circuits required by various devices, etc.) to the fire alarm devices within its coverage area. The FARP shall provide interconnection services between the device circuits in its area of coverage and the FACP just as if those device circuits were directly connected to the FACP.

F. The Owner shall be responsible for any retrofits, installation and design required by the local AHJ to comply with the requirements of the 2010 Florida Fire Prevention Code Section 11.10. This code requirement can only be determined after the construction of the building and may or may not be required by the local AHJ in the area of this project.

1.3 DESCRIPTION

A. The Contractor shall furnish and install a complete addressable analog fire detection system. The system shall include but not be limited to:
   1. Main Fire Alarm Control Panel (FACP) including all required power supplies.
   2. Fire Alarm Annunciator Panel (FAAP).
   3. Voice Evacuation System
   4. Manual Pull Stations.
   5. Smoke Detectors.
   6. Duct Detectors.
   7. Heat Detectors.
   8. Voice Evacuation Speakers
   9. Combination Audible/Visual devices (indoor and outdoor weatherproof as indicated on the drawings).
   10. Visual Devices (indoor and outdoor weatherproof as indicated on the drawings).
   11. Remote Fire Alarm Control Panels (Network Nodes).
   12. Remote Power Supplies (Remote power supplies shall be in a UL Listed assembly and be provided by the same manufacturer as the Fire Alarm Control Panel (FACP)).
   13. "Do Not Use Elevator" warning lights.
   14. Modem for remote service capabilities.

15. "Areas of Rescue Assistance" Equipment (Areas of Rescue Assistance Equipment shall be provided and installed by the Fire Alarm System Installer).
16. Surge Suppression.
17. Programming.
18. Grounding
19. Firestopping (Firestopping is to be performed under Division 7 Section Firestopping).
20. Wire and Cable Labeling.
21. Electrical power required to comply with all functions and operations called for in this section of the specifications. Contractor shall provide and install all 120 VAC circuits as required.
22. Conduit, wire, wire fittings, terminal cabinets with plywood and terminal strips, and all accessories required to provide a complete operating system.
23. A complete and accurate schematic/drawing of the fire alarm system to be placed adjacent to the fire alarm annunciator panel and the main fire alarm panel.

B. Contractor shall furnish and install all equipment (raceways, wire/cable, circuit breakers, modules, relays, etc.) necessary, and as required by applicable code, to accomplish incidental functions of the fire alarm system including but not limited to the following:
   1. Elevator recall, control, and/or shutdown.
   2. Monitoring of sprinkler system and/or fire protection system flow and tamper switches.
   3. Monitoring of sprinkler system and/or fire protection system valve supervisory switches.
   4. Monitoring of post indicator valve (PIV) switches.
   5. Gas/Fuel valve shutoff.
   6. Escalator shutdown.
   7. HVAC system control and/or shutdown.
   8. Ventilation system (supply fans, exhaust fans, fan terminal boxes, etc.) control and/or shutdown.
   9. Control of fire, smoke, and/or combination fire/smoke dampers.
   10. Fire suppression and or extinguishing systems.
   11. Monitoring of kitchen hood fire suppression systems.
   12. Control of fire and/or smoke doors, dampers, shutters, etc.
   13. Control of door hold open devices.
   14. Control of time out room door lock devices.
   15. Connection to the internet via a local data drop.
C. System shall operate as a non-coded, continuous ringing system which will sound all audible devices, evacuation devices, and activate all visual devices until it is manually silenced.
D. System shall be wired as a Class B system for all circuits.
E. System is to be a complete analog addressable system except for portables. Portables shall be wired as hard-wired circuits.
F. All portions of fire alarm system shall be installed in conduit. Conduit and boxes to be installed by Electrical Contractor.
G. Fire alarm system shall not share a raceway, junction box, enclosure, manhole or device with any other system.
H. Contractor to advise Owner of requirements for monitoring the fire alarm system by Owner's monitoring company and provide all electrical required for remote monitoring including tie to security cabinet.

I. Provide and install wiring, equipment, etc. for connection to devices furnished under other divisions of the work.
J. Provide and install wiring, equipment, etc. as required to deactivate power in the elevator rooms by heat detectors via shunt trip breakers and arm sprinkler pre-action system.
K. Provide and install wiring, equipment, etc. as required to deactivate power to computer power panels and air conditioning equipment by automatic or manual devices as shown on plans.
L. In buildings, two or more floors not fully sprinkled, provide communication equipment, in accordance with all applicable codes, for Areas of Rescue Assistance.
M. Although they may not be indicated on the fire alarm system diagram and/or drawings, all required control and interlock wiring between the fire alarm system and building equipment shall be provided hereunder. Controls are required to/for/from:
    1. Fire/smoke air and duct detectors
    2. Fire, smoke and/or combination fire/smoke dampers.
    3. Supply/Return fans, Exhaust fans, and/or Fan Terminal Boxes (FTB)
    4. Automatic fire extinguishing systems
    5. Smoke evacuation equipment
    6. Sprinkler and/or Fire Protection system components
    7. Access Control
N. Provide wiring for Post Indicator Valve Alarms, in each instance in which these are provided under work of Other Trades, connected to Fire Alarm System.
O. Provide and install all relays (electric-electric, electric-pneumatic, and/or pneumatic-electric) as required for a complete and operational fire alarm system, complying with all applicable codes and all requirements, and coordinated with all divisions of these specifications.
P. Provide terminal cabinets sized to house terminal strips and surge suppression equipment.
Q. Surge Suppression
    1. The contractor shall have equipment installed on the AC voltage supply and other lines taking care to arrest damaging electrical transient and spikes which can cause damage to the microprocessor components of the system. Central office telephone lines shall have equipment installed to arrest high voltages from electrical and/or lightning from entering the system and causing damage.
    2. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building fire alarm system from the effects of induced transient voltage surge and lightning discharge as indicated on drawings or specified in this section.
    3. Provide surge suppression equipment at the following locations:
        a. On each conductor pair and cable sheath entering or leaving a building.
        b. On each conductor associated with fire protection (sprinkler) system fire alarm connections.
        c. On all telephone lines.
        d. In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to the design of the equipment. Where equipment being protected has internal surge suppression equipment, the surge protection equipment herein specified is required to be installed in addition to internal equipment protection.

1.4 STANDARDS, CODES, REFERENCES, AND REGULATORY REQUIREMENTS

A. Equipment and installation shall comply with the current or applicable provisions of the following standards:
   1. ANSI S3.41 American National Standard Audible Emergency Evacuation Signal
   2. National Fire Protection Association Standards:
      a. NFPA 70 National Electrical Code (including but not limited to Article 760, Fire Alarm Systems, Article 770, and Article 800)
      b. NFPA 72 National Fire Alarm Code
      c. NFPA 101 Code for Safety to Life from Fire in Buildings and Structures
      d. NFPA 90A Installation of Air Conditioning and Ventilating Systems
      e. NFPA 96 Ventilation Control and Fire Protection of Commercial Cooking Operations
   3. Underwriters Laboratories Inc. System and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:
      a. UL 864 (Category UOJZ) APOU Control Units and Accessories for Fire Alarm Systems. All Control Equipment shall be listed under UL category UOJZ.
      b. UL 268 Smoke Detectors for Fire Alarm Systems
      c. UL 268A Smoke Detectors for Duct Application
      d. UL 217 Smoke Detectors Single and Multiple Station Smoke Alarms
      e. UL 521 Heat Detectors for Fire Protective Signaling Systems
      f. UL 228 Door Closers-Holders with or Without Integral Smoke Detectors
      g. UL 464 Audible Signal Appliances
      h. UL 1638 Visual Signaling Appliances – Private Mode Emergency and General Utility Signaling
      i. UL 1481 Power Supplies for Fire-Protective Signaling Systems
      j. UL 1480 Speakers for Fire Alarm, Emergency, and Commercial and Professional Use
      k. UL 1424 Cables for Power Limited Fire Alarm Circuits
      l. UL 1971 Signaling Devices for the Hearing Impaired
      m. UL 1449, 3rd Edition Standard for Safety for Surge Protective Devices
      n. UL 497 Protectors for Paired-Conductor Communications Circuits
      o. UL 497A Secondary Protectors for Communications Circuits
      p. UL 497B Protectors for Data Communications and Fire-Alarm Circuits
   4. All fire alarm equipment, including accessories to the system and including all wires and cable unless otherwise noted, shall be listed by the Underwriters Laboratories product directory called Fire Protection Equipment and/or the Electrical Construction Materials List.
   5. Each item of the fire alarm system shall be listed and classified by UL and FM as suitable for purpose specified and indicated.
   6. System controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760.
   7. All equipment supplied as part of the Fire Alarm System shall be provided by a single manufacturer and shall comprise a complete UL Listed Fire Alarm System.

8. IEEE: Fire alarm system includes solid state electronic components. Therefore, the equipment manufacturer shall provide certification that all such equipment is internally protected from, or can withstand, power line surge voltages and currents as specified in Table 1, Location Category A High Exposure of ANSI/IEEE Standard C62.41 1991.

B. Equipment and installation shall comply with the current or applicable provisions of the following codes and laws:
   1. Americans with Disabilities Act (ADA): The fire alarm system shall comply with ADA, Public Law 101-336, 1990. The system shall comply with ADA Accessibility Guidelines (ADAAG).
   2. Federal Register - Rules and Regulations - Non-discrimination on the basis of Disability by Public Accommodations and in Commercial Facilities.
   3. ASME/A17.1- 2016/CSA B44-16 Safety Code for Elevators and Escalators.
   4. Local and State Building Codes.
      a. Florida Building Code – 2020.
      b. Florida Administrative Code. All applicable chapters including but not limited to:
         i. Chapter 69A Rules, including but not limited to:
            a) Ch 69A-3 Fire Prevention - General Provisions
            b) Ch 69A-46 Fire Protection System Contractors and Systems
            c) Ch 69A-47 Uniform Fire Safety Standards for Elevators
            d) Ch 69A-48 Fire Safety Standards for the Fire Alarm Systems
         ii. Florida Administrative Code 6A-2/SREF (Schools)
      c. Florida Fire Prevention Code – 2020.
      d. Florida Department of Insurance:
         i. Insurance Code: The fire alarm system and installation thereof shall comply with the State of Florida Department of Insurance rules. The requirements of the Florida State Department of Insurance shall be as promulgated by the Division of State Fire Marshal.
         ii. Fire Alarm Rules: The fire alarm system and installation thereof shall comply with the Fire Safety Rules promulgated by the Florida State Fire Marshal.
      e. Authority Having Jurisdiction:
         i. General: The system shall comply with all applicable Codes, Ordinances and Standards as interpreted and enforced by the local Authority Having Jurisdiction.
         ii. Fire Department (AHJ – SJCSD Safety, Fire & Health)
         iii. Building Official
         iv. State of Florida: Division of State Fire Marshal.

C. Surge Suppression
   1. Equipment Certification: When available by any one manufacturer, all surge suppression equipment shall be listed by Underwriters Laboratories, shall bear the UL seal, and be marked in accordance with referenced standard. Such surge suppression equipment shall be UL listed and labeled for intended use.
   2. Comply with all standards and guides as listed under "References" above.

1.5 RELATED SECTIONS

A. All applicable sections of Division 0, Division 01, Divisions 26, 27 and 28.
B. Applicable sections of these specifications with regard to, but not limited to:
   1. Doors

2. Exhaust hoods
3. Elevators
4. Standpipe and fire hose systems
5. Sprinkler systems
6. Extinguishing systems
7. Ductwork accessories: smoke dampers
8. Building control systems
9. School, Intercom System with Time Program Clock Modular Administrative Communications System
10. Local Area Sound System
11. Intrusion Detection System
12. Access Control System

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten (10) years' experience and with service facilities within 50 miles of Project.
B. Installer:
   1. Company specializing in installing the products specified in this section with minimum ten (10) years' experience.
   2. The Installer shall be currently licensed by the Electrical Contractors Licensing Board as a Certified Alarm System Contractor I (EF).
   3. The installing Contractor shall be a direct sales division of, or the authorized and designated distributor for, a fire alarm system manufacturer.
   4. Installing Contractor shall maintain a local staff of specialists, including a Fire Alarm Planning Superintendent, for planning, installation, and service.
   5. The installing Contractor shall maintain an office within fifty (50) miles of the project with capability to provide emergency service 7-days-a-week, 24-hour days. The installing Contractor shall have been actively engaged in the business of selling, installing, and servicing fire alarm systems for at least ten (10) consecutive years going back from date of bid.
C. Surge Suppression
   1. All surge suppression devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electronics/communications systems equipment.
   2. The surge suppressor manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor.
   3. Verify proper clearances, space, etc. is available for surge suppressor.
D. Coordination/Project Conditions
   1. Verify proper grounding is in place.
   2. In installations where the electrical contractor does not provide a counterpoise system in conjunction with the underground raceway system, the fire alarm contractor shall provide a coupling conductor within the fire alarm underground raceway system to run alongside fire alarm conductors. Coupling conductors shall be sized according to applicable codes and standards.

E. To establish the type and operating characteristics of the fire alarm system, the equipment specified herein is used as a guide in determining the functions of the fire alarm system. Other equipment will be considered for approval provided the following is submitted in writing by the system installer to the engineer (See Section Common Work Results on Substitutions):
   1. Contractor qualifications (as listed above).
   2. Complete lists, descriptions, and drawings of materials to be used.
   3. A complete drawing showing conduit, conduit sizes, backboxes, number of wires and wire sizes.
   4. A complete riser diagram of Fire Alarm System.

F. Acceptable Manufacturers:
   1. Basis of Design
      a. Simplex 400-U
   2. Acceptable Substitution:
      a. Notifier NFS2-3030
      b. Fire Control Instruments, Inc (FCI) E-3
      c. Edwards EST-3

1.7 SUBMITTALS

A. Submit in accordance with Division 01 and Section Common Work Results.
B. In addition to requirements of above, the contractor shall submit:
   1. Narrative of operation of System as provided. (Submittal will not be reviewed by the A/E without this narrative.)
   2. Manufacturer's data on all products, including but not limited to:
      a. Catalog cut sheets.
      b. Roughing-in diagrams.
      c. Installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
      d. Operation and maintenance manuals.
      e. Typical wiring diagrams and risers.
      f. The contractor shall submit test reports, manufacturers' specifications, and any other information necessary to determine compliance with material and equipment specifications described herein.
   3. Submit floor plans to locate all devices. Wiring diagrams shall include wire and raceway sizes, fire alarm control panels, riser wiring and associated raceway sizes, wiring details, connections, and terminal identification. All devices shall be identified by the same applied identification symbol as shown on the contract documents.
   4. Submit all load calculations and cable/wire sizing for each branch of the individual fire alarm field circuits. Wire sizing calculations to prove maximum three percent (3%) voltage drop at all AC voltages and maximum eight percent (8%) voltage drop at all DC voltages.
   5. Battery sizing calculations.
   6. Submit a detailed step by step testing procedure for a component-by-component system functional checkout and test.

7. Point to point wiring diagrams and block diagrams of system to be installed. Point to point wiring diagrams may be submitted at time of operation and maintenance manuals in lieu of in submittal brochure. Block diagrams shall be required with submittals.
8. Riser diagrams and floor plans showing conduit runs and number of wires. All devices shall be identified by the same applied identification symbol as shown on the drawings.
9. Surge Suppression
    a. Surge protective data for 120-volt power source, power circuit, outside signaling circuit, and exterior incoming circuits from other buildings (if any), and outgoing circuits to other buildings (if any).
    b. Submit Product Data for each type of suppressor:
        i. Dimensions.
        ii. Means of mounting.
        iii. Compliance with UL Standards referenced.
        iv. Compliance with IEEE Standards referenced.
        v. Design type (Hybrid, MOV).
        vi. Size of wire leads.
        vii. Warrantee.
        viii. Performance data showing compliance with performance as specified herein.
        ix. Complete schematic data on each suppressor type indicating component values, part number, conductor sizes, etc.
        x. Manufacturer's certified test data on each suppressor type.
        xi. Test data from an independent test laboratory.
10. Name, qualifications, etc. of company providing and installing system.
11. Qualifications of installer. Submit proof installer meets specified requirements.
12. Proof of UL Listing. Indicate the UL listing, the UL classification, and NEC insulation type used for each type of wire to be used in installation of fire alarm and communications system.
13. Manufacturer's drawings showing all dimensions (height, width, and depth) for all cabinets used to house system components. Provide catalog pages, mounting details and specification sheets for all fire alarm system components and rough-in boxes.
14. Submit Florida Registered Firm certificate number.
15. Submit Florida Fire Alarm Contractor's license number.
16. Submit Fire Alarm Technician(s) manufacturer's certification.
17. Detailed drawing of the Fire Alarm Control Panels layout indicating the exact arrangement of all zones, including expansion zones.
18. Coordination Drawing: Coordination CAD drawing of building Fire Command room and equipment layout as shown on drawings, with all panel and rack footprints, using actual manufacturer's dimensions, indicating proper clearances.
19. Network:
    a. Complete description data indicating UL listing for all network components.
    b. Complete sequence of operation of all functions of the network.
    c. A list of every network node address.
    d. A list of every address of every device connected to a network node that is provided for purposes of alarm initiation, status monitoring, supervised notification appliance circuits, and auxiliary control.

e. Complete network wiring diagrams for all components and interfaces to equipment supplied by others.

20. All drawings required herein shall be on AutoCAD Release 2006 or higher.
21. Where required by Authority Having Jurisdiction submit signed and sealed documents as required by Authority Having Jurisdiction. Where Authority Having Jurisdiction requires shop drawings to be signed and sealed by a Registered Engineer, Contractor is required to submit same and include in his bid all costs associated with having a Registered Engineer other than the design Engineer of Record perform signing and sealing.

1.8 PROJECT RECORD DOCUMENTS

A. Submit in accordance with Division 01, Section Common Work Results and Section Operation and Maintenance Manuals.
B. In addition to the requirements above, the contractor shall submit:
   1. Updated and revised contract documents to record actual locations (as-installed) of all equipment, devices, initiating devices, signaling appliances, and end-of-line devices.
   2. Record actual type, size, and routing of cables installed.
   3. Record all cable identifications.
   4. Drawings required herein are in addition to those required under "OPERATION AND MAINTENANCE DATA".
   5. All drawings required herein to be on AutoCAD Release 2006 or higher.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit in accordance with Section Common Work Results and Section Operation and Maintenance Manuals.
B. In addition to the requirements of Sections above, the contractor's O & M Manuals shall include:
   1. A complete as-installed equipment list, listed by room, with manufacturers' names, model numbers, serial numbers, and quantities of each item.
   2. A complete and correct system schematic, showing detailed connections for all parts of the system, including wire numbers, terminal block numbers and layouts, and other designations and coding (point-to-point wiring diagrams). System performance measurements shall be documented as noted elsewhere in this specification.
   3. Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.
   4. Repair parts list for each and every major equipment item furnished.
   5. Service manuals for each and every major equipment item furnished.
   6. Manufacturer's warranties and operating instructions for each and every equipment item furnished. Include a copy of the certificate of warranty, signed by both parties.
   7. Technical Systems Operations Manual, custom-written by the Contractor, for the purpose of instructing the Owner's operating personnel in the detailed step-by-step operation of the system and preventive maintenance procedures. This manual shall include descriptions of the system components and their relationship to system function. This manual shall be bound separately and labeled appropriately.
   8. Surge Suppression

a. O & M data to include:
   i. All accepted shop drawings, product data, and/or cutsheets.
   ii. Installation, connection, and maintenance information on each type of surge suppression.
   iii. Procedure and/or timetable for recommended periodic inspection of devices to determine continued usefulness.

9. Complete equipment rack layouts showing locations of all rack mounted equipment items.
10. CAD floor plans, prepared at a scale of not less than 1/16" = 1'-0" showing detectors, speaker locations and orientation, rack locations, and all other related device locations.
11. The Contractor/Installer shall videotape the entire training session(s) and submit the video tape with the Operational Manual.

C. Drawings required herein are in addition to those required under Project Record Documents.
   1. All drawings required herein shall be on AutoCAD Release 2006 or higher.

1.10 WARRANTY

A. Contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of Final Completion, repair or replace any equipment found to be defective.
   1. No charges shall be made by the installer for any labor, equipment, or transportation during this period to maintain functions.
   2. Respond to trouble call within twenty-four (24) hours after receipt of such a call.

B. Contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of Final Completion.

C. Surge Suppression
   1. All surge suppression devices shall be warranted to be free from defects in materials and workmanship for a period of five (5) years.
   2. Any suppressor which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced by the manufacturer and installer at no cost to the Owner.
   3. Equipment that is damaged by surges during warrantee period shall be replaced at no expense to Owner.

1.11 ADDITIONAL DEVICES FOR JURISDICTIONAL COMPLIANCE

A. Prior to bid, Contractor shall review plans and specifications carefully for compliance with all codes and in particular, the ADA Requirements and NFPA 72. Contractor shall include in bid price any devices required to provide a fully compliant system. Said additional devices shall be shown on shop drawings submitted by contractor.

B. In addition to the above-mentioned devices, Contractor shall include in his bid price the cost of installing twenty additional audible/visual notification devices (over and above those shown on drawings, required by specifications, or determined by system installed to be required) whose location/need may not become apparent until just prior substantial completion date. At least two weeks prior to substantial completion system shall be fully operational. After system is operational SJCSD Safety Representative and the system installer shall review the placement of and coverage provided by visual and audible signals throughout the facility for compliance with all codes and in particular, the ADA Requirements and NFPA 72. System installer shall provide the additional devices at locations where the Architect/Engineer requests for complete coverage. The additional devices shall be installed and fully operational prior to date of Substantial Completion.
C. After the project has had its first annual safety inspection the system installer shall install within one weeks' notice any additional audible/visual signals that have been determined to be required during said inspection from the balance of the (20) twenty additional devices noted above. There shall be at no costs for these added devices provided the total does not exceed the balance remaining of the (20) twenty devices noted above. The final balance of the twenty additional devices included in bid price shall be turned over to the Owner as spare material after any fire alarm issues identified during the first annual safety inspection are resolved.

1.12 MAINTENANCE SERVICE

A. Furnish service and maintenance of fire alarm system for one (1) year from date of Final Completion.
   1. No charge shall be made by the installer and/or contractor for any labor, equipment, or transportation during this period to maintain functions.
   2. Respond to trouble call within twenty-four (24) hours after receipt of such call.
B. Provide annual testing and inspection of fire alarm system at end of first year in accordance with NFPA 72. Correct any deficiencies found at no cost to the Owner. Affix fire alarm tag to panel.

1.13 MAINTENANCE MATERIALS

A. Provide six (6) keys of each type.
B. Provide three (3) of each type of automatic smoke detector without base.
C. Provide three (3) of each type of surge suppression device.

1.14 PROGRAMMING

A. Contractor shall provide all programming (one (1) original copy on disk or CD ROM of the programming software as provided by the manufacturer) EPROM burners, specialty hardware (excluding generic computer), all access codes and copyrighted software needed for adding, deleting, and changing devices in the program, for the Owner's use.

1.15 OWNER'S INSTRUCTION:

A. Provide instruction to the Owner's designated personnel upon completion of the system installation. Instruction shall include a functional training session on fire alarm control panel operation and instruction on peripheral device operation, including what are normal indications and alarm indications of each type of new/added device. Videos record all training sessions and deliver (4) copies of tapes to Owner (for use in future training).
B. Contractor shall include in his bid all expenses to send two SJCSD representatives to the "End-User Certification Factory Training Course," at the manufacturer's factory. The course shall be specifically designed to allow SJCSD representatives the skills they need to successfully design, input, and modify, a database that will control the Fire Alarm System. The course shall also provide the skills to install, service and maintain the Fire Alarm System; Factory training for SJCSD Representative shall be completed prior to substantial completion of the project. Training shall provide instructions, licensed software, access codes, documentation program material, non-assignable and non-exclusive license for in-house use of the licensed software, and any other requirement to allow SJCSD the capability to add, delete or change devices in the program for the Fire Alarm/Detection system.

1.16 SYSTEM OPERATION

A. System operation shall meet the operation requirements of all codes and regulatory requirements.
B. Upon activation of the Fire Alarm System by a manual station, smoke detector, or any other new or existing automatic device the following shall take place:
    1. Energize all alarm signaling devices.
    2. Sound all audible (horn or speaker) alarms and flash visual signals throughout the campus.
    3. Alert proprietary system.
    4. Cause alarm to be displayed on the annunciator section of the control panel.
    5. Cause alarm to be displayed on remote annunciator.
    6. Close all doors or fire shutters, held open by automatic release devices throughout the facility, (coordinate with architect and door hardware supplier, provide all electrical required).
    7. Unlock all electrically locked time-out or access control doors (coordinate with the architect and door hardware supplier, provide all electrical required).
    8. Shut down all air handlers, exhaust fans supplying or exhausting air, and fan terminal boxes (FTB).
    9. Shut all fire and/or smoke dampers in ducts associated with the air handling units and exhaust fans which are shut down.
    10. Transmit signals to the building elevator control panel to initiate return to the main floor or alternate floor.
    11. Transmit signals to the building automation system to tell system that the fire alarm system has taken control of respective mechanical system.
    12. Send a signal to all dimming and lighting relay/control systems. Fire alarm signal shall initiate dimming system controls to drive all dimmed circuits to immediate full-on output. Fire alarm signal shall initiate lighting relay/control system to turn on all emergency lighting circuits.

13. Send a signal to all non-fire alarm sound reinforcement systems (i.e., Cafeteria, Gymnasium, Multi-Purpose Room, Theater, etc.). Fire alarm signals shall override all other sound systems. Alarm notification signals shall take precedence over all other signals. Operation of other sound systems shall resume after fire alarm system clears alarm.
14. Activate the system dialer and transmit the signal to the monitoring contractor, to notify the local Fire Department.

C. Elevator: Smoke detectors associated with elevator lobbies, hoist ways and machine rooms shall be types accepted by the Florida State Fire Marshal under FAC Chapter 69A-47 Uniform Fire Safety Standards for Elevators. Elevator recall shall be initiated ONLY by elevator lobby, hoist ways and machine room smoke detectors. In addition to those functions outlined in "B" above, elevator detector(s) shall initiate the following functions.
   1. Operation of any one Elevator Lobby or Hoist way Product of Combustion Detectors associated with a single bank of elevators shall signal the elevator controls to commence required procedures for that bank of elevators. Refer to Division 14 for required procedures, floor(s) of recall, and alternate floor(s) of recall.
   2. Operation of any elevator machine room Product of Combustion Detector that is part of this Fire Alarm System shall signal the elevator controls to commence required procedures for that bank of elevators. Refer to Division 14 for required procedures.
   3. Activation of the smoke detector(s) in a machine room or hoist way shall cause a suitable warning light to flash. The light is to be located adjacent to the "Phase One" recall switch or elevator hall button at the designated and alternate fire department access level.
   4. Fire Alarm system shall monitor shunt trip voltage per NFPA 72.

D. System supervisory faults, such as shorts, opens, and grounds in conductors, operating power failure, or faults within supervised devices, shall place the system in the trouble mode, which causes the following system operations:
   1. Visual and audible trouble signal indicated by zone at the fire alarm control panel.
   2. Visual and audible trouble signal indicated at remote annunciator panel.
   3. Trouble signals transmitted to central station.
   4. Manual acknowledgement function at fire alarm control panel shall silence audible trouble signal; visual signal shall be displayed until initiating failure or circuit trouble is cleared.

E. Alarm Reset: The system shall remain in the alarm mode until manually reset with a key accessible reset function. The system shall reset only if the initiating circuits are cleared.

F. Lamp Test: manual lamp test function causes alarm indication at each lamp on the fire alarm control panel and the remote annunciator.

G. When the fire alarm system is activated as a drill, all incidental functions shall be exercised including notification of the fire department.

H. Where required by codes or Authority Having Jurisdiction:
   1. When system is silenced by silence switch in control panel, audible alarm is to silence but visual alarm devices are to continue to operate.

I. Fire sprinkler valve tamper switch, when closed, shall annunciate a supervision signal at the fire alarm control panel and annunciator panels, if any. This supervision signal shall not cause a general alarm.

J. Operation of auxiliary contacts in control panel to shut all smoke dampers in ducts associated with air handling units and exhaust fans which are shut down. (These shall not be controlled from detector unit contacts.)

1.17 ZONING

A. Alarm Zones.
   1. Regardless of the number of zones shown on drawings, the minimum alarm zones required are:
      a. One per building, per floor for pull stations.
      b. One per building, per floor for automatic devices.
      c. One for each duct smoke detector).
      d. Each device shall be individually annunciated/addressable.
B. Notification Zones.
   1. Regardless of the number of zones shown on drawings the minimum notification zones (horns and strobe lights) required are:
      a. One (or more) circuit(s) for administration building
      b. One (or more) circuit(s) for exterior horns
      c. One (or more) circuit(s) for each building with voice evacuation
      d. One (or more) circuit(s) for remainder of campus.
   2. Breakdown circuits as required for load and distances involved.

PART 2 – PRODUCTS

2.1 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for the intended use and shall be provided by a single manufacturer.

2.2 RACEWAYS

A. General:
   1. All raceways (conduit, wireways, pull boxes, outlet boxes, etc.) shall comply with applicable requirements of sections within Division 26 of these specifications.
   2. All raceways (conduit, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of the manufacturer of the fire alarm system.
B. Conduit: Comply with Section Conduit except as noted below:
   1. Pull Cords: Install pull cords in all raceway runs that are installed without cable.
   2. Size: Minimum size shall be 3/4" conduit.
C. Boxes:
   1. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.
   2. Boxes shall be sized as required by the fire alarm system manufacturer and NEC for cables and/or device installed.

2.3 TERMINATION CABINETS

A. Terminal cabinets are to comply with applicable sections of these specifications.

2.4 "SYSTEMS" AND "LOCAL" GROUND BUS

A. Bus to comply with applicable sections of these specifications.

2.5 FIRE ALARM CONTROL PANEL (FACP)

A. General
   1. Fire alarm control panel shall be of dead front construction and be modular in design. Control panel shall be capable of future expansion and shall provide active signal initiating as noted on drawings (or as herein) specified with zones as noted on drawings (or as herein specified). Control panel shall provide provisions for future expansion. Fire alarm control panel shall be semi-flush mounted (unless otherwise noted on drawings) and located as shown on the drawings.

B. System Capability
   1. Communication with addressable devices: The system must provide communication with all initiating and control devices individually. All these devices are to be individually annunciated at the control panel. Annunciation shall include "Alarm", "Trouble", "Open", "Short", "Ground", "Device Fail" or "Incorrect Device" conditions for each point.
   2. All addressable devices are to have the capability of being disabled or enabled individually.
   3. Each Signal Line Circuit (SLC) two-wire loop shall be capable of addressing a minimum of ninety-nine (99) addressable devices and ninety-eight (98) monitor or control modules.
   4. Identification of Addressable Devices: Each addressable device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.
   5. Wiring Type, Distances, Survivability and Configurations: The system must allow up to 2,500 feet wire length to the furthest addressable device. Style 4 Signaling Line Circuit (as defined by NFPA-72) communications will be provided.
   6. System shall be capable of addressable devices and conventional devices within the same system.
   7. All system circuits shall be inherently power limited per NEC 760.
   8. System shall be capable of communication with a minimum of fifteen (15) remote module locations.

C. Master Controller
   1. Master controller shall be an integral part of the control panel and be microprocessor-based.
   2. Master controller shall store all programming in non-volatile memory.
   3. Master controller shall have an event log capable of storing a minimum of two hundred fifty- five (255) events in non-volatile memory.
   4. Master controller shall include an eighty (80) character Liquid Crystal Display.
   5. Master controller shall include, as a minimum, switches to accomplish Alarm/Trouble Acknowledge, Alarm Silence, Trouble Silence and System Reset.

6. Master controller shall include, as a minimum, LED's to indicate System Alarm, System Trouble, Supervisory Alarm and System Silence.
7. Master controller shall support connection of serial remote annunciators.
8. Master controller shall provide a minimum of two (2) notification appliance circuits (Class A or B, Style Z or Y).
9. Master controller shall be capable of being expanded as necessary to accommodate all required modules.

D. Notification Appliance Circuits
1. Notification Appliance Circuits Module shall provide fully supervised style Z or Y (Class A or B) indicating circuits. These circuits shall be supervised, provide power or audio to horns, strobes, and speakers. Horns and strobes with polarity reversing loops containing up to 1.75 amperes of 24 Volt notification devices. Speaker circuits with 25 or 70 Vrms containing up to a 40 Watts speaker load.
2. Module shall be provided with pluggable contact wiring terminal strips for ease of installation and service. The terminal strips shall be UL listed for 12 AWG wiring.

E. Power Supply
1. Power supply for the panel and all fire alarm peripheral shall be integral to the control panel. Power supply shall provide all control panel and peripheral power needs as well as 3.0 amperes of unregulated 24 VDC power for external audio-visual devices. Audio-visual power may be increased as needed by adding additional modular expansion power suppliers. All power supplies shall be designed to meet UL and NFPA requirements for power-limited operation on all external signaling lines, including initiating circuits and indicating circuits.
2. All power supplies shall be provided by the same manufacturer as the fire alarm control panel (FACP). Power supplies provided by manufacturers other than the manufacturer of the fire alarm control panel (FACP) shall not be acceptable.
3. Circuit breakers or other over-current protection on all power outputs.
4. Input power shall be 120 VAC, 60 Hz. Power supply shall provide internal batteries and charger. Internal battery capacity shall be as required.
5. Battery pack shall provide maximum normal operating and supervisory power for:
   a. 24 hours per NFPA 72
   b. Provide low maintenance gel cell type batteries with sufficient ampere-hour rating to meet the above NFPA Standard and to operate all alarm signals for a duration of 15 minutes at the end of the required period of time.

F. Modem
1. A modem shall be provided as an integral part of the fire alarm control panel (FACP). The modem shall provide the Owner with the ability to accomplish the following functions:
   a. View device sensitivity information.
   b. View system activity in real time.
   c. Access and view the system history log.
2. Modem shall not allow changes to system programming.
3. Modem shall operate at a minimum speed of 9600 baud.
4. Modem shall provide an RJ-11 connector for connection to a telephone line.
5. Fire alarm contractor shall coordinate with the Premise Distribution System (PDS) contractor and/or the Telephone System contractor for interconnection to a telephone line. Telephone interconnection wiring up to the modem shall be provided by the PDS or Telephone contractor.
6. The modem shall mount inside the fire alarm control panel (FACP).

G. Wall Mount Equipment Enclosure

1. The control panel, and all associated equipment, shall be housed in an enclosure designed for mounting directly to a wall or vertical surface. The back box and door shall be constructed of 16-gauge steel with provisions for electrical conduit connections into the sides and top. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.
2. The enclosure(s) shall be of sufficient size to house all equipment required for this project. All equipment shall be mounted in the enclosure(s) as designed by the manufacturer. Provide enclosures in quantities as required to provide a complete, UL Listed Fire Alarm system.

2.6 REMOTE ANNUNCIATOR

A. Fire Alarm Annunciator Panel (FAAP) shall be a serial annunciator panel and must be capable of being mounted in a remote location.
B. Annunciator shall be modular using low current circuitry. The annunciator shall be capable of operating on nominal 24 Vdc and be battery backed up.
C. Annunciator modules shall be capable of activating local or remote LED's, relays, or graphic panels.
D. All switches shall be a point in the system and be capable of controlling any system output or functions. All LED's and outputs shall be capable of being controlled by any change of state in the system or as a result of a time control, sequence or logic function. LED's and switches shall be able to be clearly marked by the end user.
E. Modular components of the annunciator shall be mounted in a recessed cabinet with hinged door and a Lexan window with keylock.

2.7 VOICE EVACUATION SYSTEM

A. The voice evacuation system shall provide 50- or 100-Watt signal power and 50- or 100-Watts voice power as required and shall be UL listed.
B. All speaker circuits shall be field selectable for 25 or 70 Vrms operation and shall be power limited. Non-power limited circuits are not acceptable.
C. The voice evacuation system shall be microprocessor based, and shall contain an integral microphone, 50- or 100-Watt audio amplifier (as required), tone generator, digital message repeater, 120 VAC power supply, and battery charger.
D. The voice evacuation message/signal shall be broadcast until the Fire Alarm Control Panel (FACP) is reset, or until fire emergency personnel interrupt the broadcast with a manual page. On reset system shall automatically return to standby (normal operating) condition.
E. A secondary message shall be provided that can be triggered by the closure of a contact from either the FACP or from any normally open contact device.
F. Remote paging microphone(s) will be supported by the system through a supervised circuit. Remote microphone(s) may be mounted up to 5,000 ft. (1,524 m) away from the voice evacuation panel.

2.8 MANUAL STATION (NON-BREAK GLASS)

A. Manual fire alarm station shall be non-code, non-break glass type providing noncoded signals and operating with a double action motion. Upon actuation, they shall not be restorable to normal except by use of a key. The key shall also allow stations to be tested nondestructively. The stations shall be constructed of metal, with operating directions provided on the cover in highlighted, embossed lettering. The words "FIRE ALARM" shall appear on the door in embossed letters one-half inch high or larger. Mount at 48" above finished floor to top and in accordance with NFPA and handicap standards. Manual stations shall be UL listed. Unit shall be equipped with an addressable interface module. Stations constructed of plastic will not be acceptable.

2.9 PHOTOELECTRIC SMOKE DETECTOR

A. The contractor shall furnish and install Analog addressable photoelectric smoke detectors, as called for on drawings. The combination detector head, and twist-lock base shall be UL-listed compatible with a UL-listed fire alarm panel.
B. Smoke detector shall have a flashing, status-indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. The detector may be reset by actuating the control panel reset switch.
C. Sensitivity of the detector shall be monitored without removal of the detector head. Metering test points shall be accessible on the exterior of the detector head. Field adjustment of the sensitivity shall be possible when conditions require a change.
D. Vandal-resistant, security locking feature shall be used in those areas as indicated on the drawings. Locking feature shall be field removable when not required.
E. It shall be possible to perform a functional test of the detector without the need of generating smoke. Test method must simulate effects of products of combustion in the chamber to ensure testing of all detector circuits.
F. To facilitate installation, detector shall be non-polarized. By using a furnished wire jumper, it shall be possible to check circuit loop continuity prior to installing the detector head.
G. Voltage and RF transient suppression techniques shall be employed to minimize false alarm potential. A gated alarm output shall be used for additional detector stability.

2.10 DUCT MOUNTED SMOKE DETECTOR

A. Duct Mounted Smoke Detector for the fire and smoke detection system shall be a high velocity rated Analog addressable series smoke detector intended for use with ventilation and conditioning ducts.
B. Detector shall provide detection of combustion gases and smoke in air conditioning ducts in compliance with NFPA 90A. Detector shall be UL-listed specifically for the use in air handling systems.
C. Detector shall operate at air velocities ranging from 300 feet per minute to 4000 feet per minute without requiring compensation for operation at specific air velocities. Sampling tubes of proper length shall be provided and installed to match duct width at the installed location.

D. Whether shown on drawings or not, a remote alarm indicator/test station shall be provided for each duct mounted smoke detector to annunciate smoke detector operation remotely. Mount unit in ceiling or wall near respective remote smoke detectors (in an occupied space).
E. Detector shall be zoned so that when either the supply or the return detector senses smoke it will cause a supervisory/trouble indication at the main fire alarm panel and immediately shut down the air handler. The duct mounted detectors are NOT to cause a general alarm to sound.

2.11 PROJECTED BEAM SMOKE DETECTOR

A. Contractor shall furnish and install Projected Beam smoke detectors, as called for on drawings. Detector shall include both the emitter and the receiver and be UL-listed compatible with a UL- listed fire alarm panel. Detector shall provide a Form A dry contact for alarm and Form B contact for trouble.
B. Smoke detector shall have a status-indicating red LED for visual supervision. When the detector is actuated, the LED will illuminate on steady and at full brilliance. Detector may be reset by actuating the control panel reset switch.
C. Detector shall have a range of 35 feet to 320 feet. Detector shall be field adjustable to one of the obscuration settings of 25%, 50% or 70% per span. These settings shall be capable of being verified with calibrated filters.
D. Projected Beam smoke detector shall possess circuitry that automatically compensates for normal ambient changes in the intensity of the emitted beam strength. The microprocessor shall provide compensation for a change in received signal value, over time, caused by contamination of the optics. When this compensating capability reaches a limit, the microprocessor automatically generates a trouble signal.
E. Projected beam smoke detector shall also signal a trouble condition if the beam has a blockage of 90% for more than twenty (20) seconds and automatically reset to normal when the blockage is removed.
F. It shall be possible to perform a functional test of the detector without the need of generating smoke. The test method must simulate effects of products of combustion in the chamber to ensure testing of all detector circuits.
G. To facilitate installation, the detector shall employ signal strength indicating LED. Alignment is facilitated by turning an alignment adjustment wheel and monitoring the relative signal strength based upon which LED is lit. The detector shall be installed in accordance with the instructions provided with every unit and the listed Installation, Operation and Maintenance Manual, and the applicable NFPA standards.
H. Projected Beam smoke detector shall include an Addressable Monitor module and a Power Supervisory relay.
I. Voltage and RF transient suppression techniques shall be internal circuitry of the detector to minimize false alarm potential.

2.12 HEAT DETECTORS

A. Contractor shall furnish and install Analog addressable heat detectors, as called for on drawings. Combination detector head and twist-lock base shall be UL-listed compatible with a UL-listed fire alarm panel.
B. Heat detector shall have a flashing, status-indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. Detector may be reset by actuating the control panel reset switch.

C. Fixed temperature automatic heat detectors shall be rated at 135□F (unless otherwise noted or required due to ambient conditions, i.e., Kiln Room). Fixed temperature element shall use dual thermistor technology. Detectors shall have a smooth ceiling rating of 900 square feet. When required, detectors shall be equipped with two Form 'A' contacts with rating of 3 amps at 6 to 125 volts A.C. and 1 amp at 6 to 28 volts DC.
D. Detectors shall be installed in accordance with appropriate articles of National Fire Protection Association and the spacing rating assigned by the Underwriters Laboratories and located as shown on the drawings. Automatic heat detectors shall be Underwriters Laboratories and Factory Mutual approved.
E. Where indicated on the drawings, the Contractor shall provide heat detectors rated, by the manufacturer, as explosion proof. If not an integral part of the heat detector assembly, the addressable module shall be located outside the area protected by the explosion proof heat detector (but interior to the building) in an accessible area. If the addressable module is located above a gypsum board ceiling the Contractor shall provide a fire rated access panel.

2.13 ADDRESSABLE MODULE

A. Analog addressable device shall be furnished as required to monitor fire alarm or supervisory initiating devices or control auxiliary functions. Each module shall contain address switches to assign a unique input point for programming or control by the system.

2.14 RELAYS

A. Relays required for control (i.e., Air Handler shutdown, Supply Fan shutdown, Exhaust Fan shutdown, Fan Terminal Box shutdown, Door Lock release, Fire Shutter release, Smoke Damper closure, Fire Damper closure, Smoke/Fire Damper closure, or any other interface required by these specifications or applicable codes) shall be UL Listed relays suitable for use in Fire Alarm systems.
B. Per NFPA, relays used for control of other systems shall be located within 3 feet of the device to be controlled.
C. Relays shall be analog addressable devices powered and controlled from the fire alarm system. Each relay shall contain address switches to assign a unique input point for programming or control by the system.
D. Each relay shall provide at least one set of Form "C" dry relay contacts.

2.15 AUDIBLE NOTIFICATION DEVICES

A. Audible notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein.
B. The audible notification device shall include screw terminals for in-out field wiring. The device shall surface mount to a standard 4-inch sq. x 2 -1/8-inch backbox.
C. The audible notification devices shall be UL listed for fire protective service and shall provide 24 VDC inputs and sound output of not less than 75 dBA at 10 feet, or more than 120 dBA at the minimum hearing distance from the audible appliance.
    1. Audible notification device shall be compliant with ANSI S3.41 for signal character conformance.

D. Audible notification devices located on the exterior of a building, or in a damp or wet location, shall be a weatherproof version and rated, by the manufacturer, for use in wet locations.

2.16 AUDIBLE/VISUAL NOTIFICATION DEVICES

A. Audible/visual notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein.
B. Audible/visual notification device shall include screw terminals for in-out field wiring. The device shall surface mount to a standard 4-inch sq. x 2 -1/8-inch backbox.
C. Audible portion of the audible/visual notification devices shall be UL listed for fire protective service and shall provide 24 VDC inputs and sound output of not less than 75 dBA at 10 feet, or more than 120 dBA at the minimum hearing distance from the audible appliance.
    1. Audible portion of the audible/visual notification device shall be compliant with ANSI S3.41 for signal character conformance.
D. Audible portion of audible/visual notification devices located on the exterior of a building, or in a damp or wet location, shall be a weatherproof version and rated, by the manufacturer, for use in wet locations.
E. Visual portion of the audible/visual notification devices shall comply with the Americans with Disabilities Act which includes the following:
    1. Lamp shall be a xenon strobe type or equivalent.
    2. Color shall be clear or nominal white (i.e., unfiltered, or clear filtered white light).
    3. Maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. Pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.
    4. Intensity shall be a minimum of 75 candela. Use of visual devices rated at 15/75, 15 or 30 candelas shall not be acceptable.
    5. Flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
    6. More than two visible notification appliances in the same room or adjacent space within the field of view must flash in synchronization. This requirement shall not preclude synchronization of appliances that are not within the same field of view.
F. A suitable polycarbonate cover shall be provided to protect devices at locations where they may be subject to damage such as Gymnasiums.

2.17 VISUAL NOTIFICATION DEVICES

A. Visual notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein. Visual notification devices shall be of the flashing type in compliance with Americans with Disabilities Act.
B. Visual notification devices shall comply with the Americans with Disabilities Act which includes the following:
    1. Lamp shall be a xenon strobe type or equivalent.
    2. Color shall be clear or nominal white (i.e., unfiltered, or clear filtered white light).
    3. Maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. Pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.
    4. Intensity shall be a minimum of 75 candela. The use of visual devices rated at 15/75, 15 or 30 candelas shall not be acceptable.

5. Flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
6. Fire alarm system strobes within same room shall flash in synchronization as required by NFPA.
7. More than two visible notification appliances in the same room or adjacent space within the field of view must flash in synchronization. This requirement shall not preclude synchronization of appliances that are not within the same field of view.

C. A suitable polycarbonate cover shall be provided to protect devices at locations where they may be subject to damage such as Gymnasiums.

2.18 VOICE EVACUATION SPEAKER/VISUAL NOTIFICATION DEVICES

A. Speaker/visual notification devices shall be wall/ceiling mounted at each location designated on the drawings and/or as specified herein.
B. Audible/visual notification device shall include screw terminals for in-out field wiring. The device shall surface mount to a standard 4-inch sq. x 2 -1/8-inch backbox.
C. Speaker portion of the speaker/visual notification devices shall be UL listed for fire protective service and shall provide 25 VMS or 70VMS inputs and sound output of not less than 85 dBA at 10 feet.
   1. Speaker shall be field configurable with taps at ¼, ½, 1, or 2 watts.
   2. Speaker shall have a frequency response: 250 to 5000 Hz.
   3. Speaker shall have a sealed back construction.
   4. Speaker shall include a DC blocking capacitor to allow electrical supervision of the audio distribution circuit.
   5. Speaker installation shall meet all UL 1480 standards for Fire Alarm.
D. Visual portion of the audible/visual notification devices shall comply with the Americans with Disabilities Act which includes the following:
   1. Lamp shall be a xenon strobe type or equivalent.
   2. Color shall be clear or nominal white (i.e., unfiltered, or clear filtered white light).
   3. Maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. Pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.
   4. Intensity shall be a minimum of 75 candela. Use of visual devices rated at 15/75, 15 or 30 candelas shall not be acceptable.
   5. Flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
E. More than two visible notification appliances in the same room or adjacent space within the field of view must flash in synchronization. This requirement shall not preclude synchronization of appliances that are not within the same field of view.
F. A suitable polycarbonate cover shall be provided to protect devices at locations where they may be subject to damage such as Gymnasiums.

2.19 ELEVATOR WARNING LIGHT WITH FLASHER

A. Provide complete, indicating light with flasher per FAC 69A-47. Install label as required.

2.20 WEATHERPROOF COVER (FOR AUDIBLE AND/OR VISUAL DEVICES)

A. Constructed of clear polycarbonate.
B. For flush or surface mount devices.
C. Provide slotted version for audible/visual devices.
   1. Maximum of 5 dB loss.

2. Provide with brass weep hole.

D. Provide un-slotted version for visual only devices.
   1. Maximum of 3 candela light intensity loss up to 110 candela light source.
   2. Provide without weep hole.
E. Provide with weather gasket.
F. Spacers for additional depth as required.
G. Provide with tamper proof screws.
H. Design criteria:
   1. Safety Technology International, Inc. #1220 (audible/visual) or #1221 (visual) series.

2.21 PULL STATION SECURITY COVER

A. Provide where pull station devices are required to be protected as indicated on the drawings.
B. Shall be UL Listed.
C. Constructed of clear polycarbonate.
D. Provide with battery operated warning horn.
E. For flush or surface mount devices.
F. Provide with weather gasket.
G. Spacers for additional depth as required.
H. Provide with tamper proof screws.
I. Design criteria:
   1. Safety Technology International, Inc. #1100 Series.

2.22 DOOR HOLDERS

A. Electromagnetic door holder/releases shall be installed on each door as detailed on the drawings and/or as specified herein. Holder/releases shall consist of wall mounted and floor mounted electromagnets and a door mounted armature with an adjustable contact plate. Electromagnets shall have a force of attraction of 24 pounds when energized and less than 3 pounds residual power disconnected. Armature contact plates shall have a horizontal adjustment of 25 degrees. The holding force of holder/releases shall be totally electromagnetic and without the use of mechanical linkage or other moving parts, and they shall normally be energized, and a release accomplished, by interrupting the circuit. Electromagnetic holder/releases shall be controlled by either automatic or manual alarm. Operating voltage shall be 24-volt DC.
B. Electromagnetic door holder/releases, where required, to be supplied and installed by the Contractor and wired into fire alarm system by systems contractor. Electromagnetic holder/releases shall be controlled by either automatic or manual alarm. Operating voltage shall be 24-volt DC.

2.23 SURGE SUPPRESSION

A. Non-Addressable Initiation Devices:
   1. Plug-in replacement modular design with associated female wiring connector.
   2. UL 497B listed and labeled.
   3. Multi-stage hybrid protection circuit.
   4. Fail short/fail safe.

5. Surge Capacity: 10KA with 8 x 20 □s waveform, 500A per line with 10 x 700 □s waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 □s waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Capacitance: 1500 pf.
9. Manufacturer:
   a. EDCO #PC642C series with #PCBIB base.

B. Addressable Initiation Devices and Data Loops:
1. Plug-in replacement modular design with associated female wiring connector.
2. UL 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 10KA with 8 x 20 □s waveform, 500A per line with 10 x 700 □s waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 □s waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Capacitance: 50 pf.
9. Manufacturer:
   a. EDCO #PC642C-LC series with #PCBIB base.

C. Horn, Strobe, Control Power (Low Voltage):
1. Plug-in replacement modular design with associated female wiring connector.
2. UL 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 5KA with 8 x 20s waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100-amp 10 x 700s waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Series Resistance: 0.2 ohms total per pair.
9. Manufacturer:
a. EDCO #P164 series (1 pair); #P264 series (2 pair), each with #SD12-PC base.

D. Power Circuit (120 volt):
1. UL 1449 listed.
2. 15 amp, 120V rated.
3. Suppressors shall be tested per IEEE, C62.41-1991 for Categories A and B.
4. Normal mode (L-N), and common mode (L+N-G) protection.
5. Internal fusing.
6. Hybrid design.
7. Indicators for normal operation and failure indication.
8. Enclosure:
   a. Fire retardant high impact, phenolic or plastic housing or metal enclosure.
9. Clamping voltage UL 1449, Line to Neutral, Category B Impulse At (3KA, 8 x 20s): 385V @ 120V.
10. Maximum Surge Capacity: 20,000 amps.

11. Maximum Continuous Operating Voltage: 115% of line voltage.
12. Provide hardwire connection or add 15-amp receptacle device to hardwired devices to match equipment being protected and maintain UL listing.
13. Provide additional 15 amp in-line fusing as required to comply with UL and the NEC when connected to a 20 amp, 120V circuit.
14. Manufacturers:
    a. Leviton #51020-WM (hardwired).
    b. EDCO #HSP-121BL2.

E. Terminations
1. Provide terminals sized for circuits required on project.
2. Where surge suppression modules are for mounting on 'M' block assembly, provide M block assembly complete with grounding system that mates with surge suppression equipment.

F. Terminal Cabinets
1. Provide terminal cabinets for all terminations and surge suppression equipment including 120VAC power surge suppressor as required in Section Surge Protection Devices. Size terminal cabinets as required to facilitate installation of terminations and surge suppression in a neat and workmanlike manner.
2. Terminal cabinet to meet specifications in Section Cabinets and Enclosures unless specifically manufactured for use.
3. Manufacturers:
    a. Interior.
        i. Square "D"
        ii. Hoffman
        iii. BUD
    b. Exterior.
        i. Hoffman
        ii. BUD
        iii. Carlon

2.24 CABLE

A. Contractor shall provide and install cable as required by the manufacturer, as specified elsewhere in these specifications, and to provide a complete, fully operational, UL Listed Fire Alarm system.
B. Fire alarm system cables installed in interior, exterior and/or underground raceways shall comply with the applicable sections of NEC Articles 760, 770 and 800.
C. Zip and zip type cables (e.g., West Penn 970, 971, 972, 974 or similarly constructed cables from other manufacturers) shall not be acceptable.
D. Wiring color code shall be as follows:
1. Horns/Strobes Black/Red
2. Door Holders White
3. A.H.S.D. Purple
4. Gas Shut-Off Pull Stations Orange
5. Addressable Twisted Pair Data Wire
6. Hard-Wired Brown/Blue
7. Speaker Twisted Pair Audio Wire

2.25 WATERFLOW DETECTOR

A. Water flow switch to be supplied and installed by the mechanical contractor and wired into Fire Alarm System by systems contractor. Zone as shown on zone schedule.

2.26 SPRINKLER SUPERVISORY SWITCHES

A. Supervisory Switch to be supplied and installed by mechanical contractor and wired into Fire Alarm System by systems contractor. Zone as shown on zone schedule.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer’s recommendations. Firestopping where penetrations are made through rated walls and floors shall be required. Firestopping is to be performed under Division 7 Section Firestopping.
B. Locate, install, and test fire alarm and detection systems in accordance with the equipment manufacturer's written instructions, and the latest editions of the National Electrical Code, the National Electrical Contractors Association publication "Standard of Installation" and all applicable codes and standards referenced in this specification.
C. Provide all work required for a complete system including complete system testing and checkout. All components shall be properly mounted and wired. The installation of this system shall comply with the directions and recommendations of authorized factory representatives.
D. Provide wiring, cabling, raceways, and electrical boxes in accordance with manufacturer's written instructions.
E. Components shall be electrically "burned-in" by operating the component at full power for a period as recommended by the manufacturer.
F. Installation shall be done in a neat workmanlike fashion by a firm regularly engaged in Fire Alarm Installation and Service.
G. The installation and inspection of all fire detection and fire alarm devices and systems shall be performed by, or under the direct on-site supervision of, a licensed fire alarm technician or a fire alarm planning superintendent who shall certify the work upon completion of the activity. The certifying licensee shall be present for the final test prior to certification.

H. As-built plans and wiring diagrams shall bear the signature and license number of the licensed fire alarm planning superintendent, the date of installation and the name, address, and certificate-of- registration number of the registered firm.
I. All components shall be completely wired. System shall be fully operable when main power service has failed, and the Emergency Standby Generator has assumed emergency system loads. This shall require that any devices which required 120-volt power shall receive supply from an emergency 120-volt source.
J. Installation of detectors:
   1. All ceiling mounted detectors shall be installed in accordance with the requirements of NFPA 72.
   2. All concealed detectors shall be provided with a remote indicating lamp and test switch installed in an occupied space (corridor, etc.) on wall or on the ceiling grid indicating the type of detector and the zone to which it is connected. Label shall be red with white lettering.
   3. Duct detectors shall be installed in accordance with NFPA 90A. All brackets and hardware shall be provided as required to install detector housing in correct position. All detector housings shall be sealed as required to prevent air leakage between duct and housing. Sampling tubes of proper length shall be provided and installed to match duct width at the installed location.

3.2 RACEWAYS AND BOXES

A. Provide dedicated raceway with applicable boxes for all fire alarm wiring in accordance with applicable sections of these specifications.
B. All initiating, indicating and auxiliary control devices shall be mounted on UL listed outlet boxes.
C. Provide supporting devices per Section Conduit.
D. Identify raceways and boxes per Section Identification for Electrical Systems.

3.3 WIRE/CABLE

A. Conductor: 98% conductivity, stranded copper with maximum of 19 strands. Stranded conductors shall have a compression lug installed at every end. Wrapping twisted strands at terminal block screw is not acceptable. As an acceptable equivalent, stranded conductor without crimp-on lugs may be terminated into terminal strips of box-lug connectors. SLC loops may utilize solid conductors.
B. Insulation: A type accepted by NEC for the application. All cable shall be UL listed for fire- protective signaling application. Communication, Class 3 or Multi-Purpose cables shall not be substituted for FP cable types. All multi-conductor cables shall have individually insulated conductors with an overall outer jacket.
C. Size: All conductors shall be sized as prescribed by the system manufacturer, with following minimums:
   1. Multiplex Signaling Line Circuit: AWG #14, solid twisted pair.
   2. Notification Circuits, Devices: AWG #14 THHN/THWN stranded conductors.
   3. Initiating Circuits, Hard-Wired Devices: AWG #14 THHN/THWN stranded conductors.
   4. Initiating Circuits, Addressable Devices: AWG #16 twisted pair.
   5. Speaker Notification Circuits: AWG #16 twisted pair.
   6. Provide larger conductors where required to maintain voltage drop or signal strength within acceptable limits.

7. Multiplex signal line circuits and addressable circuits shall be either shielded or unshielded based on equipment manufacturer's recommendations for specific application.

D. The above wire sizes shall be increased to size as required to comply with Authority Having Jurisdiction or as required for voltage drop, load, etc.
E. Color Coded:
   1. Wiring shall be color coded as required to match existing system.
   2. Permanent wire materials shall be used to identify all splices and terminations for each circuit at all junction boxes, outlet boxes, and terminations.
F. UL:
   1. General: Fire-protective signaling cable shall be UL listed as non-power limited or power limited as needed to match the output of the fire alarm equipment.
   2. Non-Power Limited: Fire protective signaling circuits classified as non-power limited shall use cable listed under UL Electrical Construction Materials Directory. Category HNHT, "NON-POWER LIMITED FIRE-PROTECTIVE SIGNALING CABLE". All such cable shall have fire resistance, listing and markings as described in NEC 760.176. Minimum cable marking shall be NPLF.
   3. Power Limited: Fire protective signaling circuits classified as power limited shall use cable listed under UL Category HNIR, "POWER LIMITED FIRE-PROTECTIVE SIGNALING CABLE". All such circuits shall be durably marked where plainly visible at terminations to indicate that it is a power-limited fire protective signaling circuit. Refer to paragraph titled "Fire Resistance of Cables" for additional requirements.
   4. Fire Resistance of Cables: Power-limited fire-protective signaling circuit cables shall be UL listed as described in NEC 760.179. All such cable shall bear a cable marking that includes a Type designation as given in NEC 760.179(I). Provide Type FPL.
G. Connections of Installation Wiring:
   1. Connections to Equipment: In accordance with NFPA for monitoring integrity and with the equipment manufacturer's instructions.
   2. Connections of installation wiring to alarm initiating devices and alarm indicating appliances shall be monitored for integrity.
   3. Interconnecting means shall be arranged so that a single break or single ground fault will not cause an alarm signal.
   4. Apply a compression lug, similar to T&B Sta-Kon Terminal, to all stranded conductors at terminations or use box-lug terminal strips.
   5. There shall be no wire splices. All wiring shall be continuous, uncut between devices and terminal blocks.
H. Rated Enclosures:
   1. All vertical fire alarm wiring traversing more than one level shall be routed in rated enclosures. In addition, all horizontal wiring serving devices located on floors other than where wiring originates shall be routed in 2-inch concrete encasement, suitable rated building construction, or 2-hour wrap application enclosure accepted by local Authority Having Jurisdiction.

3.4 MANUAL PULL STATIONS

A. Install at 48 inches to top above finished floor.
B. All manual stations shall be in unobstructed locations.
C. Install to comply with NFPA, ADA, and all handicap/accessibility code requirements.

D. Provide, install, and connect additional pull stations (from that shown on drawings) as required to comply with above requirements.

3.5 AUDIBLE SIGNAL DEVICES, VISUAL SIGNAL DEVICES, COMBINATION AUDIBLE/VISUAL SIGNAL DEVICES

A. Shall comply with NFPA, the Americans with Disabilities Act and other applicable handicap/accessibility codes including but not limited to the following:
   1. Wall mounted devices shall have their bottom edge at heights above the finished floor of not less than 80 inches and no greater than 96 inches.
   2. In general, no place in any room or space required to have a visual signal appliance shall be more than 50 ft. (15 m) from the signal (in the horizontal plane). In large rooms and spaces exceeding 100 ft. (30 m) across, without obstructions 6 ft. (2 m) above the finished floor, such as auditoriums, devices may be placed around the perimeter, spaced a maximum 100 ft. (30 m) apart, in lieu of suspending appliances from the ceiling. Placement of visual devices shall not be less than the requirements as specified by NFPA 72.
   3. No place in common corridors or hallways in which visual alarm signaling appliances are required shall be more than 50 ft. (15 m) from the signal. Placement of visual devices shall not be less than the requirements as specified by NFPA 72.

3.6 END-OF-LINE DEVICE

A. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.

3.7 AUXILIARY CONTROL RELAYS

A. An auxiliary fire alarm relay used to control an emergency control device, e.g. motor controller for HVAC system fan or elevator controller shall be located within 3 ft. of the emergency control device.
B. The installation wiring between the system panel and the auxiliary fire alarm relay shall be monitored for integrity.
C. Auxiliary control relays shall be listed for use with fire alarm systems.

3.8 SPRINKLER FLOW SWITCHES

A. Coordinate the electrical and operating characteristics of the flow switches with the fire alarm panel.
B. Run conduit and wiring to the flow switches and connect them so as to provide an operable supervised sprinkler alarm system per NFPA standards, and state and local codes.
C. Provide all electrical including zones as required by Authority Having Jurisdiction and codes.

3.9 SPRINKLER VALVE SUPERVISORY SWITCHES

A. Coordinate the electrical and operating characteristics of the supervisory switches with the fire alarm panel.
B. Run conduit and wiring to the supervisory switches and connect them so as to provide an operable supervised sprinkler alarm system per NFPA standards, and state and local codes.
C. Provide all electrical including zones as required by Authority Having Jurisdiction and codes.

3.10 DOOR ELECTRIC LOCK AND HOLD-OPEN POWER SYSTEMS

A. General: Provide 24V-dc low voltage power to all building doors with openers, hold-open devices, closers, or electric locks. Refer to Architectural door hardware schedule for doors that may have electric holders or locks. Low voltage power supplies for door hardware shall be furnished separately from the fire alarm system. The fire alarm system shall only provide the unlocking or release control signals and auxiliary control relays at power supplies, in order to reduce power draw on fire alarm system power supplies and batteries.
B. Low Voltage Power: Provide a low voltage transformer on each floor having doors with electric hardware. Transformer shall be 120-24V ac, sized as required to handle load served. Mount in a NEMA 1 enclosure above accessible corridor ceiling outside the first door closest to fire alarm riser. Provide transformer primary fusing to comply with N.E.C. Provide a 24V ac-24V dc rectifier on the secondary side of the transformer. Provide dedicated branch circuit from closest 120V normal power panel. Provide necessary interposing auxiliary control relay(s) to accept unlocking/release and restore signals from the fire alarm system.
C. Wiring: Electric hardware shall be connected for fail-safe operation. Upon loss of normal power hardware shall unlock without unlatching. Hold-open doors shall release for closure. Restoration of hardware power shall be automatic after the fire alarm system unlock control is reset. Provide all wiring necessary to connect transformer. Provide all low voltage wiring to connect electric locks. Extend wiring down hinge side of stair door jamb through hinge plate into door and through door to electric lock mechanism.
D. Fire Alarm Unlocking Control: All door hardware circuits shall be controlled by fire alarm system. Upon receipt of signal from fire alarm system all door holders shall release, and stair/egress door electric locks power system shall be disabled allowing all locks to unlock (without unlatching). Signal to activate shall be automatic fire alarm signal or manual command initiated in the building Fire Control Room. Manual unlock override command shall be through override system. Reference paragraph entitled "FIRE DEPARTMENT OVERRIDE CONTROL PANEL". Provide pilot light and 3-position override switch. ON position (illuminated red pilot light) shall initiate fail-safe operation. OFF position shall restore low voltage power. Provide separate override switch for door openers associated with Atrium Smoke Exhaust System.
E. Mount outlet box for electric door holder to withstand 80 pounds (36.4 kg) pulling force.

3.11 GAS/FUEL SHUT-OFFS

A. Whether shown on drawings or not provide gas/fuel shut-off systems for each and every gas/fuel supply as required by the applicable codes and standards.

3.12 ELEVATORS

A. Operation of elevators under fire or other emergency conditions - elevators having a travel distance of 25 feet or more shall conform to the requirements of ANSI A17.1, Safety Code for Elevators and Escalators, Rule 2.27.3, as incorporated herein by reference.
B. When an automatic sprinkler system is required to be installed throughout a building for complete fire protection coverage, the provisions of ANSI A17.1, Rule 2.8.2, which is incorporated herein by reference, shall be applicable. When an automatic sprinkler system is required to be installed, the automatic sprinkler system shall be a pre-action sprinkler system and the pre-action sprinkler shall be installed in the elevator machine room and elevator hoist way. An accepted fixed temperature (135 degrees F.) heat detector shall be installed in the elevator machine room, elevator pit, and elevator hoist way as an integral part of the pre-action sprinkler system to automatically disconnect the main power supply to the affected elevator(s) prior to the application of water. The main power supply shall not be self-resetting. The activation of sprinklers outside of the hoist way or machine room shall not disconnect the main power supply. The sprinkler head located in the elevator machine room and elevator hoist way shall have an activation temperature greater than the accepted fixed temperature heat detector.
C. In addition to the requirements of ANSI A17.1, Rule 2.27.3.2.1, an accepted smoke detector(s) shall be installed in the elevator hoist way, and the machine room meeting the requirements of Rule 69A-47.008. The activation of the smoke detector(s) in the machine room or the elevator hoist way shall cause a suitable warning light to flash. The light is to be located adjacent to the "phase one" recall switch required by ANSI A17.1 Rule 2.27.3.1 (2016) or elevator hall button. The warning light shall be red, and a minimum diameter of 1/8 inch. A sign shall be incorporated with or adjacent to the light and contain the following wording "DO NOT USE ELEVATOR". The minimum size for the letters on the sign shall be 1/8 inch. Provide supervised fire alarm system wiring and power to elevator warning lights. Lights shall function per elevator bank. Provide and install light at first floor and alternate floor as directed by Authority Having Jurisdiction.
D. Provide detectors with auxiliary relay complete with tie into elevator controller as required by all codes or provide separate zone.

3.13 CABLE IDENTIFICATION

A. Provide and install permanent cable markers on all cables/wire lines, telephone lines, etc. at terminal strips, terminal cabinets and at main equipment.

3.14 SURGE PROTECTION

A. General

1. Provide, install and connect new surge suppression equipment as specified herein, including protection of equipment power source, cable/wire entering or leaving building housing, main fire alarm system equipment, ground lugs, #6 copper ground wire in 3/4"c. to existing main building service ground.
2. Extreme care shall be taken by contractor to assure a properly surge protected system.
3. Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.
4. Installation of surge protection equipment and its grounding must be per manufacturer's recommendations to assure short and proper ground paths.

B. Equipment Selection
1. Contractor to coordinate with suppliers and installers of all equipment being protected and provide surge suppression equipment which meets these specifications on respective equipment, wires, etc.

C. Equipment Installation
1. Install surge suppression equipment per manufacturer’s recommendation at each wire terminal as noted under Part 1.
2. Install in surge suppression equipment terminal cabinets, etc. as required to facilitate installation of surge protection equipment and terminal points. Increase size of terminal cabinets (from that shown on drawings) to size required to facilitate installation of surge suppression equipment and terminal blocks.
3. Locate surge suppression equipment in terminal cabinet nearest main equipment cabinet (FACP).
4. Coordinate with Section Surge Suppression Equipment Contractor to assure that surge suppression for 120VAC power circuit and surge suppression required by this section are all installed in same terminal cabinet and bonded together.

D. Ground Installation
1. Ground Bus Connections.
   a. Provide "local" ground bus in each terminal cabinet housing surge protection equipment (with lugs, etc. as required).
   b. Bond "local" ground bus to terminal cabinet with minimum #6 copper wire.
   c. Connect terminal cabinet "local" ground bus to "systems" ground bus installed per Section Grounding and Bonding with minimum #6 copper insulated wire (unless otherwise noted) in conduit.
   d. Note that "systems" ground bar is also to be used for power transformation ground (480V to 208V) where applicable.
2. Surge suppression equipment grounding.
   a. Connect each surge suppressor to local ground bus in terminal cabinet with wire sized as recommended by manufacturer. Where "M" block type terminations/surge suppressors are used, bond ground rail to local ground bar with wire as recommended by manufacturer.
   b. Coordinate with Section Surge Protection Devices Contractor to assure that 120VAC power source/supply surge suppressor is also grounded to same local ground bus as surge suppressors provided in this section for same system (i.e., fire alarm, intercom, television, etc.).
3. Conductors.
   a. Conductors shall meet requirements of Section Building Wire and Cable. Minimum size to be #12 THWN.
   b. Bends in excess of 90 degrees in any grounding conductor shall not be permitted. A radius of 6 inches or greater shall be maintained on all bends.

c. Do not bundle unprotected conductors with protected conductors.
d. Conductors shall be kept as short as possible.
e. Conductors shall be secured at 12" intervals with an accepted copper clamp.
f. Grounding conductors shall be properly connected to the building service ground by accepted clamps.

4. Grounding Connectors
   a. Connectors, splices, and other fittings used to interconnect grounding conductors, bond to equipment or grounding bars, shall be accepted by NEC or UL for the purpose.
   b. All connectors and fittings shall be of the Nicopress crimp or compression set screw type.
   c. Special treatment to fittings, lugs, or other connectors of dissimilar material shall be applied to prevent electro-galvanic action.

3.15 CONDUIT/BOX IDENTIFICATION

A. Contractor shall identify fire alarm conduit and boxes with red paint in exposed locations. Identify conduit in concealed locations with 4" mark of red paint every 4'-0" OC.

3.16 DEMONSTRATION

A. When system is complete it shall be demonstrated to Owner's Representative who shall be given complete instructions, spare parts, manuals and maintenance information.

3.17 SYSTEM TESTING

A. Prior to certification of the fire alarm system the contractor shall accomplish a complete test of the fire alarm system in accordance with NFPA 72, Test Methods.
B. Perform a complete, functional, component by component test of the entire fire alarm and detection system. Provide a detailed step by step testing procedure which is unique to this project, reflecting the type of system and the number and location of all components.
C. Perform a sensitivity test of all smoke detectors and duct detectors. Perform a calibration/test of heat sensors.
D. Demonstrate the proper operation of each component as follows:
   1. Photoelectric, and duct smoke detectors: activate the detector with a "false smoke" product which has been specifically formulated for testing smoke detection systems.
   2. Heat detectors: activate the detector by utilizing the detector check button.
   3. Pull Stations: activate the station by operating the station in its normal mode.
   4. Audible, Speaker, and Visual Alarms: verify proper operation when the system is put into the alarm mode.
   5. Sprinkler Flow Switches: open the sprinkler system's inspection test valve. Verify that the flow switch sends an alarm signal within the allowed time corresponding to the switch's time delay setting.

6. Fire Alarm Panels: functionally check-out and test the panel per the manufacturer's written instructions. Demonstrate the proper operation of each modular component. Demonstrate automatic power change to batteries and back to building power upon a drop in voltage below the voltage threshold as specified by the panel manufacturer.

E. Demonstrate the supervisory function at each device loop circuit, and at all single component wiring runs such as for the sprinkler valve supervisory switches.

3.18 CERTIFICATION

A. After completion of the installation of the system, the licensee shall complete a NFPA Inspection and Testing form. The Inspection and Testing form format shall be as indicated in NFPA 72, Inspection and Testing Form. When an Inspection and Testing form has been completed, legible copies shall be distributed as directed by the Authority Having Jurisdiction.
B. After completion of the installation and testing provide NFPA 72, Record of Completion Form to the Owner.
C. After an installation has been complete, affix a Fire Alarm Tag to the control panel. The Fire Alarm Tag is in addition to the Inspection and Testing form. Protect the Fire Alarm Tag from vandalism by applying pressure sensitive label; do not use a "tie-on" tag. It shall be as required in the Fire Safety Rules.

3.19 FINAL DRAWINGS

A. As-built drawings shall be given to the Owner’s representative, at time of instruction, in addition to those to be supplied as general requirements of the job.

3.20 AUTHORITY HAVING JURISDICTION

A. The drawings and specifications herein comply to the best of the Engineer's knowledge with all applicable codes at time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the Engineer's attention at least 7 days prior to bid. No changes in contract cost will be acceptable after the bid for work/equipment required to comply with the Authority Having Jurisdiction.

END OF SECTION

SECTION 31 31 00
SOIL TREATMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES:

A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:

1. Pre-construction soil treatment for underslab and foundation wall perimeters.

1.3 REFERENCES

A. EPA – Environmental Protection Agency.
B. FBC – Florida Building Code.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Chemicals and products used.
2. Application instructions.
3. Certification that products used comply with U.S. Environmental Protection Agency (EPA) regulations for termiticides.
4. Information that soil treatment conforms to specified requirements.

B. Provide information regarding the type of equipment to be used to apply the soil treatment, size of volume mixing tank, the pump capacity in gallons per minute, and the application tools with in-line flow meter devices attached.

C. Certificate of Compliance: Submit as part of the close Out Documents the following statement from the pest control company: “The building has received a complete treatment for the prevention of subterranean termites. Treatment is in accordance with rules and laws established by the Florida Department of Agriculture and Consumer Services.”

D. Submit job site log book.

E. Submit sample warranty.

1.5 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.

B. Engage a professional pest control operator who is licensed according to regulations of the State of Florida.

C. Use only termiticides that bear a federal registration number of the EPA and are approved by local authorities having jurisdiction.

1.6 FIELD CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.

B. To ensure penetration, do not apply soil treatment to excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

C. Comply with other handling and application instructions of the soil toxicant manufacturer.

D. Unless treated areas are to be immediately covered, take precautions to prevent disturbance of treatment by human or animal contact.

1.7 REGULATORY REQUIREMENTS

A. Provide minimum requirements for application as authorized by the State of Florida to fulfill the work according to manufacturer’s specifications.

B. Conform to applicable code for requirements and for application in accordance with the EPA.

1.8 PROJECT RECORD DOCUMENTATION

A. Log Book to be kept at job site and to include:

1. Project name
2. Company providing treatment
3. Applicator’s name
4. Time of arrival and departure
5. Product name
6. Record date of all applications
7. Rate of application to all required areas of the designated site
8. All areas to be treated
9. The soil treatment trade name
10. Quantity of concentrate delivered to the site
11. Quantity used for the designated treated areas
12. The percentage of active ingredient in diluted form

13. Finished gallons of soil treatment for each application
14. Linear and square footage amount to determine total finished soil treatment used

1.9 DELIVERY

A. The State Registered products must be delivered to the jobsite in the original sealed and labeled containers of the manufacturer. Use a synthetic dye for proper identification on the surface areas treated.

1.10 WARRANTY

A. Warranty: Furnish written warranty, executed by Applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

B. Warranty Period: Five (5) years from Date of Substantial Completion, or the minimum more than five (5) years if prevailing local laws require.

C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer shall be one of the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. BASF Environmental Science
2. Bayer Environmental Science

2.2 SOIL TREATMENT SOLUTION

A. Use an emulsible, concentrated termiticide that dilutes with water, specially formulated to prevent termite infestation. Fuel oil will not be permitted as a dilutant. Provide a solution consisting of one of following chemical elements.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Termidor SC as manufactured by BASF.
   b. Premise 75 as manufactured by Bayer.

B. Dilute with water to concentration level recommended by manufacturer.

C. A green/blue dye shall be added to the mix for identification.

PART 3 – EXECUTION

3.1 SOIL TREATMENT SOLUTION

A. EPA and Florida Department of Agriculture & Consumer Services approved emulsible concentrate insecticide for dilution with water, specially formulated to prevent infestation by termites.

B. Fuel oil is not permitted as a diluent.

C. Use only soil treatment solutions, which are not injurious to planting or protected wild life.

3.2 INSPECTION

A. Before applying soil treatment for termites, examine areas and conditions; notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

1. Do not proceed with the work until conditions are satisfactory.

B. Verify that final grading is complete.

C. Examine the substrates and conditions under which work of this section will be performed. Do not proceed until unsatisfactory conditions detrimental to timely and proper completion of the work have been corrected.

D. Verify that the site conditions under the slab(s) are proper for the installation of termite barrier system as specified and in accordance with manufacturer's printed instructions. Prior to installation, verify that:

1. The ground has been cleared of wood scraps such as ground stakes, forms, and other termite food sources.
2. The work area has been filled with finely graded soil consisting of particle sizes no larger than 1 in and compacted to eliminate soil movement.
3. Footings and foundations, and outer forms are in place.
4. Communications, electrical, and plumbing penetrating pipes are in place.
5. Sand system: Prior to placing material, remove visible plant roots and standing water from the excavated area. Verify that utility trenches are sufficiently wide to permit adequate cover under, around, and over pipes and conduit that will be encapsulated with the termite sand barrier. Verify that the foundation perimeter has sufficient room between the sides of excavations and edges of foundations to provide the required barrier depth and width.

3.3 GENERAL

A. Surface Preparation:

1. Remove foreign matter that could decrease effectiveness of treatment on areas to be treated.
2. Loosen, rake and level soil-requiring treatment, except previously compacted areas under slabs and foundations.

B. Application Rates: Apply soil treatment solution as specified and in strict accordance with Manufacturer's recommendation for mixing and application.

1. Allow not less than 12 hours for drying after application, before beginning concrete placement or other construction activities.
2. Post signs in the areas of application warning workers of soil poisoning.
   a. Remove signs before other construction covers the.
3. Reapply soil treatment solution to areas disturbed by subsequent excavation or other construction activities following initial application.

3.4 APPLICATION

A. Apply soil treatment chemical to soil and earth which will be covered by or lie adjacent to buildings. Treat foundations. Treat areas around pipes and conduits penetrating slabs on fill to provide a lethal barrier to subterranean termites.

B. Apply chemical solution after subgrade has been made ready for placement of any floor slab vapor barrier, and as soon as practical prior to placement of concrete slabs and caps on masonry piers. Apply treatment only after all piling, pile caps, grade beams, foundation walls, and below grade waterproofing shall have been completed.

C. Apply treatment at least 12 hours prior to placement of concrete slabs during normal working hours in order to be subject to inspection. Notify applicator at least 24 hours prior to time application of chemical will be required.

D. Apply termiticide mixture to the following:

1. Soil and earth that will be covered by the buildings and soil and earth that is within 5' of the buildings.
2. Foundations.
3. Areas around pipes and conduits penetrating slabs on fill to provide lethal barrier to subterranean termites.

3.5 SOIL CONDITIONS

A. Apply chemical when moisture content of soil is sufficiently low to allow uniform distribution of chemical throughout specified areas.

END OF SECTION 31 31 00

SECTION 32 14 00 – UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. Section Includes:

1. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
    a. Concrete pavers set in sand setting beds
    b. Drainage geotextile

1.3 REFERENCES

A. ASTM C33 – Standard Specification for Concrete Aggregates.
B. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
C. ASTM C140 – Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
D. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar.
E. ASTM C150 – Specification for Portland Cement.
F. ASTM C241 – Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic.
G. ASTM C293 – Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading).
H. ASTM – C936, Standard Specification for Solid Concrete Interlocking Paving Units.
I. ASTM C979 – Standard Specification for Pigments for Integrally Colored Concrete.
J. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).
K. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

1.4 ACTION SUBMITTALS

A. Product Data: For pavers and setting materials.

B. Samples: For each type of unit paver indicated, provide two complete samples of paver to reflect the full range of colors, shapes, and surface texture.

C. Sieve Analyses: For aggregate setting-bed materials joint sand, according to ASTM C 136.

1. Four representative full-size samples of each paver type, thickness, color, and finish that indicate the range of color variation and texture expected in the finished installation. Color(s) selected by Architect from manufacturer's available colors.
2. Accepted samples become the standard of acceptance for the work.
3. Manufacturer's certification of concrete pavers by ICPI as having met applicable ASTM standards.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.

1.6 QUALITY ASSURANCE

A. Paving Subcontractor Qualifications:

1. Utilize an installer having successfully completed concrete paver installation similar in design, material, and extent indicted on this project.
2. Utilize an installer holding a current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.

1.7 MOCK-UP

A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.9 MAINTENANCE

A. Extra Materials: Provide 5% additional material for use by Owner for maintenance and repair.

B. Pavers shall be from the same production run as installed materials.

PART 2 - PRODUCTS

2.1 CONCRETE PAVERS

A. Concrete paver material shall be based on the following allowance prices. All installation, installation materials, and accessory materials in addition to the allowance price shall be included in the base bid.

1. Paver = $6.00 square foot.

2.2 MANUFACTURERS

A. Manufacturer shall be one of the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Tremron Group
2. Idea Concrete Block Company, Inc.
3. Capitol Concrete Products, Inc.

2.3 CONCRETE PAVERS

A. Concrete Pavers: Solid paving units made from normal-weight concrete with a compressive strength not less than 6000 psi, water absorption not more than 5 percent according to ASTM C 140, and no breakage and not more than 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67.

1. Thickness: 2-3/8 inches minimum.
2. Face Size and Shape: 4" by 8" rectangle.
3. Color: Pigment shall conform to ASTM C979 selected by Architect from manufacturer's full range.

2.4 CURBS AND EDGE RESTRAINTS

A. Job-Built Concrete Edge Restraints: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mixed concrete with minimum 28-day compressive strength of 3000 psi (20 MPa).

B. Size: Cast in place restraint, 8” wide by 6” deep with two #3 rebars continuous.

2.5 AGGREGATE SETTING-BED AND JOINT MATERIALS

A. General

1. Provide washed, clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural, or manufactured from crushed rock.
2. Do not use limestone screenings, stone dust, or sand for the being sand material that does not conform to the grading requirements of ASTM C33.
3. Do not use mason sand or sand conforming to ASTM C144 for the bedding sand.

B. Stabilized Subgrade: Compacted sandy site soil.

C. Graded Aggregate for Base: Sound, crushed stone or gravel complying with ASTM D 448 for Size No. 8.

D. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.

E. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve.

2.6 ACCESSORIES

A. Drainage Geotextile: Nonwoven needle-punched geotextile fabric, manufactured for subsurface drainage applications, made from polyolefins or polyesters, with elongation greater than 50 percent, complying with AASHTO M 288 and the following, per test methods referenced:

1. Survivability: Class 2, AASHTO M 288.
2. Apparent opening size: No. 40 sieve, maximum; ASTM D 4751.
3. Permittivity: 0.5 per second, minimum; ASTM D 4491.
4. UV Stability: 50 percent after 500 hours exposure; ASTM D 4355.

B. Herbicide: Commercial chemical for weed control, registered with the EPA. Provide in granular, liquid, or wettable powder form.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive unit paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Proof-roll prepared subgrade according to requirements in specification section "Earth Moving" to identify soft pockets and areas of excess yielding. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive base course for unit pavers.

3.3 INSTALLATION, GENERAL

A. Install per manufacturer's instructions.

B. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

C. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

D. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

1. For concrete pavers, a block splitter may be used.

E. Joint Pattern: Running bond, to be verified with Architect.

F. Tolerances: Do not exceed 1/16-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches and 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.

3.4 AGGREGATE SETTING-BED APPLICATIONS

A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 1557 laboratory density.

B. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Place aggregate base, compact to 100 percent of ASTM D 1557 maximum laboratory density, and screed to depth indicated.

D. Install drainage geotextile in accordance with paver manufacturers installation instructions.

E. Place leveling course and screed to a thickness of 1 to 1-1/2 inches, taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.

F. Treat leveling course with herbicide to inhibit growth of grass and weeds.

G. Set pavers with a minimum joint width of 1/16 inch and a maximum of 1/8 inch, being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch with pieces cut to fit from full-size unit pavers.

1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.

H. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.

1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches of uncompacted pavers adjacent to temporary edges.
2. Before ending each day's work, compact installed concrete pavers except for 36-inch width of uncompacted pavers adjacent to temporary edges (laying faces).
3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches of laying face.
4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.

I. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.

J. Do not allow traffic on installed pavers until sand has been vibrated into joints.

K. Repeat joint-filling process 30 days later.

3.5 REPAIRING AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

1. Remove temporary protective coating as recommended by coating manufacturer and as acceptable to paver manufacturers.
2. Do not allow protective coating to enter floor drains. Trap, collect, and remove coating material.

3.6 WASTE MANAGEMENT

A. Collect cutoffs and scrap and place in designated areas for recycling.

B. Coordinate with manufacturer and local recycler for take-back program or recycling. Set aside scrap to be returned to manufacturer for recycling into new product.

END OF SECTION 32 14 00