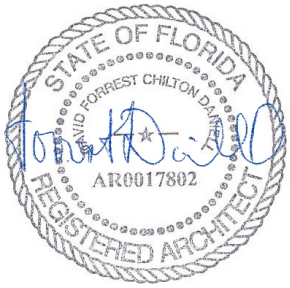


ESCAMBIA COUNTY FIRE-RESCUE
PARADISE BEACH STATION 20

PROJECT MANUAL

BCC PROJECT NO. U-26-003



BID DOCUMENTS

JULY 10, 2026

RE-BID ISSUE

OCTOBER 30, 2026

FORREST DANIELL
& Associates, P.C.
FD&A
Architecture & Planning

TABLE OF CONTENTS

DIVISION 01 – GENERAL REQUIREMENTS

01 1000 Summary
01 2300 Alternates
01 3233 Photographic Documentation
01 3300 Submittal Procedures
01 4000 Quality Requirements
01 4200 References
01 5000 Temporary Facilities and Controls
01 6000 Product Requirements
01 7300 Execution
01 7419 Construction Waste Management
01 7700 Closeout Procedures
01 7823 Operation and Maintenance Data
01 7839 Project Record Documents
01 7900 Demonstration and Training

DIVISION 02 – EXISTING CONDITIONS

02 1100 Site Clearing
02 2000 Earthwork
02 2100 Grassing
02 2210 Trench Excavation, Backfill, and Compaction
02 3100 Jack and Bore
02 3400 Rip Rap
02 3610 Termite Control
02 4000 Graded Aggregate Base
02 5140 Base Replacement and Resurfacing for Trenches
02 5150 Cast-In-Place Concrete (Sitework)
02 5160 Pavement Markings
02 5250 Asphalt Concrete Pavement (Sitework)
02 5560 Potable Water Distribution Systems
02 5700 Gravity Sanitary Sewers
02 5760 Wastewater Force Main
02 6000 Stormwater Systems
02 7000 Submersible Grinder Pumping Stations
02 9500 Maintenance of Traffic (Escambia)

DIVISION 03 – CONCRETE

03 1000 Concrete Forms and Accessories
03 2000 Concrete Reinforcement
03 3000 Cast-in-place Concrete
03 3500 Concrete Finishing

DIVISION 04 – MASONRY

04 2113 Brick Masonry

DIVISION 05 – METALS

05 3100 Steel Deck
05 4000 Cold Formed Metal Framing
05 5000 Metal Fabrications
05 5213 Pipe and Tube Railings

DIVISION 06 – WOOD, PLASTIC AND COMPOSITES

06 1053 Miscellaneous Rough Carpentry
06 4023 Interior Architectural Woodword

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

07 2100 Thermal Insulation
07 2500 Weather Barriers
07 6200 Sheet Metal Flashing and Trim
07 7200 Roof Accessories
07 9000 Joint Sealants

DIVISION 08 – OPENINGS

08 1113 Hollow Metal Doors and Frames
08 1416 Flush Wood Doors
08 3613 Sectional Doors
08 3614 Four-fold Bay Doors
08 4113 Aluminum Storefronts
08 7100 Door Hardware
08 8000 Glazing
08 9000 Louvers and Vents

DIVISION 09 – FINISHES

09 2900 Gypsum Board
09 3000 Tiling
09 5123 Acoustical Tile Ceilings
09 6513 Resilient Base and Accessories
09 9100 Concrete Coating

09 9123 Interior Painting

DIVISION 10 – SPECIALTIES

10 2800 Toilet Bath and Laundry Accessories

10 4413 Fire Extinguisher Cabinets

10 4416 Fire Extinguishers

DIVISION 13 – SPECIAL CONSTRUCTION

13 3419 Metal Building Systems

DIVISION 21 – FIRE SUPPRESSION

21 0000 Fire Protection General

21 0010 Codes and Standards

21 0553 Fire Protection Identification

21 1300 Fire Protection Sprinkler Systems

DIVISION 22 – PLUMBING

22 0000 Plumbing General

22 0010 Codes and Standards

22 0020 Plumbing Related Work

22 0517 Sleeves and Sleeve Seals

22 0519 Meters and Gauges

22 0523 Valves

22 0526 Access Doors

22 0529 Hangers and Supports

22 0539 Testing, Cleaning, and Sterilization for Plumbing Piping

22 0548 Vibration Isolation

22 0550 Excavation and Backfill

22 0553 Plumbing Identification

22 0719 Plumbing Piping Insulation

22 1116 Domestic Water Piping

22 1123 Domestic Water Pumps

22 1316 Sanitary Waste and Vent Piping

22 1500 Compressed Air System

22 1700 Gas System

22 3413 Gas Domestic Tankless Water Heaters

22 4000 Plumbing Fixtures

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING

23 0000 HVAC General

23 0010 Codes and Standards
23 0020 HVAC Related Work
23 0513 Motors
23 0517 Sleeves and Sleeve Seals
23 0529 Hangers and Supports
23 0548 Vibration Insulation
23 0553 HVAC Identification
23 0590 Startup Requirements for HVAC Systems
23 0593 Testing, Adjusting, and Balancing
23 0713 Duct Isolation
23 0719 HVAC Piping Insulation
23 0900 Instrumentation and Controls
23 3113 Metal Ductwork
23 3300 Ductwork Accessories
23 3400 Fans
23 3439 High Volume, Low Speed Propeller Fans
23 3713 Diffusers, Registers, and Grilles
23 3719 Wall Louvers
23 7339 Gas-fired Heating Units
23 8126 Split-System Air Conditioning Units
23 8128 Ductless Split-System Air Conditioning Units
23 8416 Dehumidifiers

DIVISION 26 – ELECTRICAL

26 0000 General Electrical
26 0010 Codes and Standards
26 0020 Work Required for Equipment Furnished by Others
26 0500 Electrical Related Work
26 0511 Reinforced Concrete Foundations
26 0516 Service Entrance Methods and Materials – Underground
26 0526 Grounding and Bonding
26 0530 Basic Electrical Materials and Methods
26 0550 Excavation and Backfill
26 0553 Electrical Identification
26 2420 Panelboards
26 2705 Enclosed Switches and Circuit Breakers

26 2710 Enclosed Controllers
26 2726 General Wiring Devices
26 2730 Cord Reels
26 3200 Standby Electrical System
26 3210 Deisel Generator
26 3220 Transfer Switches
26 4113 Lightning Protection System – Class I Materials
26 5025 Distributed Low Voltage Lighting Control System
26 5119 LED Interior Lighting
26 5600 Site Lighting
26 5628 Light Poles and Standards

DIVISION 27 – COMMUNICATION SYSTEMS

27 0000 Telecommunications General
27 0010 Codes and Standards
27 0020 Contractor Qualifications
27 0500 Communications and Related Work
27 1300 Backbone Cabling System
27 1500 Horizontal Cabling System

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 0000 Electronic Safety and Security
28 0010 Codes and Standards
28 0500 ESS Related Work
28 3100 Fire Alarm Systems

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 3119 Decorative Exterior Fences

APPENDIX A - GEOTECHNICAL

SECTION 011000 - SUMMARY

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:

1. Project information.
2. Work covered by Contract Documents.
3. Purchase contracts.
4. Access to site.
5. Work restrictions.
6. Specification and drawing conventions.
7. Miscellaneous provisions.

B. Related Requirements:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

1. Project Identification: Escambia County – Paradise Beach Fire Station
2. Project Location: Paradise Beach Fire Station
   1250 Bauer Road
   Pensacola, Florida

1.4 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

1.5 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

1.6 SPECIFICATION AND DRAWING CONVENTIONS

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

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012300 - ALTERNATES

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 administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included in the drawings. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012300

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

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 administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.

B. Related Requirements:

1. Division 01 Section "Submittal Procedures" for submitting photographic documentation.
2. Division 01 Section "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
3. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
4. Division 02 Section "Structure Demolition" for photographic documentation before building demolition operations commence.
5. Division 02 Section "Selective Structure Demolition" for photographic documentation before selective demolition operations commence.
6. Division 31 Section "Site Clearing" for photographic documentation before site clearing operations commence.

1.3 UNIT PRICES

A. Basis for Bids: Base number of construction photographs on average of 20 photographs per week over the duration of Project.

1.4 INFORMATIONAL SUBMITTALS

A. Digital Photographs: Submit image files within three days of taking photographs.

1. Digital Camera: Minimum sensor resolution of 8 megapixels.
2. Identification: Provide the following information with each image description in file metadata tag:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect.

d. Name of Contractor.
e. Date photograph was taken.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.
2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

C. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
1. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
2. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take 20 photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

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 the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making

corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings Project record drawings.

    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    b. Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement.
    c. The following digital data files will by furnished for each appropriate discipline:

        1) Floor plans.
        2) Reflected ceiling plans.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.

4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Contractor.
    e. Name of firm or entity that prepared submittal.
    f. Names of subcontractor, manufacturer, and supplier.
    g. Specification Section number and title.
    h. Indication of full or partial submittal.
    i. Transmittal number.
    j. Other necessary identification.

k. Remarks.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's and Construction Manager's action stamp.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files.

a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.

b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.

6. Submit Product Data in the following format:

    a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).

3. Submit Shop Drawings in the following format:

    a. PDF electronic file.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.
    e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

5. Submit product schedule in the following format:

a. PDF electronic file.

F. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

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 administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Requirements:

1. Divisions 02 through 33 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified

installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of [five] <Insert number> previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data : For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.

7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer 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.

C. Fabricator Qualifications: A firm experienced in producing products 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.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.

d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

a. Allow seven days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

7. Demolish and remove mockups when directed unless otherwise indicated.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.

5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

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 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute www.concrete.org	(248) 848-3700

ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association (Now part of CPA)	
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)	
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(405) 780-7372

APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA EWS	APA - The Engineered Wood Association; Engineered Wood Systems (See APA - The Engineered Wood Association)	
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
AWCI	Association of the Wall and Ceiling Industry www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (Now WCMA)	
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636

AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association) www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	BICSI, Inc. www.bicsi.org	(800) 242-7405 (813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
BWF	Badminton World Federation (Formerly: IBF - International Badminton Federation) www.internationalbadminton.org	6-03-9283 7155
CCC	Carpet Cushion Council www.carpetcushion.org	(610) 527-3880
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CEA	Consumer Electronics Association www.ce.org	(866) 858-1555 (703) 907-7600
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462

CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CPA	Composite Panel Association www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet and Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	Canadian Standards Association	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Cast Stone Institute www.caststone.org	(717) 272-3744
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500

EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee www.ejdc.org	(703) 295-5000
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association (Electrostatic Discharge Association) www.esda.org	(315) 339-6937
ETL SEMCO	Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA) www.intertek.com	(800) 967-5352
FIBA	Federation Internationale de Basketball (The International Basketball Federation) www.fiba.com	41 22 545 00 00
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.ch	41 21 345 35 35
FM Approvals	FM Approvals LLC www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FMRC	Factory Mutual Research (Now FM Global)	
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridaroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208

GRI	(Part of GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (Now CSA International)	
IBF	International Badminton Federation (Now BWF)	
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance	(613) 233-1510

	www.igmaonline.org	
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
	Available from ANSI www.ansi.org	(202) 293-8020
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (702) 567-8150
ITS	Intertek Testing Service NA (Now ETL SEMCO)	
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(888) 480-9138
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937 (604) 298-7578
MSS	Manufacturers Standardization Society of The Valve and Fittings	(703) 281-6613

	Industry Inc. www.mss-hq.com	
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6623 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	(800) 213-7193, ext. 453
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-2300
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (269) 488-6382
NFHS	National Federation of State High School Associations	(317) 972-6900

	www.nfhs.org	
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.com	(901) 526-5016
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	(888) 516-8585
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)	
NWWDA	National Wood Window and Door Association (Now WDMA)	
OPL	Omega Point Laboratories, Inc. (Now ITS)	
PCI	Precast/Prestressed Concrete Institute	(312) 786-0300

	www.pci.org	
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	(217) 333-3929
PLANET	Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America) www.landcarenetwork.org	(800) 395-2522 (703) 736-9666
PTI	Post-Tensioning Institute www.post-tensioning.org	(602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
RIS	Redwood Inspection Service www.redwoodinspection.com	(888) 225-7339 (415) 382-0662
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(877) 294-5424 (516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIA	Security Industry Association www.siaonline.org	(866) 817-8888 (703) 683-2075
SIGMA	Sealed Insulating Glass Manufacturers Association	

	(Now IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. (Now TCNA)	
TCNA	Tile Council of North America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700

TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tileroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(800) 795-1747
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association www.wcmanet.org	(212) 297-2122
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association) www.windowcoverings.org	(800) 506-4636 (212) 297-2109
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WIC	Woodwork Institute of California	

	(Now WI)	
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
UBC	Uniform Building Code (See ICC)	

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency	(202) 272-0167

	www.epa.gov	
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Buildings Service (See GSA)	
PHS	Office of Public Health and Science www.osophs.dhhs.gov/ophs	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA)	(800) 872-2253
	Architectural Barriers Act (ABA)	(202) 272-0080
	Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	
CFR	Code of Federal Regulations	(866) 512-1800
	Available from Government Printing Office	(202) 512-1800
	www.gpoaccess.gov/cfr/index.html	
DOD	Department of Defense Military Specifications and Standards	(215) 697-2664
	Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	
DSCC	Defense Supply Center Columbus (See FS)	
FED-STD	Federal Standard (See FS)	
FS	Federal Specification	(215) 697-2664
	Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	
	Available from Defense Standardization Program www.dps.dla.mil	
	Available from General Services Administration	(202) 619-8925
	www.gsa.gov	
	Available from National Institute of Building Sciences	(202) 289-7800
	www.wbdg.org/ccb	
FTMS	Federal Test Method Standard (See FS)	
MIL	(See MILSPEC)	

MIL-STD	(See MILSPEC)	
MILSPEC	Military Specification and Standards	(215) 697-2664
	Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	
UFAS	Uniform Federal Accessibility Standards	(800) 872-2253
	Available from Access Board	(202) 272-0080
	www.access-board.gov	

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation	(800) 952-5210
	www.dca.ca.gov/bhfti	(916) 574-2041
CCR	California Code of Regulations	(916) 323-6815
	www.calregs.com	
CPUC	California Public Utilities Commission	(415) 703-2782
	www.cpuc.ca.gov	
TFS	Texas Forest Service	(979) 458-6650
	Forest Resource Development http://txforestservice.tamu.edu	

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

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 temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.
2. Division 32 Section "Asphalt Paving" for construction and maintenance of asphalt pavement for temporary roads and paved areas.
3. Division 32 Section "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails.

B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

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

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."

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

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

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

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

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

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

1. Install electric power service underground unless otherwise indicated.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine in each field office.

2. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated.

C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.

2. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.

3. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 32 Section "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Provide temporary parking areas for construction personnel.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Division 01 Section "Execution."

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

B. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

C. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

D. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

E. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

F. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

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

B. Maintenance: Maintain facilities in good operating condition until removal.

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

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

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

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

2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

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 administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Division 01 Section "Alternates" for products selected under an alternate.
2. Division 01 Section "Substitution Procedures" for requests for substitutions.
3. Division 01 Section "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
    b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers.

Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

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 general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Requirements:

1. Division 01 Section "Summary" for limits on use of Project site.
2. Division 01 Section "Submittal Procedures" for submitting surveys.
3. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Division 02 Section "Selective Structure Demolition" for demolition and removal of selected portions of the building.
5. Division 07 Section "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

a. Primary operational systems and equipment.
b. Fire separation assemblies.
c. Air or smoke barriers.
d. Fire-suppression systems.
e. Mechanical systems piping and ducts.
f. Control systems.
g. Communication systems.
h. Fire-detection and -alarm systems.
i. Conveying systems.
j. Electrical wiring systems.
k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

a. Water, moisture, or vapor barriers.
b. Membranes and flashings.
c. Exterior curtain-wall construction.

d. Sprayed fire-resistive material.
e. Equipment supports.
f. Piping, ductwork, vessels, and equipment.
g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Division 01 sustainable design requirements Section.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where

indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.

6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. 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.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even

surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

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 administrative and procedural requirements for the following:

1. Salvaging nonhazardous construction waste.
2. Recycling nonhazardous construction waste.
3. Disposing of nonhazardous construction waste.

B. Related Requirements:

1. Division 04 Section "Unit Masonry" for disposal requirements for masonry waste.
2. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.7 WASTE MANAGEMENT PLAN

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Division 01 Section "Temporary Facilities and Controls."

B. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

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 administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Division 01 Section "Photographic Documentation" for submitting final completion construction photographic documentation.
2. Division 01 Section "Execution" for progress cleaning of Project site.
3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
6. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."

6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:

    a. PDF electronic file. Architect will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Remove snow and ice to provide safe access to building.
    f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    h. Sweep concrete floors broom clean in unoccupied spaces.
    i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    k. Remove labels that are not permanent.

l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare written report.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

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 administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 01 Section "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.
3. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.

4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and

flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."

F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

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 administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:

1. Division 01 Section "Execution" for final property survey.
2. Division 01 Section "Closeout Procedures" for general closeout procedures.
3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Divisions 02 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record prints and one of file prints.
2) Submit record digital data files and one set(s) of plots.
3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit PDF electronic files of scanned record prints and three set(s) of prints.
2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.

j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect.
    e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as paper copy.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

3. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Product Data as paper copy.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as paper copy.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

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 administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

B. Related Requirements:

1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

C. Allowances: Furnish demonstration and training instruction time under the Demonstration and Training Allowance as specified in Division 01 Section "Allowances."

D. Unit Price for Instruction Time: Length of instruction time will be measured by actual time spent performing demonstration and training in required location. No payment will be made for time spent assembling educational materials, setting up, or cleaning up. See requirements in Division 01 Section "Unit Prices."

1.3 CLOSEOUT SUBMITTALS

1.4 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

B. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

END OF SECTION 017900

SECTION 021100 - SITE CLEARING

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

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

1.1 SUMMARY

A. This Section includes the following:

1. Protection of existing trees indicated to remain.
2. Removal of trees and other vegetation necessary to perform Work.
3. Topsoil stripping
3. Clearing and grubbing.
4. Removing above-grade improvements.
5. Removing below-grade improvements.

1. Extent of site clearing shall remain within the right-of-way or easements, or project site limits of construction unless otherwise noted or instructed.

1.2 PROJECT CONDITIONS

A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

1. Protect facilities on adjoining properties and on Owner's property.
2. Restore damaged improvements to their original condition, as acceptable to property owners.

C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.

2. Provide protection for roots over 1-1/2 inch in diameter that are cut during construction operations. Coat cut faces with an emulsified asphalt or other acceptable coating formulated to use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

3. Salvable improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated or directed.

1.3 MONUMENTS

A. Provide protection for all land corners and monuments within the limits of construction.

B. Coordinate reference by a Florida Registered Land Surveyor of corners and monuments in conflict with work and in danger of being covered, damaged or destroyed.

C. A Florida Registered Land Surveyor shall restore disturbed corners and monuments to their original condition upon completion of the work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.0 SITE CLEARING

A. General: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.

1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

B. Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.

1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.

a. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.

2. Stockpile topsoil and other reusable soils in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion. Encircle with silt fencing to prevent water erosion.

C. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.

1. Completely remove stumps, roots, and other debris protruding through ground surface, to a depth of two (2) feet below finished grade.
2. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

a. Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact each layer to a density equal to adjacent original ground.

D. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.

1. Removing abandoned underground piping or conduits interfering with construction is included under this Section.
2. Removal of concrete or asphalt pavement shall be made along straight saw cut lines and only for such width as necessary.

3.1 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner's Property: Burning is not permitted on Owner's property.

B. Removal from Owner's Property: Remove waste materials and unsuitable or excess topsoil from Owner's property and dispose of in accordance with all applicable laws.

END OF SECTION 021100

SECTION 022000 - EARTHWORK

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

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

1.1 SUMMARY

A. This Section includes the following:

1. Preparing and grading subgrades for slabs-on-grade, walks, pavements, and landscaping.
2. Excavating and backfilling for buildings and structures.
3. Subbase course for walks and pavements.
4. Excavating and backfilling trenches within building lines.
5. Excavating and backfilling for underground mechanical and electrical utilities and appurtenances.
6. Pavement Crossings (Cased) for paved roadways.

B. Related Sections: The following Sections contain requirements that relate to this Section.

1. Division 2 Section "Site Clearing" for site stripping, grubbing, topsoil removal, and tree protection.
2. Division 2 Section "Trench Excavation, Backfill, and Compaction" for pipework installation.
3. Division 2 Section "Base Replacement and Resurfacing for Trenches" for pipework installation across roadways.

1.2 DEFINITIONS

A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.

B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

D. Subbase Course: The layer placed between the subgrade and base course in a paving system, or the layer placed between the subgrade and surface of a pavement or walk.

E. Base Course: The layer placed between the subbase and surface pavement in a paving system.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

G. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

H. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner or its representative. Unauthorized excavation, as well as remedial work directed by the Owner or its representative, shall be at the Contractor's expense.

I. Unsuitable Material: Any material such as muck, wood, rock, organic peat, garbage, very fine soil particles unsuitable for compaction, and any other material that is considered unsuitable by the Owner or its representative shall be considered unsuitable.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Test Reports: In addition to test reports required under field quality control, submit the following:

1. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources.
2. One optimum moisture-maximum density curve for each soil material.
3. Report of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.

1.4 QUALITY ASSURANCE

A. Testing and Inspection Service: Contractor will employ a qualified independent geotechnical engineering testing agency approved by the Engineer to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.

1.5 PROJECT CONDITIONS

A. Existing Utilities: Contractor is responsible for contacting all utility companies to obtain locations of all existing utilities or obstructions which he may encounter during construction. After location of utilities by the appropriate utility company, it is the Contractor's responsibility to protect all such utility lines, including service lines and appurtenances, and to replace at his own expense any which may be damaged by the Contractor's equipment or forces during construction of the Project.

1. Provide a minimum 48-hours' notice to the Owner or its representative and receive written notice to proceed before interrupting any utility.
2. The Contractor is responsible for contacting all utility companies to verify locations of all existing utilities, utility-related obstructions, or utility relocations which he may encounter during construction.
3. Adequate provision shall be made for the flow of existing sewers, drains, and water courses encountered during construction, and structures which may be disturbed shall be satisfactorily restored by the Contractor.

B. Should uncharted, or incorrectly charted, piping, or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner, and utility companies in keeping respective services and facilities in operation. Contractor shall bear all costs of repairing damaged utilities to the satisfaction of utility owner.

C. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

D. Operate warning lights as recommended by authorities having jurisdiction.

E. Perform excavation within dripline of large trees to remain by hand, and protect the root system from damage or dry out in the manner prescribed in Division 2 specification sections.

PART 2 - PRODUCTS

2.0 SOIL MATERIALS

A. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock, or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable, and other deleterious matter. The fill material should be a sand containing little fines. Prior to placing the fill material, the existing material shall be stripped of all soils containing a significant percentage of organics and all loose soils which cannot be readily compacted.

B. Subbase and Base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand, per the standard details.

C. Fill: In order to ensure proper bond and prevent slipping between the original ground and fill, the surface of the original ground shall be scarified to a depth of at least three inches. Each layer of fill material shall be compacted until the required density is achieved.

PART 3 - EXECUTION

3.0 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials, as necessary.

C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Tree protection is specified in the Division 2 Section "Site Clearing."

3.1 DEWATERING

A. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

C. The Contractor shall prevent the accumulation of water in excavated areas, and shall remove by pumping or other means any water which accumulates in the excavation. The Contractor shall provide, install, and operate a suitable and satisfactory dewatering system. The Contractor shall include the cost of this pumping equipment and work in the unit price bid for the work.

D. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collection or runoff areas. Do not use trench excavations as temporary drainage ditches.

C. The Contractor shall attempt to dispose of all dewatering water in contained upland areas via percolation. All dewatering discharges which result in a point source discharge to surface waters of the State, as defined by Chapter 62-620 F.A.C. shall be in accordance with the State of Florida “Notice of Intent to Use the Generic Permit for Discharge of Ground Water from Dewatering Operations”. The Contractor may use this permit if the site is non-contaminated or sample results for contaminants are below surface water standards. Some preliminary sampling may be required if there is nearby contamination in order to determine if treatment before discharge or an alternate management option, such as re-infiltration at the site, is required. All costs associated with required sampling, testing, and permitting shall be borne by the Contractor. If any of the analytical test results required by the permit are exceeded, the Contractor shall terminate the discharge as promptly as can be safely accomplished and notify the Owner or its Representative immediately.

3.2 EXCAVATION

A. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.

B. Use of Explosives: The use of explosives is not permitted.

3.3 STABILITY OF EXCAVATIONS

A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

B. All excavation work shall conform to OSHA Publication “Excavations 2226”, latest revision, and OSHA Excavation; Final Rule 29, CFR, Part 1926, latest revision, or other applicable excavation safety standards. The Contractor’s method of providing protective support to prevent cave-ins shall conform to OSHA requirements. Slope excavations, shoring and trench box usage in the field must be based on tabulated data and designed by the Contractor.

3.4 EXCAVATION FOR STRUCTURES

B. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.10 foot. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

B. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavation for Utility Trenches is specified in the Division 2 Section "Trench Excavation, Backfill, and Compaction"

3.7 APPROVAL OF SUBGRADE

A. Notify Engineer when excavations have reached required subgrade.

B. When Engineer determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Engineer.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to the Engineer.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees. Store in upland areas only and outside of environmentally sensitive areas. Provide erosion control measures adjacent to stockpile as required.

3.10 BACKFILL

A. Backfill excavations promptly, but not before completing the following:

1. Acceptance of construction below finish grade.
2. Surveying locations of underground utilities for record documents.
3. Testing, inspecting, and approval of underground utilities.
4. Concrete formwork removal.
5. Removal of trash and debris from excavation.
6. Removal of temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. No backfill material shall be placed, spread, or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, backfill operations shall not be resumed until the moisture content and density of the fill are as previously specified.

C. Backfill for Utility Trenches is specified in the Division 2 Section "Trench Excavation, Backfill, and Compaction"

3.11 FILL

A. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.

1. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.

B. When subgrade or existing ground surface to receive fill has a density less than that required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil and re-compact to required density.

C. Place fill material in layers to required elevations for each location listed below.

1 Under grass, use satisfactory excavated or borrow soil material.
2. Under walks and pavements, use subbase or base material.
3. Under steps and ramps, use subbase material.
4. Under building slabs, use drainage fill material.
5. Under footings and foundations, use engineered fill.

3.13 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.

a. Stockpile or spread and dry removed wet satisfactory soil material.

3.14 COMPACTION

A. Unless otherwise stated in an attached Soils Report, the following conditions shall apply to this project:

1. Place backfill and fill material in layers at not more than the loose depth that can be compacted in accordance with the requirements herein. In areas of construction in FDOT right-of-way, backfill and fill shall be placed as required by FDOT standards of construction.
2. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.

B. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D 1557 (Modified Proctor):

1. Under structures, building slabs, walks, steps, and pavements, compact the top 12 inches below subgrade and each layer of backfill or fill material at 98 percent maximum dry density.
2. Perform in place density tests for each 2000 square feet but in no case fewer than three tests, under structure, building slabs, walkways, steps, and pavements in each layer of backfill. Compaction shall meet or exceed 98 percent of the maximum dry density.
3. Under lawn or unpaved areas, compact the top 6 inches below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.

C. Compaction for Utility Trenches is specified in the Division 2 Section "Trench Excavation, Backfill, and Compaction"

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between existing adjacent grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 0.10 foot.
2. Walks: Plus or minus 0.10 foot.
3. Pavements: Plus or minus 1/2 inch.

C. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

D. Overall grading for which no grades are indicated: Within the limits of construction and outer limits of clearing and grubbing, all holes and other depressions shall be filled, all mounds and ridges cut down, and the area brought to sufficiently uniform contour that the Owner's subsequent mowing operations will not be hindered by irregular terrain and such that surface runoff will flow to existing or proposed drainage infrastructure. This work shall be done regardless of whether the irregularities were the result of the Contactor's operations or originally existed. Permanent ponds or other permanent water areas, as so designated by the Engineer, will not be required to be filled.

3.16 SUBBASE AND BASE COURSES

A. Under pavements and walks, place subbase course material on prepared subgrades. Place base course material over subbases to pavements.

1. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of ASTM D 1557 (Modified Proctor).
2. Shape subbase and base to required crown elevations and cross-slope grades.
3. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
4. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

B. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders at least 12 inches wide of acceptable soil materials and compact simultaneously with each subbase and base layer.

C. Subbase and Base Course requirements for Utility Trenches is specified in the Division 2 Section "Base Replacement and Resurfacing for Trenches".

3.17 PAVEMENT CROSSINGS

A. In areas where open cuts are allowed, the edges shall be saw-cut. The backfilling and repaving shall be done in accordance with the applicable sections of these specifications and the construction drawings. At least one-half of the traveled portion of the roadway must be open to traffic at all times and adequate barricades and warning signs shall be provided.

3.18 FIELD QUALITY CONTROL

A. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Footing Subgrade: At footing subgrades, perform at least one test of each soil stratum to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata when acceptable to the Engineer.
2. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2,000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
3. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 100 feet or less of wall length, but no fewer than two tests along a wall face.
4. Lawn or Unpaved Areas: Perform three in-place density tests every 1000 feet of trench length at the following depths: 6-inches above pipe, 18-inches above pipe, and 30 inches above pipe. Locations of the tests shall be randomly selected by the owner's field representative.

B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify, and moisten or aerate, or remove and replace soil to the depth required, re-compact and retest until required density is obtained at no additional cost to the Owner.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, and erosion. Keep free of trash and debris.

D. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Engineer; reshape and re-compact at optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

D. Barricades, Guards, and Safety Provisions: To protect persons from injury and to avoid property damage, adequate barricades, construction signs, torches, red lanterns, and guards as required shall be placed and maintained by the Contractor during the progress of the construction work. Rules and regulations of the local authorities with respect to safety provisions shall be observed.

E. Property Protection: Trees, fences, poles, and all other property shall be protected unless their removal is authorized; and any property damaged shall be satisfactorily restored by

the Contractor at the Contractor’s expense.

F. Erosion Control: The Contractor shall be responsible for the prevention of erosion from the site and for maintaining filled and graded surfaces for the duration of the project. This includes but is not limited to, the erection of a silt fence and hay bale barricades at all locations requiring erosion control.

G. The Contractor shall take whatever steps necessary to prevent erosion and sedimentation and will be responsible for any damages which might occur to down-land properties as a result of run-off from the site during sitework construction.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property, unless otherwise noted.

3.21 CLEAN-UP AND FINAL INSPECTION

A. Before final inspection and acceptance the Contractor shall clean ditches, shape shoulders, and restore all disturbed areas, including street crossings, grass plots, re-grassing if necessary, to as good a condition as existing before work started.

END OF SECTION 022000

SECTION 022100 - GRASSING

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.1 DESCRIPTION OF WORK:

A. Extent of grassing work is as specified or shown on the construction plans. Sodded areas disturbed during construction shall be re-sodded to match existing. All other areas disturbed during construction operations shall be seeded and mulched, unless otherwise noted on the Construction Drawings.

1.2 QUALITY ASSURANCE:

A. All seed used shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of Invitation for Bids. All seed shall be furnished in sealed standard containers, unless exception is granted in writing by the Owner. Seed which have become wet, moldy, or otherwise damaged in transit or in storage shall not be used.

B. Fertilizer shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, shall not be used. Seed, fertilizer and other grassing materials shall be stored under cover and protected from damage which would make them unacceptable for use.

1.3 SUBMITTALS:

A. Approvals, except those required for field installations, field applications, and field tests shall be obtained before delivery of materials or equipment to the project. The results of laboratory tests performed on the topsoil material shall be submitted. The reports shall include the pH level, the amount of organic matter, and available phosphoric acid and potash of the soil intended for use in the work. Certificate of conformance will be required for the following:

1. Grass seed shall be certified by registered, certified seed association or a registered testing laboratory not more than ten months prior to seeding.
2. Sprigs
3. Fertilizer
4. Topsoil
5. Lime
6. Mulching

PART 2 - PRODUCTS

2.0 TOPSOIL

A. If the quantity of existing stored or excavated topsoil is inadequate for planting, sufficient additional topsoil shall be furnished. Topsoil furnished shall be a natural, fertile, friable soil, possessing characteristics of representative productive soils in the vicinity. It shall be obtained from naturally well-drained areas. Topsoil shall be without admixture of subsoil and free from Johnson grass (Sorghum halepense), nut grass (Cyperus rotundus) and objectionable weeds and toxic substances.

2.1 SOIL AMENDMENTS

A. Lime: Ground limestone (Dolomite) containing not less than 85 percent of total carbonates and shall be ground to such a fineness that 50 percent will pass a 100-mesh sieve and 90 percent will pass a 20-mesh sieve.

B. Fertilizer: 16-16-16 formulation of which 60 percent of the nitrogen is in the urea-formaldehyde form and shall conform to the applicable State Fertilizer laws. It shall be granulated so that 80 percent is held on a 16-mesh screen, uniform in composition, dry and free-flowing.

C. Mulch: Clean hay, fresh straw mulch or wood chips.

2.2 GRASS MATERIALS

A. Grass Seed: Federal Specifications JJJ-S-181 and shall satisfy the following requirements:

	Min. % Pure Seed	Germination and Hard Seed	Max. % Weed Seed
Argentine Bahia	95%	80% (min)	0.25%
Pensacola Bahia	95%	80% (total)	(for all
Bermuda	95%	85% (min)	types)
Rye	95%	90% (min)	

Seed failing to meet the purity or germination requirements by no more than twenty-five percent may be used, but the quantity shall be increased to yield the required rate of pure live seed. Seed failing to meet the weed seed requirements shall not be used.

B. Sod: Sod shall be matched to adjacent sod for all applications unless otherwise specified elsewhere in the Bid Documents. In the event sod is required but not specified and none exists to match, Centipede sod shall be required.

PART 3 - EXECUTION

3.0 GRADING

A. Areas to be grassed shall be graded to remove depressions, undulations, and irregularities in the surface before grassing.

3.1 PLACING TOPSOIL

A. Areas to be grassed shall have a minimum topsoil cover of two inches. Topsoil shall not be placed when the subgrade is excessively wet, extremely dry or in a condition otherwise detrimental to the proposed planting or proper grading.

3.2 TILLAGE

A. The area to be grassed shall be thoroughly tilled to a depth of four inches using a plow and disc harrow or rotary tilling machinery until a suitable bed has been prepared and no clods or clumps remain larger than 1-1/2 inches in diameter.

3.3 APPLICATION OF FERTILIZER

A. Fertilizer shall be applied at the rate of 6 pounds per 1,000 square feet and shall be thoroughly incorporated into the top three to four inches of soil.

3.4 PLANTING SEEDS

A. All areas disturbed during construction, not specifically requiring sod, shall be seeded as specified herein. Immediately before seeds are sown and after fertilizer and lime are applied, the ground shall be scarified as necessary and shall be raked until the surface is smooth, friable, and of uniformly fine texture. Areas to be grassed shall be seeded evenly with a mechanical spreader, raked lightly, rolled with a 200-pound roller, and watered with a fine spray. Seed shall be applied at the rate of 6 lbs./1000 square feet.

1. Seeded areas shall be mulched at the rate of not less than 1-1/2" loose measurement over all seeded areas. Spread by hand, blower, or other suitable equipment. Mulch shall be cut into the soil with equipment capable of cutting the mulch uniformly into the soil. Mulching shall be done within 24 hours of the time seeding is completed or prior to a rainfall event, if one is forecast within 24 hours of planting.

3.5 HYDROSEEDING

A. Fertilizer, seed and mulch shall be applied in one operation with approved hydraulic equipment. Apply materials at the following rates:

1. Hydromulch, at 50 lbs. per 1,000 square feet.
2. Seed, at 6 lbs. per 1,000 square feet.
3. Fertilizer, at 6 lbs. per 1,000 square feet.
4. Soil Binding Agent, at 1 lb. per 1,000 square feet.

B. Hydroseeding shall not be done during windy weather or when the ground is overly wet or frozen. Contractor shall give the Owner 48 hours' notice of hydroseeding operations.

C. Equipment shall use water as the carrying agent utilizing a continuous built-in agitation system. Equipment with a gear pump is not acceptable.

D. Pump a continuous, non-fluctuating supply of homogenous slurry to provide a uniform distribution of material over designated areas.

3.6 PLANTING SOD

A. The sod shall be alive, fresh, and uninjured at the time of planting and shall have a thick mat of roots with enough adhering soil to assure growth. Apply sod within 24 hours of stripping. Do not plant dormant sod, or if ground is frozen. Protect sod against drying and breaking of rolled strips.

B. Placement: Prepare the ground by loosening the soil. Place sod on the prepared soil to form a solid mass with tightly fitted joints. Ensure the butt ends and sides of sod strips do not overlap. Stagger strips to avoid a continuous downhill seam. Tamp or roll lightly to ensure contact with subgrade. Tamp the outer edges of the sodded area to produce a smooth contour. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass. Water sod thoroughly with a fine spray immediately after planting.

C. Watering: Keep the sod continuously moist to a depth below the root zone for three weeks after placement. If there is no water available to the site, the Contractor shall provide the water for the sod.

D. Clean-Up: All excess soil, excess grass materials, stones, pallets and other waste shall be removed from the site daily and not allowed to accumulate. All paved areas shall be kept clean at all times.

E. Maintenance: Maintain sod by watering, fertilizing, weeding, mowing, trimming and other operations such as rolling, re-grading, and re-planting as required to establish a lawn free of eroded or bare areas and acceptable to the Engineer. Where inspected work and materials do not comply with requirements, replace rejected work and continue maintenance until re-inspected by Engineer and found to be acceptable. Remove rejected materials promptly from the project site.

3.6 ROLLING

A. After seeding and mulching or sodding, a cultipacker, traffic roller, or other suitable equipment shall be used for rolling the grassed areas. Areas shall then be watered with a fine spray.

3.7 WINTER COVER

A. All areas to be grassed shall be protected against erosion at all times. For protection during winter months (November 1st through March 31st) Italian rye grass shall be planted at the rate of four pounds per 1,000 square feet on all areas which are not protected by permanent grass, including newly sodded areas.

3.8 CLEAN-UP

A. All excess soil, excess grass materials, stones, and other waste shall be removed from the site daily and not allowed to accumulate.

3.9 MAINTENANCE

A. Maintenance of the grass shall continue until the Owner accepts the project for use. Prior to acceptance, maintenance shall include watering, mowing, replanting and other work necessary to produce a uniform stand of grass. If during the warranty period the grass fails to grow, producing bare areas, the Contractor will replant as necessary, at no cost to the Owner.

END OF SECTION 022100

SECTION 022210 - TRENCH EXCAVATION, BACKFILL AND COMPACTION

PART 1 – GENERAL

1.1 GENERAL DESCRIPTION OF WORK

A. Topics Covered – Excavation, shoring, dewatering, pipe bedding, trench backfill, compaction, grading, and cleanup of all pipeline trenching for the project.

B. Requirements – All work must be done in accordance with these specifications and the safety requirements of the State and OSHA standards.

C. Contractor Visitation – Prior to submittal of bid, the Contractor shall visit the site and become thoroughly familiar with site conditions existing along the route of the planned work. The Contractor shall accept site in condition existing during Contract time frame.

D. Groundwater/Surface Water – Management of groundwater/surface water encountered during construction are conditions of the Contract and responsibility of Contractor.

PART 2 - PRODUCTS

2.1 Source Materials – Determination of source of materials for bedding and backfill shall be responsibility of Contractor, but use of such materials shall be subject to approval of Engineer.

2.2 Pipe Bedding and Backfill – Pipe bedding shall be angular material.

2.3 Sand Backfill – (Where specified on plans). Use sand or fine aggregate with source of material subject to approval of Engineering.

2.4 Cradling Rock – Use crushed rock or stone with 70-100 percent passing 1-inch sieve and no more than 50 percent passing ¾-inch sieve.

2.5 Controlled Density Fill –

A. Mixture – Use high slump mixture of Portland cement, fly ash and fine aggregate formulated, licensed and marketed as K-Krete or equal.

B. Strength – Provide mixture with minimum 28-day compressive strength of 70 psi with no measurable shrinkage or surface settlement.

2.6 Sheeting, Shoring, and Bracing – All excavation and trench safety measures shall be OSHA compliant. Use sound timber or structural steel. Use shapes and sizes as required.

PART 3 - EXECUTION

3.1 GENERAL

A. Dewatering -

1. Prevent surface and subsurface or groundwater from flowing into excavation.

2. Provide equipment for handling water encountered as required. Obtain approval of proposed method of dewatering. All dewatering discharges which result in a point source discharge to surface waters of the State, as defined by Chapter 62-620 F.A.C. shall be in accordance with the State of Florida “Notice of Intent to Use the Generic Permit for Discharge of Ground Water from Dewatering Operations”. The Contractor may use this permit if the site is non-contaminated or sample results for contaminants are below surface water standards. Some preliminary sampling may be required if there is nearby contamination in order to determine if treatment before discharge or an alternate management option, such as reinfiltration at the site, is required. All costs associated with required sampling and testing shall be borne by the Contractor. If any of the analytical test results required by the permit are exceeded, the Contractor shall terminate the discharge as promptly as can be safely accomplished and notify the Owner or its Representative immediately.

3. No sanitary sewer shall be used for disposal of trench water.

B. Protection Of Existing Utilities -

1. Notify all utilities of location and schedule of work.

2. Locations and elevations of utilities shown on plans are to be considered approximate only. Notify utility and Engineer of conflicts between existing and proposed facilities.

3. Repair, relay, or replace existing utilities damaged, destroyed, or disrupted during work. Unless specified otherwise, replacement will be at the Contractor's expense.

C. Sheeting, Shoring, And Bracing -

1. Provide as necessary, to hold walls of excavation, prevent damage to adjacent structures, and to protect workmen and property.

2. Leave sheeting and shoring in place where removal might cause damage to work or as otherwise indicated on drawings.

3. When moveable trench shield is used below spring line of pipe, it shall be lifted prior to any forward movement to avoid pipe displacement.

D. Changes in Grade – Minor adjustments to grades may be made from plan grades to suit unforeseen construction conflicts or conditions with approval from Engineer. Additional compensation will be made for such minor changes.

3.2 EXCAVATION AND TRENCHING

A. General -

1. Method of excavation at the Contractor's option.

2. The Contractor will use caution when excavating under tree roots, under and around structures and utilities. Contractor shall hand dig where appropriate.

3. Stockpile and replace topsoil equal to pre-existing depth for surface restoration in grassed or agricultural areas where specified or shown on plans.

B. Trench Characteristics -

1. Depth – As indicated for pipe installation to lines and grades required with proper allowance for thickness of pipe and type of bedding specified or indicated.

2. Width – Keep width of trench as narrow as possible and yet provide adequate room for backfilling and jointing. Maximum trench width of 30-inch or pipe O.D. plus 18 inches where soil conditions permit.

3. General -

a. Provide bell holes for each pipe joint where pipe bears on undisturbed earth.

b. Trench bottom shall be free of large stones, water, and other foreign material.

3.3 ORGANIC OR UNSTABLE MATERIALS

A. Guidelines – Stop work and notify Engineer. Perform remedial work as directed.

B. Unsuitable Material – If material is judged unsuitable and removal is authorized, remove and replace with trench stabilizing material as directed by Engineer.

3.4 ROCK EXCAVATION

A. Guidelines – Excavate any rock to maintain a minimum 6-inch clearance around pipe. Dispose of rock material not suitable for backfill as directed by Engineer.

B. Explosives – The use of explosives is not permitted without prior written authorization from Owner and Engineer. If authorization to use explosives is given, the Contractor must provide Special Hazard Insurance covering liability for blasting operations.

3.5 BEDDING

Place after bottom of trench has been excavated to proper depth and grade. Place, compact and shape bedding material to conform to barrel of pipe to insure continuous firm bedding for full length of pipe.

Provide bedding as described in following table unless indicated otherwise within the Construction Documents.

Pipe Bedding	
Pipe Material	Minimum Bedding Class
Ductile Iron Pipe	Class D*
Flexible or Composite Pipe	Class 1**

3.6 TRENCH BACKFILL

A. Guidelines -

1. Use excavated material backfill unless otherwise specified or directed.

2. Use suitable backfill for all trenches within 5 feet of buildings and beneath walks, parking areas, paved streets or existing exposed utilities.

3. Unless otherwise stated in the Project Soils Report, the following requirements shall be met.

B. Unless otherwise stated in the Project Soils Report, the following backfill requirements shall be met:

a. Initial Backfill -

1) Place after pipe has been bedded and checked for alignment, grade, and internal obstructions.
2) Carry out in an orderly fashion after authorization to cover pipe has been given.
3) Allow no more than 300 feet of trench to be open at one time.
4) Do not backfill until concrete or mortar has sufficiently cured.
5) Record location of connections and appurtenances before backfilling.
6) Place by hand and hand tamp to not less than 12 inches above top of pipe, in approximately 4-inch layers.
7) Backfill simultaneously on both sides of pipe to prevent displacement.
8) Place cushion of 4 feet above pipe envelope before using heavy compacting equipment.

b. Subsequent Backfill -

1) Place backfill into trench at an angle so that impact on installed pipe is minimized.

2) Subsequent backfill shall be installed in maximum six (6) inch lifts.
3) Compaction of all backfill material shall be performed in a manner that shall not crack, crush, and/or cause the installed pipe to be moved from the established grade and/or alignment.
4) Area under pavement and walks or within buildings shall be mechanically compacted to the top of the subgrade in 6-inch lifts.
5) Areas not subject to vehicular traffic shall be backfilled and compacted in layers not more than 12 inches in depth.
6) Mound excavated materials no greater than 6 inches in open areas only.
7) Fill upper portion of trench with topsoil as specified hereinbefore.
8) No trench shall be open overnight.

C. Trench Compaction -

1. Compaction method at discretion of the Contractor with following exceptions:

a. If in the Engineer's opinion compaction method presents potential damage to pipe, it will not be allowed.

b. Compaction of any backfill material by flooding or jetting is not allowed.

c. Percentage of Maximum Dry Density Requirements –

1) Perform in place density tests for each 2,000 square feet but in no case fewer than three tests under structures, building slabs, walks, steps, and pavements, compact the top twelve (12) inches below subgrade and each layer of backfill or fill material at 98 percent of the maximum dry density.
2) For lawn or unpaved areas over trench backfill, perform in-place density tests every 1,000 feet of trench length at the following locations: i) springline of the pipe; ii) 6 inches above the pipe; iii) Every 24 inches thereafter. Locations of the tests shall be randomly selected by the Owner’s field representative. Compaction shall meet or exceed the adjacent site compaction; however, in no case shall the backfill density be less than 90 percent of the maximum dry density.

D. Controlled Density Fill -

1. Use where shown on plans.

2. Provide suitable forms to limit volume of controlled density fill material.

3. Protect exposed utility lines during placement.

4. Place material in accordance with suppliers' written recommendations unless directed otherwise by Engineer.

5. Where the backfill material is deposited in water, the layer and density requirements shall not apply until a one-foot layer of comparatively dry material is obtained, but this one-foot layer shall be thoroughly compacted by tamping.

6. If the Contractor has compaction equipment with which the required density can be obtained in thicker lifts than permitted above and upon satisfactory evidence that the proposed equipment will produce work equal in quality to that produced by the specified methods, The Owner or its Representative may permit placement of granular material of soil groups A-1, A-2, or A-3 in lifts up to a maximum of three foot compacted thickness. The Contractor will be required to furnish equipment and labor to excavate and backfill test pits to be dug for the performance of density tests.

7. Use of thick lift compaction procedures will not be allowed for first stage backfilling (beneath the haunches) of pipe culverts and storm sewers.

3.7 EXCESS MATERIAL – Dispose of waste excess excavated material in off-site upland areas in accordance with all Local, State, and Federal laws.

3.8 FIELD QUALITY CONTROL

A. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work to verify compliance with requirements.

B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, re-compact and retest until required density is obtained.

C. In Place Density –

1. ASTM D1556 (Sand Cone)

2. ASTM D2167 (Balloon)

3. ASTM D3017 (Nuclear)

END OF SECTION 022210

SECTION 02310 - JACK AND BORE

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION OF WORK

This work shall consist of boring and jacking operations related to the installation of water pipe and sanitary sewer pipe, in areas where trenching is not feasible or permitted, or as designated on the plans.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications sections, apply to this section.

B. Division 2, Sections 02556, 02560, 02570 and 02576 apply to this section.

PART 2 - PRODUCTS

2.1 PIPE

A. Steel casing shall be used for all installations requiring casing sizes 8- inches or larger.

B. The steel casing shall be seamless or electric resistance-welded tubing for sizes up to 24-inch O.D. and standard double-submerged arc-weld for sizes over 24 inches.

C. Steel pipe shall be new, unused, ASTM A-139, Grade B, straight seam, minimum yield strength of 35,000 psi, and minimum tensile strength of 60,000 psi, with one beveled end (to 37 degrees) and other end square cut.

D. The following table shall be used for determining minimum casing size.

CASING SIZE VERSUS CARRIER SIZE				
Steel Casing Diameter	MINIMUM WALL THICKNESS		Carrier Pipe I.D.	
	Highway	Railroad	Gravity	Pressure
8”	.188"	.188"	NA	2”
10"	.188"	.188"	NA	3” or 4"
12"	.188"	.188"	4"	6"
14"	.250"	.250"	6"	8"
16"	.250"	.250"	8"	10"
18"	.250"	.250"	10"	10"
20"	.250"	.250"	12"	12"
24"	.250"	.281"	14"	14"
24"	.250"	.281"	16"	16"
30"	.250"	.312"	18"	18"
30"	.312"	.344"	20"	20"
36"	.312"	.406"	24"	24"
CASING SIZE VERSUS CARRIER SIZE				
Steel Casing	MINIMUM WALL THICKNESS		Carrier Pipe I.D.	
Diameter	Highway	Railroad	Gravity	Pressure
42"	.375"	.469"	30"	30"
48"	.500"	.532"	36"	36"
60"	.500"	.563"	42"	42"
72"	.625"	.625"	48"	48"

2.2 SMALLER CASING SIZES

For casing sizes eight inches and smaller, install in accordance with Section 3.2; steel, PVC, or PE material may be used.

2.3 CASING SPACERS

A. For Carrier Pipes Greater Than or Equal to16” Nominal Diameter - Casing spacer shall be a two-piece shell per carrier pipe and made from T-304 stainless steel of a minimum 14 gauge thickness. Each shell section shall be lined with a 0.090” thick, ribbed PVC extrusion with a retaining section that overlaps the edges of the shell and prevents slippage. Bearing surfaces (runners) shall be ultra high molecular weight polyethylene (UHMW) to provide abrasion resistance and a low coefficient of friction (0.12). The runners shall be attached to support structures (risers) at appropriate positions to properly support the carrier pipe within the casing pipe and to ease installation. The runners shall be mechanically bolted to the riser. The bolt heads are welded to the inside of the risers for strength. Risers shall be made of T-304 stainless steel of a maximum 10 gauge. All risers shall be MIG welded to the shell. Bottom risers 6" and over in height shall be reinforced. All reinforcing plates shall be 10 ga. T-304 stainless steel and shall be MIG welded to mating parts. All welds and metal surfaces shall be chemically passivated. Spacing requirements shall be in accordance with manufacturer’s recommendations. Casing spacers shall be Model CCS as manufactured by Cascade Waterworks Mfg. Co. of Yorkville, IL or approved equal.

1. Standard positioning within the casing pipe shall be sized such that the carrier rests near the bottom of the casing pipe and the height of the risers and runners are to provide a bottom clearance not less than one-half inch between the casing pipe and the extreme outside diameter of the joint (bell, seam weld, joint clamp, etc.) of the carrier pipe.

2. Centered & restrained positioning within the casing pipe shall be sized such that the height of the risers and runners are to center the carrier pipe in the casing pipe with a top clearance of three-fourths inch minimum.

3. Restrained positioning within the casing pipe shall be sized such that the carrier rests near the bottom of the casing pipe and the height of the risers and runners are to provide a bottom clearance not less than one-half inch between the casing pipe and the extreme outside diameter of the joint (bell, seam weld, joint clamp, etc.) of the carrier pipe and a top clearance of three-fourths inch minimum.

4. Multiple Carrier pipes within the casing pipe shall be sized such that the carrier pipes are held at fixed distances relative to each other, with the height of the risers and runners to provide not less than three-fourths inch between the casing pipe and the outside diameter of the riser/runner combinations. Special reinforcing plates may be required to stabilize and support structure.

B. For Carrier Pipes less than 16” Nominal Diameter - High density polyethylene (HDPE) casing spacer shall be non-metallic and molded in segments for field assembly with a supplied ball tip Allen wrench. The casing spacer shall have integrally molded runners extending beyond the bell, mechanical joint, or restrainer of the carrier pipe. Individual segments shall have a solid core and each runner shall be within 1.5" of the casing pipe to center the carrier pipe within the casing. Phoenix Plastic Casing Spacers shall be spaced within two feet of both ends of each individual casing pipe section with all remaining spacers assembled along the length of the pipe section at an equal distance apart not exceeding eight feet in length. All Phoenix Series Spacers are supplied with a molded TPR (Thermo Plastic Rubber) non-slip button comprised of pliable material having a high coefficient of friction that is designed to grip all types of pipe; especially good for PVC. The casing spacers shall be Cascade Phoenix Gold Series, as manufactured by Cascade Waterworks Mfg. Co., Yorkville, Illinois, or approved equal.

PART 3 – EXECUTION

3.1 REQUIREMENTS

A. Prior to the start of the boring operations, the Contractor shall submit the following details to the Engineer when requested.

1. Boring pit bracing.
2. Casing boring head.

B. Boring shall be performed to alignment and grade as shown on the construction drawings.

C. The earth and/or rock augers shall not exceed the O.D. (outside diameter) of the steel casing by more than ¼ of an inch. The boring and insertion of the steel casing shall be performed with equipment capable of simultaneous operations.

D. The feed rate of augers and hydraulic pushing of the casing shall be the same. Under no circumstances will boring be allowed unless operations are simultaneous.

E. Equipment shall be of adequate size and capability to install the product and in conformance with the equipment Manufacturer’s recommendations for all power equipment used in the installation. Equipment shall have a means for controlling line and grade and a means for centering the cutting head inside the borehole. Equipment shall provide a means for preventing voids by assuring:

1. In stable, cohesive conditions, the rear of the cutting head must be prevented from advancing in front of the leading edge of the casing by more than 1/3 times the casing diameter, not to exceed 8 inches.

2. In unstable conditions, such as granular soil, loose or flowable materials, the cutting head must be retracted into the casing a distance that permits a balance between pushing pressure, pipe advancement and soil conditions.

F. Every effort shall be made to prevent formation of voids. Upon completion of the boring operations, voids around the outside face of the casing shall be filled by grouting.

G. Excavated material shall be removed from the casing as excavation progresses and no accumulation of such material within the casing shall be permitted.

H. The Contractor shall be responsible for protecting any underground utilities and for any damage resulting to located utilities.

I. The Contractor shall be fully responsible for producing a sound, tight installation, true to line and grade. All pipe shall be installed through the casing using casing spacers.

J. Only workmen experienced in boring operation shall perform the work.

K. The allowable tolerance as to grade and alignment of the installed casing shall not exceed 1/10 of a foot per hundred feet of casing length.

L. Joint restraint for pressure pipe shall be provided in accordance with the details.

M. If the grade of the pipe at the jacking end is below the ground surface, suitable pits or trenches shall be excavated for the purpose of conducting the jacking operations and for placing end joints of the pipe. Such work shall be sheeted securely and braced in accordance with OSHA Trench Safety requirements.

N. Heavy duty jacks suitable for pushing the casing through the soil shall be provided. In operating jacks, even pressure shall be applied to all jacks used so that pressure will be applied to the casing uniformly around the ring of the casing.

O. A suitable jacking frame or back stop shall be provided. The pipe to be jacked shall be set on guides properly braced together, to support the section of the casing and to direct it in the proper line and grade.

P. The whole jacking assembly shall be placed so as to line up with the direction and grade of the casing. In general, soil material shall be excavated just ahead of the casing and material removed through the casing and the casing forced through the soil with jacks, into the space thus provided.

Q. The casing, preferably, shall be jacked from the low or downstream end. Lateral or vertical variation in the final position of the casing from the line and grade established by the Engineer shall not exceed 0.1 feet per 50 linear feet of pipe for gravity flow installations, provided that such variation shall be regular and only in one direction and that the final grade or flow line shall be in the direction indicated.

R. If the Contractor desires, he may use a cutting edge of steel plate around the head end of the casing extending a short distance beyond the end of the casing with inside angles or lugs to keep the cutting edge from slipping onto the casing.

S. When jacking of casing is once begun, the operation shall be carried on without interruption, insofar as practical, to prevent the casing from becoming firmly set in the soil.

T. Any casing damaged in jacking operations shall be removed and replaced by the Contractor at his entire expense.

U. Immediately after jacking is complete and the carrier or encasement pipe is accurately positioned and approved for line and grade, the clearance space between the casing and soil shall be completely filled by pressure grouting for the entire length of the installation.

V. The pits or trenches excavated to facilitate jacking operations shall be backfilled in accordance with other sections of these specifications immediately after the jacking of the casing has been completed.

W. The excavation for the underside of the casing, for at least 1/3 of the circumference of the casing, shall conform to the contour and grade of the casing. A clearance of not more than 2 inches may be provided for the upper half of the casing. This clearance is to be tapered off to zero at the point where the excavation conforms to the contour of the casing.

X. The distance that the excavation shall extend beyond the end of the casing depends on the character of the material, but it shall not exceed 2 feet in any case. This distance shall be decreased if the character of the material being excavated makes it desirable to keep the advance closer to the end of the pipe.

3.2 Smaller Casing Sizes – For casing or sleeve sizes eight inches or smaller, alternate casing installation methods are allowed subject to the approval of the applicable transportation authority having jurisdiction over the subject real estate. These methods may include pneumatic mole, punching, or pushing methods.

END OF SECTION 02310

SECTION 023400 - RIP RAP

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to work of this Section.

B. Florida Department of Transportation, Standard Specifications for Road and Bridge Construction (FDOT Specs), Section 530. Work shall comply with requirements of FDOT Specs as modified herein.

1.2 DESCRIPTION OF WORK

This section shall cover the work of furnishing and constructing the Riprap which shall consist of a protective course of stone or other approved materials on embankment slopes, in channels, or other work as shown on the plans or directed, in accordance with these Specifications and in conformity with the lines and grades noted in the plan details.

PART 2 - PRODUCTS

2.1 MATERIALS

Rubble\Stone Riprap shall comply with Florida Department of Transportation Standard Specification 530-2.1.3.

A. Banks and shore protection shall comply with Florida Department of Transportation Standard Specification 530-2.1.3.1.

B. Ditch lining shall comply with Florida Department of Transportation Standard Specification 530-2.1.3.2.

C. Broken stone and broken concrete shall comply with Florida Department of Transportation Standard Specification 530-2.1.3.3.

D. Geotextile fabric shall comply with Florida Department of Transportation Standard Specification 514.

E. Bedding stone shall comply with Florida Department of Transportation Standard Specification 530-2.1.4.

F. Sand/Cement Riprap: Materials and placement shall comply with Florida Department of Transportation Standard Specification 530-2.1.2.

PART 3 - EXECUTION

3.1 EXECUTION

A. Construction Requirements:

1. General: All slopes to be treated with riprap shall be trimmed to the lines and grades indicated by the plans or directed, loose material shall be compacted by methods approved by the Owner or its representative or removed.

2. Slopes which require a filter blanket under the riprap shall, in addition to the above, shall be prepared as noted below.

3. Placement of any riprap on a filter blanket shall be by such means that will not damage or destroy the blanket. Any damage to the blanket shall be repaired without additional compensation.

4. If directed by the Owner or its representative or shown by plan details, all outer edges and the top of riprap where the riprap terminates shall be formed so that the surface of the riprap will be embedded and even with the surface of the ground and/or slope.

5. All riprap construction shall begin at the bottom of the slope and progress upward.

6. Filter Blanket: Unless otherwise specified by the plans or ordered in writing, a fabric blanket shall be provided.

7. The bedding stone shall be constructed in accordance with Florida Department of Transportation Specification 530-3.3.

8. Foundation Preparation: Areas on which filter fabrics are to be placed shall be uniformly trimmed and dressed to conform to cross-sections shown by the plans.

B. Plastic Filter Fabric:

Plastic filter fabric shall be placed in the manner and at the locations shown in the plans or as directed by the Engineer. At the time of installation, fabric shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacturing, transportation or storage. The fabric shall be placed with the long dimension parallel to the centerline of the channel or shoreline unless otherwise directed by the Owner or its representative, and shall be laid smooth and free of tension, stress, folds, wrinkles or creases. The strips shall be placed to provide a minimum width of 24 inches of overlap for each joint with the upstream strip of fabric overlapping the downstream strip. Overlap joints and seams shall be measured as a single layer of cloth. Securing pins with washers shall be inserted through both strips of overlapped cloth at not greater than the following intervals along a line through the midpoint of the overlap.

<u>Pin Spacing Slope</u>
2 ft.(Steeper than 3:1)
3 ft. (3:1 to 4:1)
5 ft. (Flatter than 4:1)

The fabric shall be turned down and buried two feet at all exterior limits except where a stone-filled key is provided below natural ground.

Additional pins regardless of location shall be installed as necessary to prevent any slippage of the filter fabric. Overlaps in the fabric shall be placed so that any upstream strip of

fabric will overlap the downstream strip. Should the Owner or its representative direct that the fabric be placed with the long dimension perpendicular to the centerline of the channel or shoreline, the lower strip of fabric shall underlap the next higher strip. Each securing pin shall be pushed through the fabric until the washer bears against the fabric and secures it firmly to the foundation. The fabric shall be protected at all times during construction from contamination by surface runoff and any fabric so contaminated shall be removed and replaced with uncontaminated fabric. Any damage to the fabric during its installation or during placement of riprap shall be replaced by the Contractor. The work shall be scheduled so that 5 days does not expire between placement of the fabric and the covering of the fabric with riprap.

3.2 STONE AND CONCRETE RUBBLE RIPRAP

A. General: Unless otherwise shown by plan details or directed, stone or concrete shall not be placed on slopes steeper than the natural angle of repose of the riprap material.

Placement of stone or concrete may, unless otherwise noted hereinafter, be placed by methods and equipment approved by the Owner or its representative suitable for the purpose of placing the riprap in accordance with the requirements for the class riprap involved without damaging any existing facility or construction feature.

The stone or concrete shall be placed in such a manner as to produce a reasonably well graded mass of rock with the minimum practical percentage of voids. Stone or concrete shall be laid with close broken joints and resting on the embankment slope. The riprap shall be constructed to the lines, grades and thickness shown by the plans or as directed. Riprap shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing or damaging the filter blanket material. The larger stone or concretes shall be well distributed and the entire mass of stone or concretes in their final position shall conform to a reasonable uniform gradation. The finished riprap shall be free from objectionable pockets of small stone or concretes and clusters of larger stone or concretes. Open joints shall be filled with spalls, or small stone or concretes in such manner that all stone or concretes are tightly wedged or keyed. Placing riprap by dumping into chutes or by other methods likely to cause segregation of sizes will not be permitted. The desired distribution of the various sizes of stone or concretes throughout the mass shall be obtained by selective loading of the material at the source, by controlled dumping of successive loads during final placing, or by other methods of placement which will produce the specified results. The individual pieces of stone or concrete in each horizontal course shall be laid so that they will not break away from embankment. Rearranging of individual stone or concretes by mechanical equipment, or by hand, will be required to the extent necessary to obtain a reasonably well graded distribution of stone or concrete as specified above.

3.3 SAND/CEMENT RIPRAP

A. Placing: Immediately following mixing, the mixture shall be placed in the bags, tied (so that when laid in position, they will flatten out and give a thickness of not less than six inches) and placed flat on the area designed. Bags shall be layered and rammed against each other to form closed joints, with tied ends of sacks all laid in the same direction. Sacks ripped or torn in placing shall be removed and replaced with sound, unbroken sacks. When required to be placed under water, special care shall be taken to see that bags are closely jointed to give the same tight joints as required on dry slopes. After the riprap is placed, it shall be sprinkled with water as directed and kept damp for not less than three days. No

sand/cement riprap shall be mixed in freezing weather.

B. Grouting: Immediately after watering, all openings between sacks shall be filled with dry grout composed of one part Portland cement and five parts sand.

C. Pinned Bags: Bags shall be pinned when called for on drawings.

3.4 MAINTENANCE

The Contractor shall maintain all riprap until the contract work is accepted, and shall replace, without additional compensation for any damaged or lost riprap.

3.5 CLEAN-UP

Before final inspection and acceptance, the Contractor shall remove all excess material from site and restore all disturbed areas to as good a condition as existed before work started.

END OF SECTION 023400

SECTION 023610 - TERMITE CONTROL

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. This Section includes the following for termite control: Soil treatment.

1.3 DEFINITIONS

A. EPA: Environmental Protection Agency.

B. PCO: Pest control operator.

1.4 SUBMITTALS

A. Product Data: Treatments and application instructions, including EPA-Registered Label.

B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.

C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:

1. Date and time of application.

2. Moisture content of soil before application.

3. Brand name and manufacturer of termiticide.

4. Quantity of undiluted termiticide used.

5. Dilutions, methods, volumes, and rates of application used.

6. Areas of application.

7. Water source for application.

D. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that

indicated for this Project and whose work has a record of successful in-service performance.

B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.8 WARRANTY

A. General Warranty: Special warranty 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 Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

C. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants.
Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AgrEvo Environmental Health, Inc.; a Company of Hoechst and Schering, Berlin.

2. American Cyanamid Co.; Agricultural Products Group; Specialty Products Department.

3. Bayer Corp.; Garden & Professional Care.

4. DowElanco.

5. FMC Corp.; Pest Control Specialties.

6. Zeneca Professional Products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.

2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.

4. Masonry: Treat voids.

5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until round-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 023610

SECTION 024000 - GRADED AGGREGATE BASE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and other Specification Sections, apply to the work of this section.

B. Florida Department of Transportation, Standard Specifications for Road and Bridge Construction (FDOT Specs), latest edition.

1.2 DESCRIPTION OF WORK

A. This item shall consist of a base course of graded aggregate base or limerock base constructed on a subgrade prepared in accordance with the specifications and in conformity with the line, grades and typical cross-section as shown on the drawings. The construction methods shall conform to the requirements of Sections 200, 204, or 230 of the FDOT Specs for graded aggregate base or limerock base.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall be secured from sources approved by the Owner or its representative, and shall be furnished by the Contractor. Graded aggregate material shall conform to Section 901 of the FDOT Specs. Limerock material shall conform to Section 911 of the FDOT specs.

2.2 EQUIPMENT

A. The aggregate shall be spread by mechanical rock spreaders, equipped with a device which strikes off the aggregate uniformly to laying thickness, and capable of producing an even distribution of the aggregate. Spreading may be done by bulldozers or blade graders for crossovers, intersections, and ramps areas; for roadway widths of 20 feet or less; for the main roadway area when forms are used; and for any other areas where the use of a mechanical spreader is not practicable. All equipment for proper construction of this project shall be in first-class working condition.

PART 3 - EXECUTION

3.1 TRANSPORTING BASE MATERIAL:

A. The graded aggregate shall be transported to the point where it is to be used, over aggregate previously placed if practicable, and dumped on the end of the preceding spread. Hauling over the subgrade and dumping on the subgrade will be permitted when, in the Engineer’s opinion, these operations will not be detrimental to the base.

3.2 SPREADING BASE MATERIAL:

A. Method of Spreading: The graded aggregate shall be spread uniformly. All segregated areas of fine or coarse aggregate shall be removed and replaced with properly graded aggregate.

B. Number of Courses: When the specified compacted thickness of the base is greater than six inches, the base shall be constructed in two courses. The thickness of the first course shall be approximately one-half the total thickness of the finished based, or enough additional material added to bear the weight of the construction equipment without disturbing the subgrade. When compacted thickness is six inches or less, graded aggregate shall be placed in one lift.

3.3 COMPACTING AND FINISHING BASE:

A. GENERAL

Single-Course Base: For single-course base, after the spreading is completed, the entire surface shall be scarified and then shaped so as to produce the required grade and cross-section after compaction.

Double-Course Base: For double-course base, the first course shall be cleaned of foreign material and bladed and brought to a surface cross-section approximately parallel to that of the finished base. Prior to the spreading of any material for the upper course, the density tests for the lower course shall be made and the Owner or its representative shall have determined that the required compaction has been obtained. After the spreading of the material for the second course is completed, its surface shall be finished and shaped so as to produce the required grade and cross-section after compaction, and free of scabs and laminations.

Moisture Content: When the material does not have the proper moisture content to ensure the required density, wetting or drying will be required. When water is added, it shall be uniformly misted-in by discing to the full depth of the course which is being compacted. Wetting or drying operations shall involve manipulation, as a unit, of the entire width and depth of the course which is being compacted.

3.4 DENSITY REQUIREMENTS:

A. As soon as proper conditions of moisture are attained, the material shall be compacted to meet the density requirements of the details, the Earthwork section and/or the report of Geotechnical Investigation.

3.5 TESTING SURFACE, PROTECTION, AND MAINTENANCE

A. During final compacting operations, if blading of any areas is necessary to obtain the true grade and cross-section, the compacting operations for such areas shall be completed prior to making the density tests on the finished base.

B. Correction of Defects:

Contamination of Base Material: If, at any time, the subgrade material should become mixed with the base course materials, the Contractor shall, without additional compensation, dig out and remove the mixture, reshape and compact the subgrade, and replace the materials removed with clean base material, which shall be shaped and compacted as specified above.

Cracks and Checks: If cracks or checks appear in the base, either before or after priming, which, in the opinion of the Owner or its representative, would impair the structural efficiency of the base, the Contractor shall remove the cracks or checks by re-scarifying, reshaping, adding base material where necessary, and re-compacting.

C. Compaction of Widening Strips:

Where base construction consists of widening strips and the trench width is not sufficient to permit use of standard base compaction equipment, compaction shall be accomplished by use of vibratory compactors, trench rollers or other special equipment which will achieve the density requirements specified herein.

D. Testing Surface:

The finished surface of the base course shall be checked with a template cut to the required crown and with a 15-foot straightedge laid parallel to the center line of the road. All irregularities greater than ¼ inch should be corrected by scarifying and removing or adding aggregate as required, after which the entire area shall be re-compacted as specified herein. In the testing of the surface, the measurements will not be taken in small holes caused by individual pieces of rock having been pulled out by the grader.

E. Priming and Maintaining:

Priming: The prime coat shall be applied only when the base meets the specified density requirements and the moisture content in the top half of the base does not exceed 90 percent of the optimum moisture of the base material. At the time of priming, the base shall be firm, unyielding and in such condition that no undue distortion will occur.

Maintaining: The Contractor will be responsible for assuring that the true crown and template are maintained, with no rutting or other distortion, and that the base meets all the requirements, at the time the surface course is applied.

F. Thickness Requirements:

Measurements: Thickness of the base shall be measured at intervals in such a manner that each test represents 5,000 square feet of road pavement, or as otherwise directed by the Owner or its representative. Measurements shall be taken at various points on the cross-section, through holes not less than three inches in diameter.

Areas Requiring Correction: Where the compacted base is deficient by more than ½ inch from the thickness called for in the plans, the Contractor shall correct such areas by scarifying and adding rock. The base shall be scarified, and rock added for a distance of 100 feet in each direction from the edge of the deficient area. The affected areas shall then be brought to the required state of compaction and to the required thickness and cross-section.

END OF SECTION 024000

SECTION 025140 - BASE REPLACEMENT AND RESURFACING FOR TRENCHES

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 specification sections, apply to work of this section.

1.1 DESCRIPTION OF WORK

A. Extent of work includes base course replacement and temporary and permanent resurfacing for trenches associated with installation of this project.

1.2 QUALITY ASSURANCE:

A. Where the pipelines lie within the right-of-way of a state highway, all resurfacing shall be done in strict accordance with the specifications, general and special provisions of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Latest Edition. State highway permits will be obtained by the Owner. County permits will be obtained by the Contractor.

B. At the completion of construction, the Contractor shall obtain a written release from the County and/or the State DOT authority (as applicable) on all work completed in their respective rights-of-way.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.0 BASE REPLACEMENT

A. Immediately after trenches have been backfilled as specified in these specifications, to a depth consistent with the bottom of the existing base but in no case less than six (6) inches below the bottom of the proposed surface of the street, the Contractor shall complete filling and compacting the trench with an approved base material unless otherwise specified.

B. Unless otherwise directed by the Owner, the Contractor shall maintain base replacement for the period during construction and replace any settlement of the trench with additional base replacement material as specified. The surface of the base replacement over the trench shall be maintained in a condition satisfactory for use by normal traffic. The Contractor shall pay all claims for damages arising from his neglect to properly maintain the base replacement. No base replacement shall be required on unimproved streets.

3.1 TEMPORARY RESURFACING

A. Where paved streets are cut, undermined, or otherwise disturbed as a result of the construction, limerock base or graded aggregate base cover shall immediately be provided to temporarily restore the area until repaving occurs. This material shall be maintained until repaved.

3.2 PERMANENT RESURFACING

A. Surface Courses: The Contractor shall properly prepare the previously placed base replacement by compacting, shaping, and priming the area to be patched. The Contractor shall place a permanent surface course conforming to the existing wearing surface in type, depth, crown, and grade. All resurfacing shall conform to the pertinent sections of the Florida DOT Standard Specifications for Road and Bridge Construction.

3.3 ASPHALT RESURFACING

A. Asphalt paving shall be replaced by first compacting fill in accordance with the applicable section of these specifications, then placing the base material to grade. Finally, the asphalt surface course shall be placed. Care must be taken to make the saw cut in a straight line so the patch will be neat.

3.4 CONCRETE RESURFACING

A. Where the pipelines underlie a concrete roadway, the backfill shall be brought up to the level of the base of the existing concrete paving. The concrete shall be cut back on solid ground so that the new concrete paving will rest on a minimum width of six inches solid earth shoulder on both sides of the trench. The concrete shall be 4000 psi class reinforced by 4" x 4" x No. 6 x No. 6 gauge wire mesh and finished in the same manner as the existing pavement. Felt construction joints are required where new concrete abuts existing concrete to remain.

3.5 CONCRETE CURB REPLACEMENT

A. Wherever the pipeline trench crosses or underlies concrete curbing, the Contractor shall replace any damaged portion of each curbing with new curbing constructed of 4000 psi concrete finished in a manner similar to the existing curbing at Contractor's expense. If the Contractor damages any curbing not overlaying or crossing the trench, he shall replace all such curbing at his own expense. Felt construction joints are required where new concrete abuts existing concrete to remain.

3.6 SIDEWALK REPLACEMENT

A. Where the pipe underlies an existing sidewalk, the entire sidewalk surface between scorings or joints shall be carefully removed to avoid damage to adjoining slabs. After backfilling, the entire area exposed by removal of the sidewalk shall be graded to the proper elevation and compacted to a firm even surface by means of watering, rolling, and/or tamping. Felt construction joints are required where new concrete abuts existing concrete to remain.

B. Concrete sidewalks shall be constructed of 4000 psi concrete and finished similar to that of the existing pavement. Slabs shall be separated by transverse premolded joints 1/4" thick for the full depth of the concrete, and joints shall be placed adjacent to existing structures where directed. The slabs between joints shall be divided into blocks five feet in length by scoring transversely for a depth of at least one-third the thickness of the slab with an edger having 1/4" radius.

C. Replace asphalt sidewalks to match existing. The Contractor shall properly prepare the previously placed base replacement by compacting, shaping, and priming and place a permanent surface course conforming to the existing wearing surface in type, depth, crown, and grade.

END OF SECTION 025140

SECTION 025150 - CAST-IN-PLACE CONCRETE (SITEWORK)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

B. Florida Department of Transportation, Standard Specifications for Road and Bridge Construction (FDOT Specs), latest edition.

1.2 SUMMARY

This Section includes concrete work for the following:

A. Roadways.
B. Parking lots.
C. Curbs and gutters.
D. Walkways.
E. Pads.
F. Flumes.
G. Curb Ramps.
H. Cast-in-place utility structures.

1.3 SUBMITTALS

A. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, joint systems, curing compounds, dry-shake finish materials, and others if requested by Owner or its representative.

B. Design mixes for each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

B. Material certificates in lieu of material laboratory test reports when permitted by Owner or its representative. Material certificates shall be signed by manufacturer and Contractor certifying that each material item complies with or exceeds requirements. Provide certification from admixture manufacturers that chloride content complies with requirements.

D. Sustainable Design Submittals:

1. Product Certificates: For products and materials required to comply with requirements for regional materials indicating location and distance from project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Concrete shall conform to requirements of FDOT Specs, Section 346 for curbs, curb ramps, gutters, walks, structures, and miscellaneous concrete.

B. Concrete for pavement shall conform to requirements of FDOT Specs, Section 350.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars and Tie Bars: ASTM A 615, Grade 60, deformed.

B. Welded Steel Wire Fabric: ASTM A 185.

1. Furnish in flat sheets, not rolls, unless otherwise acceptable to Owner or its representative.

C. Deformed-Steel Welded Wire Fabric: ASTM A 497.

D. Fabricated Bar Mats: Welded or clip-assembled steel bar mats, ASTM A 184. Use ASTM A 615, Grade 60 steel bars, unless otherwise indicated.

E. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

F. Hook Bolts: ASTM A 307, Grade A bolts, internally and externally threaded. Design hook bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

G. Supports for Reinforcement: Chairs, spacers, dowel bar supports and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with CRSI specifications. Use supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I.

1. Use one brand of cement throughout Project unless otherwise acceptable to Owner or its representative.

2. All concrete shall develop a 28-day compressive strength of 4000 psi. If any concrete should fail to meet the strength requirement, the structure shall be removed as necessary to remove the defective concrete and shall then be rebuilt at the contractor's expense.

B. Fly Ash: ASTM C 618, Type F.

C. Normal-Weight Aggregates: ASTM C 33, Class 4, and as follows. Provide aggregates from a single source unless otherwise approved by the Owner or its representative.

1. Maximum Aggregate Size: 1-1/2 inches.

2. Do not use fine or coarse aggregates that contain substances that cause spalling.

3. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Owner or its representative.

D. Water: Potable.

E. Fiber Reinforcement: Synthetic fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III.

2.4 ADMIXTURES

A. Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

B. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.5 CONCRETE MIX

A. Prepare design mixes for each type and strength of normal-weight concrete per FDOT Standard Specification 346-6.2. Use a qualified independent testing laboratory for preparing and reporting proposed mix designs.

B. Fiber Reinforcement: Add to mix at rate of 1.5 lb per CY, unless manufacturer recommends otherwise.

C. Adjustment to Concrete Mixes: Mix design adjustments may be allowed by the Owner or its representative when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of FDOT Standard Specifications.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION FOR CONCRETE PAVING

A. Proof-roll prepared base or subgrade surface to check for unstable areas and verify need for additional compaction. Do not begin concrete work until such conditions have been corrected and are ready to receive paving.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install sufficient forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork and screeds for grade and alignment to following tolerances:

1. Top of Forms: Not more than 1/8 inch in 10 feet.

2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.3 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Maintain minimum cover to reinforcement.

D. Install welded wire fabric in lengths as long 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.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.4 JOINTS

A. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.

B. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as shown on Drawings. If not specified on drawings, intervals shall be not greater than 10 feet or less than 5 feet. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows:

1. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into hardened concrete when cutting action will not tear, abrade, or otherwise damage surface and before development of random contraction cracks.

3. Inserts: Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strips into fresh concrete until top surface of strip is flush with paving surface. Radius each joint edge with a jointer tool. Carefully remove strips or caps of two-piece assemblies after concrete has hardened. Clean groove of loose debris.

C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than ½ hour, unless paving terminates at isolation joints.

1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless indicated otherwise. Embed keys at least 1-1/2 inches into concrete.

2. Continue reinforcement across construction joints unless indicated otherwise.

D. Expansion Joints: Form expansion joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 25 feet, unless indicated otherwise.

2. Extend joint fillers full width and depth of joint, not less than ½ inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.

3. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

E. Filler and Sealants: Submit specifications to Engineer for approval.

F. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one half of dowel length to prevent concrete bonding to one side of joint.

3.5 CONCRETE PLACEMENT

A. Comply with requirements of FDOT Standard Specification 350-8 placing concrete.

B. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place. No concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. Deposit concrete as nearly as practical to its final location to avoid segregation. When concrete placing is interrupted for more than ½ hour, place a construction joint.

C. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

D. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with FDOT Standard Specifications 350-9.

E. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.

F. Curbs and Gutters: Shall be constructed in accordance with FDOT Specs. When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

G. Slip-Form Pavers: When automatic machine placement is used for paving, submit revised mix design and laboratory test results that meet or exceed requirements. Produce paving to required thickness, lines, grades, finish, and jointing as required for formed paving. Compact subgrade of sufficient width to prevent displacement of paver machine during operations.

H. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength, or sufficient strength to carry loads without damage or injury.

I. Cold-Weather Placement: Comply with provisions of FDOT Standard Specifications 346.7.4. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

J. Hot-Weather Placement: Place concrete complying with FDOT Standard Specification 346.7.5 and as specified when hot weather conditions exist.

3.6 CONCRETE FINISHING

A. Float Finish: Begin floating when bleed water sheen has disappeared, and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/8 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across concrete surface perpendicular to line of traffic to provide a uniform fine line texture finish.

2. Tine Finish: Apply to curb cut ramps and other areas as noted on the drawings. Finish shall be applied by an approved hand method and shall consist of transverse grooves which are 0.03 to 0.12 inch in width and 0.10 to 0.15 inch in depth, spaced at approximately ½ inch center to center.

B. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces. Radius: ½ inch.

3.7 CONCRETE PROTECTION AND CURING

General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of FDOT Standard Specification 350-11 curing.

3.8 FIELD QUALITY CONTROL TESTING

A. The contractor shall be responsible for all required testing & re-testing noted herein, at his expense.

B. A qualified independent testing and inspection laboratory, under the direction of a Professional Engineer, licensed in the State of Florida, shall sample materials, perform tests, and submit test reports during concrete placement as follows:

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

a. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
b. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test but no less than one test for each day's pour of each type of air-entrained concrete.
c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below and when 80 deg F (27 deg C)

and above, and one test for each set of compressive-strength specimens.

d. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class, plus one set for each additional 50 cu. yd. Test two specimens at 7 days, plus two specimens at 28 days.

f. Contractor shall replace materials removed for testing purposes. Should any work or materials fail to meet the requirements set forth in the plans and specifications, contractor shall pay for retesting of same.

g. All samples shall be made by the testing laboratory.

2. Basis for acceptance of concrete will be per FDOT Section 346-8 through 346-11.

C. Test results will be reported in writing to Engineer, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing laboratory, concrete type and class, location of concrete batch in the work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing laboratory will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Owner or its representative. Testing laboratory may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.9 REPAIRS AND PROTECTION

A. Remove and replace concrete work that is broken, damaged, or defective, or does not meet the requirements of this Section.

B. Drill test cores where directed by Owner or its representative when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory concrete areas with Portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from concrete pavement for at least 14 days after placement. When construction traffic is permitted, maintain concrete as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete work free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION 025150

SECTION 025160 - PAVEMENT MARKINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Specifications Sections, apply to work of this section.

B. Unless otherwise specified on the plan sheets or in other sections of this contract, all materials and work shall conform to the applicable requirements in the following documents:

1. Florida Department of Transportation Roadway and Traffic Design Standards, Indices 17344 through 17359, latest edition.

2. Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Sections 705, 706, 710, 711, 971, and 993, latest edition.

3. USDOT, Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways, latest edition.

1.2 DESCRIPTION OF WORK

The work under this section includes the installation of temporary and permanent pavement markings. The Contractor shall furnish all labor, materials, tools, supplies, equipment, and machinery necessary to fully complete the work shown in the plans and in these specifications.

PART 2 – PRODUCTS

2.1 MATERIALS

All materials shall be new and of good quality unless otherwise specified. The Contractor shall, if requested by the Engineer, furnish samples of material and/or shall certify that the material meets all FDOT requirements. All material or work that has been rejected shall be remedied by the Contractor at his own expense and without delay. If the Contractor fails to promptly remove and/or dispose of rejected material and replace the same, the Owner may remove and replace the same and deduct the cost of the work from the contract amount.

2.2 TEMPORARY PAVEMENT MARKINGS

Materials for temporary pavement marking shall meet all requirements of FDOT Specs, Section 710, latest edition.

2.3 PERMANENT PAVEMENT MARKINGS

Materials for permanent pavement markings shall meet all requirements of FDOT Specs, Section 710 or 711, latest edition, as noted on the plans.

PART 3 – EXECUTION

3.1 GENERAL

All pavement markings shall be applied in accordance with FDOT requirements.

3.2 PERMANENT PAVEMENT MARKINGS

Permanent pavement markings, including painted stripes, thermoplastic stripes, and reflective pavement markers, shall be installed as shown on the plans. Materials and installation shall conform to applicable standards in the documents referenced in herein. Installation of permanent markings on all final asphaltic concrete surfaces shall not be accomplished prior to 14 calendar days, nor later than 30 calendar days, after placement of the final surfaces.

END OF SECTION 025160

SECTION 025250 - ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specifications sections, apply to work of this section. The Standard Specifications referenced in this section refer to the Florida Department of Transportation Standard Specifications for Road and Bridge Construction (FDOT Specs), Latest Edition.

1.2 DESCRIPTION OF WORK

A. Extent of asphalt concrete paving work is shown on drawings.

1.3 SUBMITTALS

A. Material Certificates: Provide copies of material certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.4 JOB CONDITIONS

A. Weather Limitations: Apply prime and tack coats when ambient temperature is above 40 degrees F (4 degrees C), and when temperature has not been below 35 degrees (1 degree C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

B. Construct asphalt concrete surface course when atmospheric temperature is above 40 degrees F (4 degrees C), and when base is dry.

C. Grade Control: Establish and maintain required lines and elevations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Use locally available materials and gradations which exhibit a satisfactory record of previous installations.

B. Surface Course Aggregate: Crushed stone, crushed gravel, or crushed slag, and sharp-edged natural sand.

C. Use only fine graded Type SP asphalt mixes as defined by FDOT Section 334. Fine graded mixes are defined as having a gradation that passes above the restricted zone when plotted on an FHWA 0.45 Power Gradation Chart.

1. Fine Mixes: The allowable structural layer thicknesses for fine Type SP Asphalt Concrete mixtures are as follows:

Type SP 9.5	3/4 – 1 1/4 inches
Type SP 12.5	1 1/4 – 2 1/2 inches
Type SP 19.0	2- 2 3/4 inches

2. Additional Requirements: The following requirements also apply to fine Type SP Asphalt Concrete mixtures:

   a. A minimum 1 1/2-inch initial lift is required over an Asphalt Rubber Membrane Interlayer (ARMI).

   b. When construction includes the paving of adjacent shoulders (5 feet wide or less), the layer thickness for the upper pavement layer and shoulder shall be the same and paved in a single pass, unless shown differently in the plans.

   c. Use the minimum and maximum layer thicknesses as specified in above unless shown differently in the plans. On variable thickness overbuild layers, the minimum allowable thickness may be reduced by 1/2 inch, and the maximum allowable thickness may be increased 1/2 inch, unless shown differently in the plans.

D. Prime and tack coats shall be provided in accordance with FDOT Section 300.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Proof roll prepared base surface to check for unstable areas and areas requiring additional compaction.

B. Notify Engineer of unsatisfactory conditions. Do not begin paving work until deficient base areas have been corrected and are ready to receive paving.

C. Prime Coat: Apply at rate of 0.10 gal. per sq. yd. (minimum), over compacted base. Apply material to penetrate and seal, but not flood, surface. Cure and dry as long as necessary to attain penetration and evaporation of volatiles.

D. Tack Coat: Apply to contact surfaces of previously constructed asphalt or Portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. Distribute at rate of 0.02 to 0.08 gal. per sq. yd. of surface.

   1. Allow to dry until at proper condition to receive paving.

   2. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.

E. General Construction Requirements: Surface preparation and application of patching, leveling and surface courses shall conform to FDOT Specs Section 330, Paragraphs 330-8, 330-9 and 330-10.

3.2 PLANT MIX ASPHALTIC STRUCTURAL/SURFACE COURSE:

A. General: This work shall consist of a structural and/or wearing surface constructed of asphaltic concrete on a prepared base or existing asphalt pavement, in accordance with the plans and specifications.

B. Materials: The materials and construction methods shall comply with those set forth for Superpave Asphaltic Concrete in the latest edition of the Standard Specifications, Sections 330 and 334.

C. Job Mix Formula: Design the Type SP asphalt mixture in accordance with AASHTO PP-28, except as noted herein, to meet the requirements of this specification. Use only previously approved design. Prior to the production of any Type SP asphalt mixture, submit the proposed mix design with supporting test data indicating compliance with all Type SP asphalt mix design criteria.

The Engineer will consider any marked variations from original test data for a mix design or any evidence of inadequate field performance of a mix design as sufficient evidence that the properties of the mix design have changed, and the Owner or its representative will no longer allow the use of the mix design.

1. Gyratory Compaction: Compact the design mixture in accordance with AASHTO TP-4. Use the number of gyrations as defined in the Table below:

Type SP Design Gyratory Compactive Effort			
	$N_{initial}$	Ndesign	$N_{maximum}$
SP Mixes	7	75	115

2. Volumetric Criteria: Use an air void content of the mixture at design of 4.0% at the design number of gyrations (Ndesign). Meet the requirements of the Table below:

Mixture Densification Criteria % G_{mm}			
	$N_{initial}$	N_{design}	$N_{maximum}$
SP Mixes	$\geq$89.0	96.0	$\leq$98.0

3. VMA Criteria: Meet the requirements of the Table below for voids in the mineral aggregate (VMA) of the mixture at the design number of gyrations.

VMA Criteria	
Type Mix	Minimum VMA (%)
SP 9.5	15.0
SP 12.5	14.0
SP 19.0	13.0

4. VFA Criteria: Meet the requirements of the Table below: for voids filled with asphalt (VFA) of the mixture at the design number of gyrations.

VFA Criteria	
	Design VFA (%)
SP Mixes	65 - 75

5. Dust Proportion: Use an effective dust-to-binder ratio as defined in FDOT Section 334-3.2.5.

6. Moisture Susceptibility: Provide a mixture (4-inch specimens) having a retained tensile strength ratio of at least 0.80 and a minimum tensile strength (dry and unconditioned) of 100 psi.

7. Additional Information: In addition to the requirements listed above, provide the following information with each proposed mix design submitted for use:

   a. The design number of gyrations (N_{design}).
   b. The source and description of the materials to be used.
   c. The FDOT source number product code of the aggregate components furnished from an FDOT approved source.
   d. The gradation and proportions of the raw materials as intended to be combined in the paving mixture. The gradation of the component materials shall be representative of the material at the time of use. Compensate for any change in aggregate gradation in handling and processing, as necessary.
   e. A single percentage of the combined mineral aggregate passing each specified sieve. Degradation of the aggregate due to processing (particularly –No. 200 [-75µm]) should be accounted for and identified for the applicable sieves.
   f. The bulk specific gravity value for each individual aggregate (and RAP) component as identified in the FDOT aggregate control program.
   g. A single percentage of asphalt binder by weight of total mix intended to be incorporated in the completed mixture, shown to the nearest 0.1%.
   h. A target temperature at which the mixture is to be discharged from the plant and a target roadway temperature (per 330-6.1.3). Do not exceed a target temperature of 340˚ F for modified asphalts and 315˚ F for unmodified asphalts.
   i. Evidence that the completed mixture conforms to all specified physical requirements.
   j. The name of the Mix Designer.

D. Thickness: The thickness of the new pavement shall be as shown on the construction plans. This requirement shall be checked by cores and where a deficiency of more than ¼" exists, the Contractor will be required to correct the deficiency either by replacing the full thickness or overlaying the area to the satisfaction of the Engineer.

3.3 PLACING THE MIX

A. Notify the Engineer at least 48 hours prior to commencement of any paving operation.

B. General: Place asphalt concrete mixture on prepared surface, spread and strike-off. Spread mixture at minimum temperature (per FDOT). Place inaccessible and small areas by hand. Place each course to required grade, cross-section, and compacted thickness.

C. Pavement Placing: Place in strips not less than 12’ wide, unless otherwise acceptable to Engineer. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.

D. Joints: Make joints between old and new pavements, or between successive days’ work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

3.4 ROLLING

A. General: Begin rolling when mixture will bear roller weight without excessive displacement.

1. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.

C. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

D. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

E. Patching: Remove and replace paving areas mixed with foreign materials and defected areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

1. Erect barricades to protect paving from traffic until mixture has cooled enough to become marked.

3.5 TRAFFIC CONTROL

A. Temporary and permanent pavement markings shall conform to applicable Division 2 specifications.

B. Maintenance of Traffic: Suitable methods shall be used by the contractor to protect the new pavement from all types of vehicular traffic without damage. Opening to traffic does not constitute acceptance of work. Conform to requirements of applicable Division 2 specifications.

3.6 FIELD QUALITY CONTROL

A. General: Test in-place asphalt concrete courses for compliances with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by Engineer. Contractor to replace asphalt removed for testing purposes.

1. Should any work or materials fail to meet the requirements set forth in the plans and specifications, Contractor shall pay for retesting of same.

2. Make at least one coring of asphalt for thickness and density for every 300 linear feet of pavement, but in no case less than 3 corings. Take two plant samples per day and 2 drilled cores for density each day.

B. Thickness: In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:

New Pavement Course: ¼", plus or minus.
Overlay Pavement Course: ¼", plus or minus.

C. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 15' straightedge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness.

1. Any Course Surface: 3/16"

2. Check surfaced areas at intervals as directed by Engineer.

END OF SECTION 025250

SECTION 025560 - POTABLE WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION OF WORK

The Contractor shall furnish and install all pipes, fittings, structures, and accessories required for water transmission, distribution and/or service lines in accordance with the requirements of the Construction Plans and related Contract Documents.

1.2 COMMONLY USED ACRONYMS

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASSE	American Society of Safety Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CA	Concrete Asbestos
CI	Cast Iron
DI	Ductile Iron
DIPS	Ductile Iron Pipe Standard
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FLG	Flange
HDPE	High-Density Polyethylene
MJ	Mechanical Joint
MSS	Manufacturer's Standardization Society
NSF	National Standards Foundation
OD	Outside Diameter
PVC	Polyvinyl Chloride
SBR	Styrene Butadiene Rubber
SF	Suction Flange

1.3 QUALITY ASSURANCE

A. AWWA Standards - Construction materials and methods shall comply with the requirements of the latest published edition of American Water Works Association (AWWA) Standards. Applicable standards include, but may not be limited to, the following:

AWWA C104	Cement Mortar Lining for Ductile Iron Pipe and Fittings
AWWA C105	Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	Ductile-Iron and Gray-Iron Fittings
AWWA C111	Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
AWWA C151	Ductile Iron Pipe, Centrifugally Cast
AWWA C153	Ductile Iron Compact Fittings, For Water Service
AWWA C213	Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
AWWA C301	Pre-stressed Concrete Cylinder Pressure Pipe (PCCP), 16-in. and Larger
AWWA C502	Dry Barrel Fire Hydrants
AWWA C504	Rubber Seated Butterfly Valves 3-in. (75 mm) Through 72-in. (1,800 mm)
AWWA C509	Resilient Seated Gate Valves for Water Supply Service
AWWA C510	Double Check Valve Backflow Prevention Assembly
AWWA C511	Reduced-Pressure Principle Backflow Prevention Assembly
AWWA C515	Reduced-Wall, Resilient Seated Gate Valves for Water Supply Service
AWWA C550	Protective Interior Coatings for Valves and Hydrants
AWWA C600	Installation of Ductile Iron Water Mains & Their Appurtenances
AWWA C605	Underground Installation of Polyvinyl Chloride (PVC) And Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
AWWA C651	Disinfecting Water Mains
AWWA C800	Underground Service Line Valves and Fittings
AWWA C900	PVC Pipe and Fabricated Fittings, 4-in. Through 12-in. (100 mm through 300 mm), For Water Transmission and Distribution
AWWA C901	Polyethylene (PE) Pressure Pipe and Tubing 1/2-in. (13 mm) through 3-in. (76 mm), For Water Service
AWWA C905	Polyvinyl Chloride (PVC) Pressure Pipe & Fabricated Fittings, 14-in. through 48-in. (350 mm through 1200 mm)
AWWA C906	Polyethylene (PE) Pressure Pipe & Fittings, 4-in. (100 mm) through 63-in. (1600 mm) for Water Distribution and Transmission

B. ASTM and NSF Standards - In addition, construction materials and methods shall also comply with the requirements of the latest published editions of the American Society for Testing and Materials (ASTM) Standards, and the National Sanitation Foundation (NSF) Standard 61.

C. All water system components that come into contact with drinking water shall conform to NSF-61.

ASTM A126	Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A48	Standard Specification for Gray Iron Castings
ASTM B584	Standard Specification for Copper Allow Sand Castings for General Applications
ASTM B62	Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B88	Standard Specification for Seamless Copper Water Tube
ASTM D1248	Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
ASTM D1598	Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
ASTM D1599	Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings
ASTM D1693	Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D2241	Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2737	Standard Specification for Polyethylene (PE) Plastic Tubing
ASTM D3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
ASTM D429	Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates
ASTM F477	Standards Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

D. ASME and ANSI Standards - In addition, construction materials and methods shall also comply with the requirements of the latest published editions of the American Society of Mechanical Engineers (ASME) Standards, and the American National Standards Institute (ANSI).

ASME/ANSI B16.20	Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed
ASME/ANSI B16.1	Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
ASME/ANSI B 1.1	Unified Inch Screw Threads, UN and UNR Thread Form
ASME/ANSI B 1.20.1	Pipe Threads, General Purpose (Inch)
ASME/ANSI B 1.20.3	Dryseal Pipe Threads (Inch)

PART 2 - MATERIALS AND EQUIPMENT

2.1 GENERAL

All pipe, fittings and accessories shall be new, and shall be suitable and rated for potable water use. All pipe, fittings and accessories shall be rated for a pressure of 160 psi or greater. All water pipe and fittings shall be color coded blue in accordance with FDEP and AWWA requirements, and FAC 62-555.320.

2.2 DELIVERY, STORAGE, AND HANDLING

Certificates of Compliance with the Specifications may be required for all materials used on the Project. All materials are to be transported, stored, handled, and installed in accordance with the Manufacturer's recommendations to avoid physical damage. All materials shall be stored to prevent physical deterioration due to sun and weather. The Owner or its representative reserves the right to reject material which in any way does not meet the requirements of these Specifications.

2.3 WATER MAINS

A. Polyvinyl Chloride Pipe (PVC) - PVC pipe shall meet the designations on the table below and shall be provided with push-on joints with the bell integrally cast into the pipe. PVC pipe shall be installed with elastomeric gaskets meeting ASTM Standard F477 and meet the requirements of the following table.

PVC PIPE STANDARDS				
Standard	Nominal Size	Dimension Ratio	OD Classification	Pressure Rating (Psi)
ASTM 2241	2" – 3"	SDR 21	IPS	200
AWWA C900	4" – 12"	DR 18	DIPS	200
AWWA C905	14" – 36"	DR 18	DIPS	200

1. Markings - PVC pipe shall be marked to indicate the following:

   a. Nominal pipe size and OD base

   b. Material Code Designation

   c. Dimension Ratio

d. Pressure Class or Pressure Rating

e. Manufacture's Name or Trademark

f. National Sanitation Foundation Approved Marking

g. Appropriate AWWA or ASTM Standard Number

h. Date Pipe Was Manufactured

2. Color Coding - Entire pipe shall be colored with blue pigment.

B. Ductile Iron Pipe (DIP) - Ductile iron pipe shall meet the requirements of the table below and have a design operating pressure of up to 150 psi, installed in Class 2 Trenching conditions. Increase pressure class or bedding class as required by AWWA C151 for surface loads greater than indicated or operating pressures greater than 150 psi. DIP shall be constructed with push-on joints using rubber gaskets in accordance with AWWA Standard C111. Other methods of joint construction, such as mechanical, flanged, or ball-and-socket, may be required in special applications as appropriate. All DIP shall meet the requirements of the following table.

DIP PIPE STANDARDS			
Standard	Nominal Size	OD Classification	Pressure Rating (Psi)
AWWA C151	3" – 12"	DIPS	350
AWWA C151	14" – 20"	DIPS	250
AWWA C151	24" – 64"	DIPS	200

1. Minimum Pipe Design Criteria –

a. The minimum internal design working pressure shall provide/ensure: (1) a 100-psi surge allowance, (2) a safety factor of 2, and (3) a total internal design pressure of 600 psi. No reduction of safety factor for transient pressures shall be allowed.

b. The external loads design criteria shall be a minimum of 4-foot depth of cover at 120 lbs. per cubic feet soil weight, and live load based on one AASHTO H-20 truck load. The thickness design of ductile iron pipe shall be in accordance with AWWA C150.

c. The horizontal deflection of epoxy lined ductile iron pipe resulting from external load conditions shall not exceed three percent of the pipe diameter.

2. Joint Design –

a. General – Ductile Iron pipe and fittings shall be furnished with push-on joints, push-on restrained joints, and flanged joints, as required.

b. Push-on Joints – Push-on joints shall conform to AWWA C111. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR). Push-on joints shall be Fastite, as manufactured by American Cast Iron Pipe Company (ACIPCO), or equivalent. The pressure rating for push-on joints shall be a minimum of 350 psi or the specified pressure rating of the pipe, whichever is less.

c. Restrained Joints – Restrained joints shall be "Flex-Ring" restrained joints as manufactured by ACIPCO or equivalent. When restrained joints require factory welding, the Manufacturer shall qualify all welding procedures and welders used to produce the product per the requirements of a documented quality assurance system based on ANSI/AWS D11.2. Unless otherwise specified, gasket material shall be standard SBR. Restrained joints and restrained joint pipe shall have a working pressure rating of 350 psi for 3 to 16-inch sizes and 250 psi for 18 to 48-inch sizes. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes. The Manufacturer shall furnish test results showing that restrained joints in the sizes specified have been successfully tested to at least twice the specified pressure rating of the joint without leakage or failure. Tests shall be performed on pipe with nominal metal thickness less than or equal to that specified for the project.

d. Flanged Joints – Ductile iron pipe and fittings 3 to 54 inches for above ground service or in below ground pits shall have flanged joints and meet the following requirements:

1) Flanged ductile-iron pipe shall conform to current AWWA/ANSI Specification C115/A21.15 and C110/A21.10 with factory-applied screwed long hub flanges except as otherwise specified hereinafter. Flanges shall be fully machined faced and drilled after being screwed tight on the pipe, with flanges true to 90 degrees with the pipe axis and shall be flush with end of pipe conforming to ANSI B161.1, 125-pound std. or Class 250, for the purpose intended. No welding of flanges or accessories in the field will be acceptable.

2) Full face type 1/16-inch-thick red rubber ring gaskets shall conform to ANSI A21.11. Ring gaskets shall be of approved composition suitable for the required service.

3. Markings - Each ductile iron pipe section shall be marked to indicate the following:

   a. Weight class or nominal thickness.

   b. Letters DI or DUCTILE shall be cast or stamped on the pipe.

   c. The Manufacturer's mark.

   d. Country where cast.

   e. Date in which the pipe was produced.

   f. Date when pipe was lined.

   All required markings shall be clear and legible; and all cast marks shall be on or near the bell. All letters and numerals on pipe sizes 14-inch and larger shall be not less than 0.5-inch in height.

4. Color Code -

   a. Potable water pipe shall have 3 blue stripes (1/2 inch wide) with permanent ink along the entire length of pipe with the word "POTABLE" in 3/4-inch-tall letters every 21 inches along each stripe.

5. Interior Coating of Ductile Pipe - DIP shall be lined in accordance with AWWA Standard C104, unless otherwise specified and approved.

6. Exterior Coating of Ductile Iron Pipe – The options for protection of the exterior of ductile iron pipe, fittings, etc. shall consist of one of the following: (1) standard shop coating and annealing oxide layer, (2) standard coating and annealing oxide layer plus polyethylene-encasement, (3) epoxy coating, or (4) epoxy coating plus heat shrink sleeves. Options (1) and (2) are typically used for buried pipe. Option (3) is typically used for pipe that is exposed, above grade. Option (4) is typically used in exposed locations where the presence of corrosive conditions may be present (e.g., ARV vaults).

   a. Standard Coating – Coating type and amount per the requirements of the pipe and appurtenance Manufacturer.

   b. Encasement – DIP shall be encased in the specified polyethylene material as indicated on the project plans. DIP shall be encased in 4 mil HDCL or 8 mil LLD polyethylene material in accordance with ANSI/AWWA Standard C105, using Encasement Method A (tube wrapped).

      1) Location Information – The installed locations of polyethylene encasement of the DIP shall be documented on the final as-built project plans.

   c. Epoxy Exterior Coating –

1) Shop Surface Preparation – Abrasive blast to remove loose annealing oxides, all rust and other contaminants. All surfaces shall have a minimum surface profile of 1.5 mils.

2) Field Surface Preparation – All abraded areas shall be abrasive blasted to remove all loose rust and shall result in a surface preparation equal to that listed above. All edges shall be feathered. All other surfaces shall be abraded to provide a sufficient surface profile for the proposed finish coat(s).

3) Coating – Utilize products by Sherwin Williams, SherGlass FF Epoxy for exposed piping, either above grade or within underground vaults, pits, etc. For pipe remaining exposed above ground, top coating with a urethane (Acrolon Ultra) for color and gloss retention is required. The table below does not include the standard shop applied primer coating.

Approved Coating Products			
Coat	Product	Color	Dft
1st	* SherGlass FF Epoxy **	White	10.0 – 20.0
2nd	* SherGlass FF Epoxy **	White	10.0 – 20.0
Final	* Acrolon Ultra **	Purple	2.0 – 3.0

* Lining to be applied in a single coat
** Or approved equivalent

4) Discontinuity Testing – After cure of the lining, all surfaces shall be high voltage holiday tested in accordance with NACE RPO 188 (latest edition) and the recommendations of the Manufacturer.

d. Heat Shrink Sleeves – Heat shrink sleeve shall consist of a cross-linked and pre-stretched sheet (coated with a protective heat-sensitive adhesive) which, upon heating, will shrink to its original length. The sleeve adhesive will achieve the corrosion protection by preventing moisture and air ingress to the pipe surface. Further, the adhesive shall act to hold and anchor the backing around the joint through adhesion to the substrate and the backing. Careful attention required concerning the compatibility of the sleeves with pipe coatings. AWWA C216 covers the material and application requirements of heat-shrinkable cross-linked polyolefin coatings for the exterior of special sections, connections, and fittings for steel pipelines.

C. Polyethylene Pipe (HDPE) - HDPE pipe shall meet the requirements of the table below and shall be high performance, high molecular weight, high density polyethylene pipe and shall conform to ASTM D 1248 (Type III C, Class C, Category 5). Minimum cell classification values shall be 345464C, as referenced in ASTM D 3350 - latest edition. All pipe resin shall be manufactured by the same company that manufactures the pipe itself in accordance with these specifications to ensure complete resin compatibility and total product accountability. The fittings shall be molded or manufactured from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe.

To ensure compatibility of polyethylene resins, all fittings supplied under this specification shall be of the same Manufacturer as the pipe being supplied.

HDPE PIPE STANDARDS				
Standard	Nominal Size	Dimension Ratio	OD Classification	Pressure Rating (Psi)
AWWA C901	1.5”	DR 9	CTS	200
AWWA C901	2”	DR 9	CTS	200
AWWA C901	3”	DR 11	IPS	200
AWWA C906	4”+	DR 11	DIPS	200

1. Quality Control - Refer to the following guidelines regarding quality control:

   a. The resin used to manufacture the pipe shall be produced by the pipe Manufacturer, thus maintaining complete control of the pipe quality. The pipe shall contain no recycled compound except that generated in the Manufacturer’s own plant from resin of the same specification and from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects, and shall be identical in color, density, melt index, and other physical properties.

   b. The Engineer may request, as part of the quality control records submittal, certification that the pipe produced is represented by the quality assurance testing. Additionally, test results from Manufacturer’s testing or random Manufacturer’s representation, may be cause for rejection of pipe represented by the testing. These tests may include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D 3350, 10.1.9.

      1) Verification - The Owner or the specifying Engineer may request certified lab data to verify the physical properties of the materials supplied under this specification or may take random samples and have them tested by an independent laboratory.

      2) Rejection - Polyethylene pipe and fittings may be rejected for failure to meet any of the requirements of this specification.

3.2 Color Coding –

a. Potable water pipe shall have 3 blue stripes (1/2 inch wide) with permanent ink along the entire length of pipe with the word "POTABLE" in 3/4-inch-tall letters every 21 inches along each stripe.

b. Entire pipe shall be colored with blue pigment.

3. Alternate Pipe Materials - The Owner may consider other pipe materials as appropriate for the needs of the Project. Alternate pipe materials identified during design and approved for use on the Project shall be noted on the Construction Plans.

2.4 WATER MAIN APPURTENANCES

A. Water Main Fittings -

1. General – All water main fittings shall be blue in color in accordance with FDEP and AWWA requirements, and FAC 62-555.320.

2. PVC Or Ductile Iron Pipe Fittings - Water main fittings shall include Tees, Wyes, Bends, Reducers, and other appurtenances commonly used in pipe construction. Fittings shall be ductile iron meeting AWWA Standard C110 or C153 with pressure ratings of not less than that specified for adjacent pipe. Fittings shall be constructed with mechanical joints, unless otherwise specified, and shall be supplied complete with low alloy bolts and nuts, SBR gaskets and other necessary parts required for field assembly. Fittings shall be cement-mortar lined in accordance with AWWA Standard C104/A21.4.

B. HDPE Pipe Fittings -

1. Mechanical connections of HDPE pipe (4 inch and larger) to ductile Iron or PVC piping, mechanical joint fittings, or valves shall be through a self-restraining, fusible mechanical joint adapter. Mechanical joint adapter shall be the same SDR rating as the pipe. Provide the mechanical joint adapter, including but not limited to longer tee bolts and all thread rods with nuts at the mechanical joint bell.

2. Mechanical connections of HDPE pipe sized under 4 inches to ductile iron or PVC piping, mechanical joint fittings, or valves shall be through the use of the above specified mechanical joint adapter if available. As an alternate, transition fittings of HDPE by male iron pipe threaded end installed by butt fusion may be used.

C. Pipe Couplings -

1. Pipe couplings shall be solid sleeve type with mechanical joints at each end containing a compression gasket. Couplings shall be ductile iron, 12 inches minimum in length, with low alloy bolts and nuts, and SBR gaskets. Rings and gaskets shall be sized to conform exactly to the requirements of the pipe Manufacturer.

2. For transition between asbestos cement and PVC or DI pipe types, Hymax 2000 Series, Romac Macro HP, Couplings, or approved equal, shall be used.

3. Polyethylene pipe and fittings may be joined using approved electro fusion couplings. Fittings shall be PE3408 HDPE. Electro fusion fittings shall have a pressure rating equal to the pipe.

D. Pipe Cut-In Sleeves - Cut-in sleeves shall be solid ductile iron, one end plain for insertion to female fitting, the other end flanged mechanical joint, furnished with loose attaching flange and fastener, nominal length of 20-21 inches. Specify pipe main size and type of pipe fabrication.

Approved Manufacturers – Pipe Cut-in Sleeves		
Manufacturer	**Model**	**Application**
Clow	F-1220	for centrifugally cast or sand cast pipe (special)
Clow	F-3459	for all classes of centrifugally cast pipe
Union Foundry	21-4520 21-4610 24-4800	MJ X PE FLG X PE MJ X FLG
Others as approved by Owner in writing.		

E. Repair Clamps - Repair clamps shall not be used in the installation of new pipe except with the written permission of the Engineer. Repair clamps shall be full circle and selected based on the table below.

Repair Clamp Sizes	
Pipe Diameter	
Up to 12-inch	Single Band
14-inch and above	Double Band

1. Repair clamps shall be composed of stainless-steel bands and bolts, DI lugs and full gridded virgin SBR compounded gasket.

2. Repair clamps shall be sized so that the OD of the existing pipe being repaired falls within the designated range for the clamp size. Repair clamps shall have ample length to give full gasketing at both ends.

Approved Manufacturers	
Manufacturer	Model
Ford	FS series (all SS)
Smith Blair	226, 228
Others as approved by Owner in writing.	

* See Manufacturer's catalog to complete model numbers by size.

F. Pipe and Fitting Restraints –

1. Joint restraints and thrust blocks are required for 90-degree bends, 45-degree bends, tees, tapping sleeves, dead-ends, and fire/flushing hydrants. Joint restraints shall be used in conjunction with all pipe, fittings, and appurtenances. Joint restraints shall be used on pipe and fittings in each direction.

2. Restraints shall have set or anchor screws used to secure body to pipe with torque limit break away head design.

Approved Manufacturers	
Manufacturer	Model
Smith Blair	Cam-Lock 111, 120
Sigma	One-Lok
Ebba Iron	MegaLug Series
Others as approved by Owner in writing.	

G. Expansion Joints -

1. Expansion joint fittings shall be used where specified on the Construction Plans. They shall be of the rigid or flexible type as specified, and manufactured of ductile iron in accordance with the DIP specified herein. They shall be capable of expanding or contracting to the extent specified by the Engineer, but in no case less than 4-inches axially, and designed to prevent separation beyond the maximum extension without the use of external tie rods.

2. Fittings shall be flanged or provided with restrained mechanical joints, individually pressure tested to a minimum of 350 psi against their own restraints, and internally coated on all exposed surfaces with a minimum of 15 millimeters of fusion bonded epoxy conforming to AWWA C116. They shall be capable of deflecting at least 15 degrees by means of an integral ball at each joint in the case of flexible types.

Approved Manufacturers		
Type	**Manufacturer**	**Model**
Rigid	EBAA Iron, Inc.	EX-TEND 200
Flexible	EBAA Iron, Inc.	Flex-Tend
Others as approved by Owner in writing.		

H. Tapping Sleeves -

3. The minimum size tapping sleeve shall be 4 inches. Connection of 3-inch lines to existing pipes 4 inches and larger shall be made by a 4-inch tapping sleeve with appropriate reducing fitting. Tapping saddles shall be used for smaller connections.

4. Tapping sleeves shall be designed for a working pressure of 200 psig without leakage. Tapping sleeves shall be all stainless steel including stainless steel flange. The outlet branch connection shall have a recessed flanged face for connection of tapping valve with standard dimensions in accordance with Manufacturers Standardization Society (MSS) SP-60. A complete set of neoprene or other elastomer gaskets shall be furnished. Sleeves shall be furnished to fit ductile iron, cement-asbestos, Class 160, or C900/905 PVC pipe with side connection as shown on plans or specifications in standard pipe sizes. Sleeves shall be furnished with all necessary installation parts.

Approved Manufacturers	
Manufacturer	**Model**
Ford	FAST
Mueller	H-304SS
JCM Industries	432
Romac	
Smith-Blair	663, 665
Others as approved by Owner in writing.	

Note: To specify exact fitting when ordering, confirm line outside diameter and material. Confirm compatibility of selected fitting with existing main material.

I. Pipe Hangers and Supports - Hangers and supports shall be in compliance with Federal Specification WW-H-171E, or Manufacturer's Standardization Society SP-69, or UL listed. Materials of construction shall be in accordance with the requirements outlined in the table below.

Approved Materials for Construction of Pipe Hangers and Supports	
Part I.D.	**Material**
Clamps	Steel - Epoxy Coated or Galvanized Cast Iron - Galvanized Malleable Iron
Hanger Rods	Steel - Electro Galvanized Steel - Stainless 304
Roller Bases/Roller Stands	Cast Iron
Fasteners/Fittings	Galvanized Steel Stainless
Hanger Rod Inserts	Steel - Cadmium Plated Steel - Galvanized Universal Concrete Insert - Cast Iron - Galvanized
Rod Attachments	Clevis - Forged Steel Turnbuckle: 1) Forged Steel, 2) Malleable Iron Sockets, Eye Nuts, Extension - Malleable Iron
Roller Bases/Roller Stands	Cast Iron
Rollers	Steel or Iron Core, Insulated from Structure

Approved Manufacturers – Pipe Hangers and Supports		
Manufacturer	**Part I.D.**	**Model No.**
Utility Pipe Sales	Clevis Hanger	590
	Socket Clamp	224 246
	Concrete Inserts: CB-Universal Screen Insert	 282 152
	Rod Attachments: Eye Nut Forged Clevis Forged Turnbuckle Carbon Steel Couplings Socket Eye Extension	 290 299 230 233 136 110R 157
	Pipe Rolls: Adjustable Swivel Adjustable Steel Yoke	 174 181
	Pipe Roll with Base	274
	Pipe Roll and Plate	277
Others as approved by Owner in writing.		

J. Valves - All valves shall be manufactured in accordance with the current appropriate AWWA Standard and shall be NSF approved for use in potable water.

1. Resilient Seated Gate Valves - Resilient seated gate valves shall be designed and fabricated in accordance with the current AWWA Standard C-509 or C-515. The basic design of the gate valves shall have an iron body, elastomer encapsulated iron disc, bronze stem, and operating nuts with non-rising stem design. Valves 16-inches and larger shall be equipped with right angle gears (bevel gearing) for horizontal installation. The valve working pressure for all sizes shall be a minimum of 250 psig with a test pressure of 500 psig.

1. Materials and Construction - Valves shall open counterclockwise with a 2-inch square iron operating nut secured to the valve stem by a corrosion resistant Type 304 stainless steel nut to threads on the valve stem. The valve stem shall be made of high tensile strength bronze and shall be of one-piece construction sealed by O-Rings. The thrust collar shall be secured in place by a stuffing box or bonnet cover with a thrust washer located above the thrust collar. Valve construction shall be so that upper O-Rings can be replaced with the valve in service. The disc shall be cast iron encapsulated with an elastomer material bonded in accordance with ASTM D429 and shall be secured to the threaded stem by a bronze nut. The disc shall effect a seal that is bubble-tight at-250 psig.

b. Body-Disc-Bonnet-Operating Nut Material - Cast ductile iron construction in accordance with current AWWA Standard C-509 and C-515 and AWWA Standard C-153. Body bolts shall be equipped with square or hex head bolts for easy removal.

c. Corrosion Resistant Coatings - All interior and exterior cast iron surfaces shall be coated with fusion bonded epoxy in accordance with AWWA Standard C-550.

d. Body Sizing - Valve body length shall be per ASME/ANSI B16.20 for the type of end connections specified. In the fully open position, the valve internal bore shall be smooth and obstruction-free without cavities or projections that could accumulate solids. The internal cross-sectional area of the valve shall be approximately equal to the nominal cross-sectional area of the adjoining pipe.

e. End Connections -

1) Valves shall be furnished with mechanical joint end connections, complete with accessory kits, unless otherwise specified on the plans.

2) When flanged ends are specified, they shall be flat face class 125, conforming to ASME/ANSI B16.1 with bolt holes straddling the vertical center line.

Approved Manufacturers - Resilient Seated Gate Valves						
Manufacturer & Specs			**Valve Body Connections**			
			Mechanical Joint	**Flange & Mechanical Joint**	**Flanged End**	**Mechanical Joint for Tapping**
			(MJxMJ)	**(FLGxMJ)**	**(FLGxFLG)**	**(MJxSF)**
American Flow Control		Size:	2" - 12"	2" - 12"	2" - 12"	2" - 12"
		Model No.:	AFC2500	AFC2500	AFC2500	AFC2500
Clow	C-509	Size:	2" - 12"	3" - 12"	2" - 12"	3" - 12"
		Model	F-6100	F-6106	F-6102	F-6114
	C-515	Size:	4" - 48"	4" - 48"	4" - 48"	4" - 24"
		Model	F-6100	F-6106	F-6102	F-6114
Kennedy	C-509	Size:	2" - 12"	3" - 12"	2" - 12"	4" - 12"
		Model	8571SS	8572SS	8561ASS	8950SS
	C-515	Size:	2" - 12"	3" - 12"	2" - 12"	4" - 12"
		Model	7571SS	7572SS	7561SS	7950SS
M&H	C-509	Size:	2" - 12"	3" - 12"	2" - 12"	4" - 12"
		Model	4067-01	4067-13	4067-02	4751-01
	C-515	Size:	2" - 16"	3" - 16"	2" - 16"	4" - 16"
		Model	7571	7572	7561	7950
Others as approved by Owner in writing.						

2. Resilient Seated Tapping (Gate) Valves - Resilient seated tapping gate valves shall be designed and fabricated in accordance with the specifications for resilient seated gate valves noted above.

   a. Body Sizing - Valve body length shall be per ASME/ANSI B16.20 for tapping valves. Tapping valves shall conform to Specification AWWA C509 or C515, latest revision, covering gate valves except as modified for passage and clearance of tapping machine cutters. The opening through the valve shall be at least 1/4-inch larger than nominal valve diameter. Tapping valves shall allow full size shell cutters to be used.

   b. End Connections - Valves shall be furnished with one end of the body with projecting face flange in accordance with specification MSS SP-60 for tapping valve/saddle connections to bolt to a standard tapping sleeve and the other end for mechanical joint.

3. Butterfly Valves - All butterfly valves shall be of the rubber-seated, tight-closing type. They shall meet or exceed AWWA Standard C504. All valves must use full AWWA C504 Class 150B valve shaft diameter, and full Class 150B underground service operator torque rating throughout entire travel, to provide capability for operation in emergency service.

a. Valve Construction - Valve body shall be high-strength ductile iron ASTM A126 with ASTM 276 18-8 Type 304 stainless steel body seat. Valve vane shall be high strength cast iron ASTM A126, having rubber seat mechanically secured with an integral 18-8 stainless steel clamp ring and 18-8 stainless steel self-locked screws. Shaft shall be one piece ASTM 276 Type 304 stainless steel. Bearings shall be sleeve-type, self-lubricated with O-Ring seals.

b. Operators - Operator shall be of the traveling-nut type, sealed, gasketed, and lubricated for underground service. It shall be capable of withstanding an overload input torque of 450 ft. lbs. at full-open or closed position without damage to the valve or valve operator. Operator shall have operating nut or post indicator as specified.

c. End Connection - End connections shall be mechanical joint, wafer-type with flange meeting ANSI B16.1 Class 125, and furnished as specified.

Approved Manufacturers	
Manufacturer	**Model**
Clow	F-53XX*
M & H	450, 1450, 4500
Others as approved by Owner in writing.	

* XX: See Manufacturer's catalog to complete model numbers by size.

K. Valve Vaults and Boxes –

1. Valve boxes shall be provided for all direct buried valves. Use nominal (5 ¼) inch cast-iron, screw-type pipe shaft with cover and base casting. The box top shall be set at finished grade and encased with a concrete ring in unpaved areas. Each valve box shall be furnished with a drop-in cover marked "WATER".

2. Valve Vaults or Chambers – All valves which are not designed for direct burial shall be installed in vaults, which shall be constructed from standard precast concrete manhole sections. They shall be sized to allow sufficient room for maintenance and repair in situ.

L. Line Stops - Line stops are to be used where specified to temporarily stop water flow without depressurizing the entire line. The line stop parts and installation equipment are to be rated at a minimum of 150 psig working pressure unless otherwise specified.

1. Materials and Construction - Tapping saddles shall have 360-degree clamping on the main. All tapping saddles shall be fabricated of 304 Stainless Steel. All bolts and fasteners are to be 304 Stainless Steel, and the saddle shall be installed with Buna-N or neoprene rubber full facing gasket.

a. The stopping device attaching nozzle to be vendor's standard with connecting threads or flange face, and the nozzle I.D. to be manufactured with a shelf to provide a position stop for the closure plug.

b. The closure plug is to be fabricated carbon steel, ductile iron, or malleable iron with at least one Buna-N or neoprene O-Ring seal on the outside diameter.

2. Corrosion-Resistant Coatings - Non-stainless steel permanently installed parts to have Manufacturer's standard red or black water base epoxy coating.

3. Connection - Tapping saddle shall be fabricated with dimensions to fit on concrete, steel, CA, PVC, CI, DI main as specified.

4. Installation - Temporary line stops shall only be installed by vendor personnel or Contractor Personnel trained and certified for stop by the vendor.

M. Valve Insertions -

Approved Manufacturers (Main Sizes 4-inch – 42-inch)	
Manufacturer	**Contact**
Hydra-Stop, Inc.	Phone: 800-538-7867
JCM 440	Phone: 800-527-8482
Romac	Phone: 800-426-9341
Others as approved by Owner in writing.	

N. Location Aids - All new water main and service line installations shall include an approved method for locating lines from the ground surface after completion.

1. Tracer Wire - Tracer wire for water lines shall be minimum 12-gauge copper with blue PVC insulation for open trench installation. For trenchless installation, 8-gauge copper with blue PVC insulation shall be used. Tracer wire systems shall be electrically continuous covering all mains and services within the project. Wire-to-wire connections shall be made with silicone-filled wire nuts. Wire-to-appurtenance attachments shall be made with lug-type terminals. Wire shall be secured to the top of every other pipe joint with blue nylon ties or blue colored PVC tape.

Approved Manufacturers (Tracer Wire Silicone-filled Wire Nut Connectors)	
Manufacturer	**Model**
Ideal Industries	Twister® DB Plus
King Technology, Inc.	Failsafe™
Others as approved by Owner in writing.	

2. Tracer Tape - Tracer tape shall be approximately 3" wide indicator tape with aluminum inner foil sandwiched between plastic layers printed with appropriate warning; wording to be approved by the City. Tracer tape shall be Terra-Tape, or equivalent, and shall be buried directly above all non-metallic pipes no deeper than 18" below ground.

3. Curb Markers – Curb marker base material must be 30 ml. non-yellowing UVI plastic. UV resistant inks with a minimum 7-year rating will be used to decorate the marker surface. A clear urethane dome no less than 60 ml shall be applied to the surface. The dome must not yellow or pit. It must be self-healing and have a

Durometer hardness of D-60. Marker must have a 12-year written warranty. Copy to be supplied by vendor. Marker must meet ADA minimum recommendations for slip resistance. Markers shall be as manufactured by DAS Manufacturing, Inc. or approved equal.

a. Curb Marker Adhesive - Adhesive must permanently affix markers to concrete, asphalt and cast iron. Adhesive must be ready to use requiring no special surface preparation. Adhesive must have a shelf life of at least one year. Adhesive must be black in color and remain resilient for a minimum of twelve years. Adhesive must be available in a 5 oz. Re-sealable Squeeze Tube.

b. Provide curb markers per the following table:

CURB MARKER SPECIFICS			
TYPE	**Nominal Size**	**Color**	**Designation**
Potable Water Valve	2.5”	Blue	#2.5 NVA
Potable Water Meter	2.5”	Blue	#2.5 NMT

4. Composite Utility Marker

The Composite Utility Marker shall be a single piece marker capable of simple, permanent installation by one person using a manual driving tool. Upon proper installation, it shall resist displacement from wind and vehicle impact forces. The marker shall be of a constant flat "T" cross sectional design with reinforcing support ribs incorporated longitudinally along each edge to provide sheeting protection and structural rigidity. The bottom end of the marker shall be pointed for ease of ground penetration.

The Marker shall be constructed of a durable, UV resistant, continuous glass fiber and resin reinforced, thermosetting composite material which is resistant to impact, ozone, and hydrocarbons within a service temperature range of -40°F to +140°F.

The marker shall be pigmented throughout the entire cross-section so as to produce a uniform color, which is an integral part of the material. Ultraviolet resistant materials shall be incorporated in the construction to inhibit fading or cracking of the delineator upon field exposure. Color shall coincide with utility it is marking (i.e., blue for water, green for sewer, etc.).

Composite utility markers shall be as manufactured by Carsonite International Corporation, or approved equal. All markers shall be installed with a decal as noted on the typical details.

2.5 HYDRANTS AND FLUSHING EQUIPMENT

A. Fire Hydrants - Fire Hydrants shall be in compliance with the AWWA Standard C-502, with rated working pressure of 250 psig. The basic design of the fire hydrant shall be of the dry barrel type of breakaway traffic design. Use 304 stainless steel bolting below grade, and use fusion bond epoxy coating on mechanical joint inlet shoe, per AWWA C-550.

1. Hydrant Construction -

a. The hydrant inlet connection shall be 6-inch mechanical joint type complete with Accessory kit.

b. The hydrant shall be designed with a safety feature incorporating a break-away flanged design. Split ring retainer-type breakaway design with pinch bolts is not acceptable. The hydrant design shall allow the upper barrel to be rotated 360 degrees in order to assure proper nozzle orientation.

c. The drain valve shall assure quick and complete drainage of the hydrant and the drain hole shall be brushed with bronze if passing through ductile iron. The drain valve sealing facing shall be made of Buna N, nylon, or urethane. If the valve top plate comes in contact with the bronze seat ring to facilitate draining of the hydrant, the valve top plate shall be made of bronze.

2. Main Hydrant Valve -

a. The main hydrant valve shall be compression type, opening counterclockwise against system pressure and closing clockwise with system pressure. The main valve connection opening shall not be less than 5¼-inches. The main valve shall have a resilient seat.

b. The hydrant shall be designed such that the operating threads on the stem are prevented from coming in contact with potable water and shall be enclosed in an operating chamber and sealed by O-Rings at the top and bottom of the chamber. The chamber shall be constructed for grease or oil lubrication with an installed grease fitting for maintenance.

c. The operating nut shall be 1½-inches in size and pentagon in shape and of one-piece construction.

d. The hydrant shall have one 4½-inch pumper nozzle, and two 2½-inch pumper nozzles having National Standard Hose coupling threads. The nozzles shall be field replaceable utilizing either a threaded or quarter-turn fitting with an O-Ring seal.

3. Operation and Maintenance Features -

a. The hydrant shall not incorporate parts requiring field adjustment for proper operation.

b. The hydrant shall be designed to permit the removal of all working parts from the hydrant through the barrel without disturbing the earth around the hydrant.

c. Removal of the working parts of the hydrant shall be accomplished by use of a seat removal wrench. Hydrants requiring other special tools to perform removal of interior parts will not be accepted.

4. Materials - All operating parts including operating nut, hold-down nut, drain ring and seat ring shall be bronze. The valve seat ring shall thread into a bronze insert or drain ring to provide bronze-to-bronze seating. Breakaway stem coupling is to have bronze or stainless-steel bolts or pins.

5. Markings - The fire hydrant shall have permanent markings identifying the Manufacturer by name, initials or insignia, the size of the main valve opening, and the year of manufacture.

6. Approved Manufacturers -

Approved Manufacturers	
Manufacturer	**Model No.**
American Flow Control	B62B
M & H	129T
Mueller	A423
Others as approved by Owner in writing.	

B. Fire Hydrant Appurtenances -

1. Extensions Kits

a. Where required, hydrants shall be installed using original Manufacturer hydrant extension kits as necessary to position the hydrant breakaway flange above finish grade.

b. Stand extension shall be in standard lengths of 12, 24, 36, 48, and 60 inches.

2. Hydrant Connectors

a. Hydrant connector spools shall be ductile iron per AWWA C151 used for connection between the hydrant and lead valve, and shall incorporate joint restraints. One end of the connector spool shall have swivel flange.

b. Standard hydrant connector sizes shall be as follows:

1) 6-inch X 12-inch long

2) 6-inch X 24-inch long

3) 6-inch X 36-inch long

4) 6-inch X 48-inch long

5) 6-inch X 60-inch long

c. Hydrant Offset Connectors - When a height adjustment is required to avoid an obstruction between the hydrant shut-off valve and the hydrant, an offset fitting shall be used. Material to be ductile iron per ANSI/AWWA C153/A21.53. Sizes shall be as follows:

1) 6-inch X 18-inch long with 6-inch offset

2) 6-inch X 30-inch long with 12-inch offset

3) 6-inch X 41-inch long with 24-inch offset

3. Approved Manufacturers -

Approved Manufacturers		
Manufacturer	**Straight Hydrant Connector**	**Offset Connector**
Assured Flow Sales, Inc.	N/A	GRADELOK
Clow	✓	N/A
Others as approved by Owner in writing.		

C. Flushing Hydrants - Flushing hydrants shall be in general compliance with AWWA Standard C-502, with rated working pressure of 200 psig. A fully restrained gate valve shall be installed at each flushing hydrant per the typical details.

1. Hydrant Construction - Flushing hydrants shall meet the requirements of Paragraph 2.5.A.1 above, except the breakaway feature is not required.

2. Main Valve - Generally the same as Paragraph 2.5.A.2, except main valve opening shall be not less than 2-1/8 inches and the flushing hydrant shall have one (1) 2½-inch nozzle having national standard hose coupling threads.

3. Operation and Maintenance Features - Unless otherwise specified, the hydrant bury length shall be 30-36 inches. The bury length is the distance measured to the nearest 1/2 foot, from the bottom of the connecting pipe to the ground line of the hydrant.

4. Materials -All operating parts including operating nut, hold-down nut, drain ring and seat ring shall be bronze. The valve seat ring shall thread into a bronze insert or drain ring to provide bronze-to-bronze seating.

5. Markings - Flushing hydrant markings shall meet the requirements of Paragraph 2.5.A.2.5 above for fire hydrants.

6. Approved Manufacturers -

Approved Manufacturers	
Manufacturer	**Model**
M & H	Style 33
Mueller	A-411
Others as approved by Owner in writing.	

2.6 WATER SERVICE LINES

A. General – No galvanized pipe or fittings will be allowed. All fittings shall meet or exceed the requirements of NSF/ANSI Standard 61.

B. Polyethylene Tubing (HDPE) - Polyethylene service tubing shall meet the designations of the table below. However, only sizes up to 2 inches will be allowed. Services above 2 inches shall be PVC (refer to paragraph 2.3.C for service lines greater than 2 inches in diameter). All tubing must have a minimum cell classification of 445574 with code letter for blue colored tubing. PE tubing dimensions shall conform to ASTM D2737 with Copper Tubing OD base.

HDPE TUBING STANDARDS				
Standard	Nominal Size	Dimension Ratio	OD Classification	Pressure Rating (Psi)
AWWA C901	3/4" – 2"	DR 9	DIPS/CTS	200

1. Markings -

a. Nominal Size

b. Standard PE Code: 4710

c. Tubing Dimension Ratio

d. Pressure Class: PC200

e. Manufacturer's Name or Trademark

f. Tubing Shall Be Blue

g. Date Manufactured

2. Approved Manufacturers -

Approved Manufacturers	
Manufacturer	**Model**
Endot Industries	Endopoly, Endopure
Chevron – Phillips Performance Pipe	Driscoplex 5100 Series Ultra-Line
Others as approved by Owner in writing.	

C. Pipe Sleeves for Long Water Services - Long water services shall be sleeved in PVC or PE pipe color coded blue or black with blue stripes. The sleeves shall be a minimum of 2-inch diameter with no fittings and shall extend a minimum of five-feet either side of the paved surface. The sleeve shall be one continuous leak free piece which is open on each end. The long service shall be sized according to the table shown below.

Pipe Sleeve Sizing for Long Water Services	
Service Size (inches)	**Sleeve Size (inches)**
1	2
2	4

2.7 SERVICE LINE APPURTENANCES

A. Fittings and Valves - Fittings and valves shall be manufactured in accordance with AWWA C-800 and be listed and approved by NSF for underground use in potable water service.

1. Material -

   a. Fitting and valve bodies, plugs, and compression nuts shall be bronze, copper alloy no. C83600 and meet chemical and mechanical requirements of ASTM B62 or ASTM B584.
   b. Component parts such as fasteners, seals, and packing may be of other materials selected for adequate endurance, corrosion resistance and strength in accordance with AWWA C-800.

2. Pressure - Fittings and valves shall be high pressure type for maximum allowable pressure of 150 PSIG, nominal operating pressure 100 psig.

3. Markings - Fittings and valves shall be marked as appropriate with the following information: Manufacturer’s name or logo; pressure rating; direction of flow; and size.

4. Thread Specifications - Refer to the following table regarding thread specifications:

Thread Specifications	
Thread Type	**Standard**
Unified Inch	ANSI/ASME B1.1
General Purpose Pipe	ANSI/ASME B1.20.1
Dryseal	ANSI/ASME B1.20.3

5. Pack Joint Couplings - Refer to the following table regarding pack joint couplings:

Pack Joint Couplings		
Type	**Manufacturer**	**Model**
Joint Couplings		
Copper or Plastic Tube X MPT	Ford Mueller	C84-XX H-15428-X
Copper or Plastic Tube X FPT	Ford Mueller	C14-XX H-15451-X
Copper or Plastic Tube to Tube	Ford Mueller	C44-XX H-15403-X
Female Copper Pipe (replaces flare nut) X Copper or Plastic Tubing	Ford Mueller	CO4-XX H-15071-X
Others as approved by Owner in writing.		

* XX: See Manufacturer's catalog to complete model numbers by size.

6. Tapping Saddles - Tapping saddles shall be either bronze or ductile iron with shop coat, with the exception of saddles for PE pipe. Saddles used to tap Class 160 PVC pipe shall be designed with mechanical features or stops to prevent over-tightening.

   a. Saddle Sizes -

      1) Main Pipe: 2-inch and above

      2) Tap Size: 1-inch, or 2-inch

   b. Refer to the following table regarding saddle sizes.

Acceptable Manufacturers		
Manufacturer	**Application**	**Model**
Ford	1-inch tap on PVC/steel OD pipe	S-70 and S-90
	1-inch tap on DI and CI Pipe	F-202
Mueller		H-105 DR2A
Smith Blair		313
JCM	C900 / C905 or DI	402
Romac	C900 / C905 or DI	202U
Others as approved by Owner in writing.		

7. Water Tubing Couplings - Water tubing couplings in sizes 1-inch, 1 ½-inch, and 2-inch only shall be bronze compression-type, inlet and outlet for PE or copper tubing. Crimp-type couplings are not acceptable. Refer to table below for acceptable manufacturers.

Acceptable Manufacturers	
Manufacturer	**Model**
Ford	C44-XX*
Mueller	H-15403-XX*

* XX: See Manufacturer's catalog to complete model numbers by size.

8. Meter Couplings - Meter couplings shall be bronze and sized as appropriate to accommodate the relevant meter. Inlet shall have male pipe thread. Refer to table below for acceptable manufacturers.

Acceptable Manufacturers	
Manufacturer	**Model**
Ford	C84-XX*
Mueller	H-15428-XX*

* XX: See Manufacturer's catalog to complete model numbers by size.

B. Service Line Valves

1. Corporation Stops - Corporation stops shall be brass, high-pressure class, ball type, with inlet taper CC thread. Outlet shall be compression-type for PE or copper tubing. Corporation stops shall be sized for 1-inch, or 2-inch tubing as appropriate. Refer to table below for acceptable manufacturers.

Acceptable Manufacturers	
Manufacturer	**Model**
Ford	F-1000 and FB-1000
Others as approved by Owner in writing.	

2. Curb Stops - Curb stops shall be brass, high pressure, ball-type with locking wings. Inlet shall be compression-type for PE tubing. Outlet shall be female iron pipe threads. Curb stops shall be sized for 1-inch tubing as appropriate. 2-inch valves shall be as specified in Section 2.4 J. Refer to table below for acceptable manufacturers.

Acceptable Manufacturers		
Manufacturer	**Size**	**Model**
Ford	1-inch	B43-342W-G-NL
Others as approved by Owner in writing.		

2.8 BACKFLOW PREVENTION ASSEMBLIES

Backflow prevention assemblies shall be manufactured in accordance with AWWA C-510 and AWWA C-511, and shall also be approved by ASSE and/or approved by NSF for use in potable water systems with a maximum continuous operating pressure of 150 psig, and capable of sustaining a hydrostatic test pressure of 300 psig. Backflow prevention devices shall be located immediately downstream of the Owner's control valve.

A. Materials and Construction - The body shall be cast iron with hot dip galvanized coating or fusion bonded epoxy on the interior and exterior, or cast bronze with a maximum lead content of 5 percent. Working parts and springs shall be bronze or stainless steel; valve discs shall be silicone rubber; diaphragms shall be fabric reinforced neoprene, and O-rings shall be Buna-N, neoprene, or silicone rubber. Check valve enclosures shall be glass-filled nylon or Teflon, or bronze or stainless steel. Other working parts shall be bronze or stainless steel.

B. Double-Check Valve - A double check valve assembly (DC) is a mechanical backflow preventer that consists of two independently acting, spring-loaded check valves. It includes shutoff valves at each end of the assembly and is equipped with test cocks. A DC is effective against backpressure backflow and back-siphonage but should be used to isolate only non-health hazards.

C. Reduced Pressure Assembly - A reduced pressure valve assembly (RP) is a mechanical backflow preventer that consists of two independently acting, spring-loaded check valves with a hydraulically operating, mechanically independent, spring-load pressure differential relief valve between the check valves and below the first check valve.

D. Pressure Vacuum Breaker - The pressure vacuum-breaker assembly (PVB) is a mechanical backflow preventer that consists of an independently acting, spring-loaded check valve and an independently acting, spring loaded, air inlet valve on the discharge side of the check valve. It includes shutoff valves at each end of the assembly and is equipped with test cocks. A PVB may be used to isolate health or non-health hazards but is effective against back-siphonage only and can only be used in an irrigation setting.

E. Appurtenances - All backflow assemblies shall be provided and installed as a complete assembly with all necessary fittings to enable testing in place. Tapped test ports shall be fitted with test petcocks in each body cavity. Inlet and outlet gate or ball valve shall be of the same line size as that of the body.

F. Approved Assemblies - The word "approved" when used with reference to a backflow prevention assembly, is an assembly which has been manufactured in full conformance with the standards established by the American Water Works Association titled: *AWWA C510-89 Standard for Double Check Valve Backflow Prevention Assembly*, or *AWWA C511-89 Standard for Reduced-Pressure Principle Backflow Prevention Assembly*, as such standards may be amended from time to time, and which comply with the laboratory and field performance specifications of the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California established by "Specification of Backflow-Prevention Assemblies: - Section 10 of the most current issue of the Manual of Cross-Connection Control.

2.9 METER BOX

Meter boxes shall be supplied to the Owner for installation. Provided meter boxes shall be Pentek with solid lids.

PART 3 – EXECUTION

3.1 GENERAL

The Contractor shall provide all labor, equipment and materials as required to install all pipes, valves, fittings, and other appurtenances as indicated on the construction plans or as specified in the Contract documents.

3.2 POTABLE WATER LINE SEPARATION FROM SANITARY SEWER LINES

A. New or relocated water lines must be laid to provide a horizontal separation of at least three feet between the outside of the potable water main and the outside of a reclaimed water main. In locations where it is not feasible to comply with this requirement the Contractor shall refer to the conflict details on the construction plans.

3.3 PIPE INSTALLATION

The Contractor shall utilize equipment and methods in accordance with pipe Manufacturer's requirements and standard construction practices to ensure pipe installation to line and grade as indicated.

A. Trench Excavation - Contractor shall maintain a minimum of 30 inches and maximum of 36 inches of cover below finished grade unless otherwise approved by the Owner or its representative in writing.

B. Alignment - Pipe shall be installed along the alignment indicated by the construction plans. Accomplish horizontal and vertical changes in alignment of pipe with bends or other appropriate fittings. Joint deflection shall not exceed the recommendations of the pipe Manufacturer.

C. Pipe Preparation -The Contractor shall clean the interior of all pipes, fittings, and joints prior to installation. Pipes shall be inspected for defects prior to installation. Damaged pipe shall be rejected and removed from the project.

D. Pipe Installation -

1. Install pipe only when weather and trench conditions are suitable. Do not lay pipe in water. Join pipe in accordance with Manufacturer's recommendations.

2. Provide initial backfill or anchoring as necessary to prevent displacement and preserve alignment after establishing final position.

3. Encase water pipe in steel casing or use ductile iron pipe when crossing under pipe, conduit, or structure when a 6-inch separation distance cannot be maintained. This protection shall extend a minimum of 5 feet beyond crossed structure.

E. Crossings - Where the crossing of a roadway, water body, rail, or other obstacle requires trenchless installation, the materials and installation methods shall conform to Section 02300-“Horizontal Directional Drilling” or Section 02310-“Jack and Bore”, as applicable.

F. Protection - Prevent the introduction of foreign matter into the pipe at all times. Close open ends of pipe with watertight fitting closures or plugs. Do not let water fill trench, but include provisions to prevent flotation should water control measures prove inadequate. Remove water, sand, mud, and other undesirable materials from trench before removal of pipe closure piece.

G. Cutting - PVC or PE pipe shall be cut in a neat workmanlike manner, and the spigot end shall be beveled per Manufacturer's recommendation. Ductile iron pipe shall be cut in accordance with Manufacturer’s recommendation. Do not allow excessive heat to develop. Smooth and bevel cut end as per Manufacturer’s recommendations. Use of pipe with damaged lining is unacceptable.

H. Closure Pieces - Closure pieces shall only be used where called for on plans. Closure may be accomplished with sleeve coupling as long as its length is such that gaskets are not less than 3 inches from pipe ends.

I. Restraints and Thrust Blocking - Mechanical joint restraints shall be furnished and installed for all water line fittings and appurtenances. Restraints and thrust blocks are required-for 11.25-, 22.5-, 45- and 90-degree bends, tapping sleeves, tees, dead-ends, behind fire hydrants, and flushing hydrants.

3.4 APPURTENANCE INSTALLATION

A. Valves - Valves shall be installed with operating stems vertical for valves 16 inch and smaller. For valves larger than 16 inches, the valve may be installed horizontally. Horizontal valves shall be provided with a right-angle gear drive and flush port piping to the lower clean-out. Extensions shall be provided if the valve operating nut is greater than 24 inches below finish grade. Valves shall be installed on a suitable bearing surface as shown on the project plan details, to prevent vertical displacement.

1. Air release valves shall be located and installed at the down-stream end of all high points as shown in the details and on the approved construction plans.

2. Check valves, complete with vaults if applicable, shall be installed at locations shown in the approved construction plans in accordance with the Manufacturer’s instructions.

B. Valve Boxes - Valve boxes shall be centered on the valve. The earth shall be compacted around each valve box to a distance of 4 feet on all sides of box, or to undisturbed trench face if less than 4 feet. An 18-inch diameter by 4-inch-thick collar shall be constructed and sloped to direct water away from the valve box. In lieu of the constructed collar, a 24-inch by 4-inch-thick pre-cast, sloped, concrete collar may be used.

C. Tracer Wire - Tracer wire shall be installed on all new water mains and on all new water service lines. The tracer wire shall be placed directly above the pipe and electrically continuous throughout the project. Tracer wire shall be secured to the pipe with PVC tape the same color as the wire insulation, at a maximum of 10-feet on center between tapings. The tracer wire shall be brought to the ground surface at each valve location in accordance with the details. Splices and/or connections in the tracer wire shall be installed with silicone-filled wire nuts designed for direct burial.

3.5 SERVICE LINE INSTALLATION

A. General - The Contractor shall install individual services with tracer wire from the new main to a convenient point on the right-of-way or property line for each house, building or unit that is currently served through a meter. New services for undeveloped lots shall be located 1 foot from the common property line.

1. This section will deal with service line tubing 1-inch and 2-inches in diameter, to serve 5/8-inch, 1-inch, 1 ½-inch, and 2-inch meters. The installation of service lines for 3-inch meters and larger shall be in accordance with the requirements for water main installation, (See Section 3.3 above).

B. Service Line Connections - Service lines shall be installed in accordance with the details. Tubing shall be installed in one continuous length from corporation stop to curb stop with no intermediate fittings. Service lines damaged after initial installation but before acceptance may be repaired by means of a single splice, except that no repair fittings will be permitted under any paving. The tap location shall be at least 10 feet from any sanitary sewer joint with less than 18 inches vertical clearance. Service taps shall be made with a tapping machine designed for the pipe material being tapped. Other types of tapping machines may be used upon prior approval by the Owner or its representative.

C. Long Service Lines - Unless otherwise noted on plans, HDPE pipe and tubing shall be installed at the shallowest depth that can safely and reasonably be achieved (but no less than 36 inches minimum). Depth shall consider all utility conflicts, bend radius of the pipe, and bend radius of the drill stem. Where utilities cross under DOT, county and/or city roads, depth of cover shall comply with applicable permits and shall be adequate to provide reasonable measures to avoid damage to the road surface and/or road base.

3.6 TAPS ON PRESSURIZED LINES

Taps for service lines of 2-inch and smaller PE tubing shall be made using a tapping saddle. The Contractor shall perform taps on pressurized lines for the installation of pipes other than service lines of 2-inch and smaller PE tubing in accordance with these requirements:

A. Materials - All materials used for taps on pressurized lines shall meet the requirements of these specifications. Tapping sleeves shall be properly sized for the pipe being tapped. Resilient seated tapping valves shall be furnished with special end connections. All other material used to accomplish the tap shall meet the standards set forth by the AWWA for potable water construction.

B. Procedure - The Contractor shall notify the Owner or its representative three working days in advance of work. The Contractor shall in the presence of the Owner or its representative:

1. Expose the existing pipe at the location shown on the plans, and clean the section of the pipe to receive the tapping sleeve.

2. Check the tapping sleeve and valve for defects and make sure the gate fully retracts in the valve to allow the shell cutter free passage.

3. Assemble the tapping sleeve on the pipe, then install the tapping valve.

4. Hydrostatically pressure test the tapping sleeve and valve after it has been assembled on the water main using the test plug on the sleeve. The test shall be 150 psi minimum. The duration of the test shall be 2 hours.

5. Pour a thrust block behind the tapping sleeve sufficient to withstand the pressure of the new line. Also, provide a concrete pad or suitable bearing surface sufficient to support the weight of the sleeve, valve, and tapping machine. Concrete shall be in place a minimum of 24 hours prior to testing the main installation.

6. Assemble an approved tapping machine and proceed to make the necessary cut in accordance with the recommendation of the tapping machine Manufacturer. Approved tapping machines shall be:

   a. In good working condition.

   b. Designed for and have a cutting bit for the pipe material to be cut.

   c. Equipped with a depth of cut gauge.

   d. Designed to capture the coupon.

   e. Equipped with the Manufacturer’s recommended diameter shell cutter for the tap to be made.

   f. Tapping machine power head to be hydraulic or pneumatic drive; use of electric motor drives expressly prohibited.

   g. Tapping machine shall be disinfected prior to each use for potable water taps.

7. The following tapping chart may be used for field reference only:

Tap Size Reference Chart		
Nominal Main Size	**Tapping Valve ID AWWA Standard**	**Tapping Machine Shell Cutter OD**
2-inch	2 1/8-inch	1½ -inch
3-inch	3 1/8-inch	2½-inch
4-inch	4 1/4-inch	3½ -inch
6-inch	6 1/4-inch	5½ -inch
8-inch	8 1/4-inch	7½ -inch
10-inch	10 1/4-inch	9½ -inch
12-inch	12 1/4-inch	11½ -inch
14-inch	14 1/4-inch	Per Manufacturer's Recommendation.
16-inch	16 1/4-inch	Contractor shall submit shop drawings for valves and tapping machine for approval, prior to use. Per Manufacturer's Recommendation.
18-inch	18 1/4-inch	
20-inch	20 1/4-inch	
24-inch	24 1/4-inch	

8. Tap coupon shall be given to the Owner or its representative. If the coupon is lost in the main, Contractor shall, at his expense, dismantle main to retrieve the coupon. Main will be reassembled, pressure tested, and bacteriological tests retaken as required at Contractor's expense.

PART 4 - ACCEPTANCE REQUIREMENTS

4.1 INSPECTION

Upon completion of the installation, the system shall be inspected to ascertain that valves, fittings, fire hydrants, flush hydrants, etc. are located in conformance with the plans, and confirm that all 'as-built' measurements have been accurately taken. The Owner or its representative shall observe all appropriate activities related to properly placing the line in service including flushing, pressure and leakage testing, disinfection, and bacteriological sampling. Final connections and testing of fire hydrants shall be accomplished after final clearance of lines. Tracer wire shall be tested for continuity by the Contractor with the Owner or its representative present. The Contractor, with the Owner or its representative, shall make sure all main valves and hydrant valves are open.

4.2 NEW WATER MAIN CLEANING

All newly installed reclaimed water lines shall be flushed with potable water to remove any sediment, solids and/or foreign matter prior to testing. The Owner will make water available to the Contractor. Flushing shall be conducted at a sufficient velocity to clear the pipe. Discharge of flushing water must be through a 2-inch diameter pipe (or larger) and must be controlled so as not to cause any property damage. Chlorinated water must be disposed of in an acceptable manner. Flush water source connection shall incorporate backflow preventer and meter when required by the Owner or its representative.

A. If flushing is unsuccessful in satisfactorily removing debris from the line or for larger diameter lines (12" or larger) if designated on the plans, cleaning shall be performed by swabbing (pigging). Pipes shall be flushed and swabbed a minimum of 3 passes until line is clear. To facilitate this process, pigging launch stations and receiving pits shall be installed and incorporated into system as shown on the plans.

4.3 PRESSURE/LEAKAGE TEST

A. General - All newly installed water lines and appurtenances shall be pressure/leak tested to assure the strength of materials and quality of workmanship of the installation. Testing shall be conducted in accordance with the details and the requirements of AWWA Manual 23 for PVC and other flexible pipe or AWWA C600 for Ductile Iron Pipe. Leakage testing may be conducted concurrently with the pressure test.

B. Procedure -

1. Contractor shall notify the Owner or its representative three working days prior to a scheduled test. Tests are to be conducted in segments not to exceed three thousand (3,000) feet of pipe. Water in the new line shall be pumped up to a pressure of 150 psi minimum. This pressure shall be maintained for a minimum of two (2) hours by pumping a quantifiable amount of water into the line and record the amount of water added during the test period. This represents the leakage.

2. Pressure/leakage tests shall be deemed acceptable when leakage does not exceed that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133200} \text{ (or 11.65 gpd/mi/inch/dia)}$$

or $$L = \frac{ND\sqrt{P}}{7400} \text{ for DI pipe 18' lengths}$$

or $$L = \frac{ND\sqrt{P}}{6600} \text{ for PVC pipe 20' lengths}$$

where:

L = Maximum leakage, in gallons per hour.
S = Length of pipe under test, in feet.
N = Number of pipe joints in segment under test.
D = Nominal internal diameter of pipe, in inches.
P = Average actual leakage test pressure, psig.

3. Record all data for submission with as-built plans.

4. The Owner or its representative shall be present during test.

5. Refit and replace all pipe not meeting the leakage requirements. Repair clamps are not permitted.

6. Repair all visible leaks regardless of the amount of leakage.

7. When a satisfactory pressure/leakage test has been completed, reduce the pressure at or below normal line pressure, and continue on with line disinfection.

4.4 DISINFECTION

A. General - The Contractor shall provide all equipment, materials and testing apparatus required to perform disinfection in accordance with AWWA C651 and the typical details.

B. Procedure -

1. Prior to beginning disinfection, the Contractor shall submit information to the Engineer for approval of proposed materials and methods. The Owner or its representative will approve the number and location of all sampling points. Temporary sampling taps may be required consisting of a corporation cock with HDPE tubing.

2. Method of disinfection shall be the continuous feed method as described in AWWA-C651. Add chlorine to attain an initial concentration of 25 mg/l chlorine with 10 mg/l remaining after 24 hours.

3. Initial concentration is to be obtained by mixing proper amount of HTH granules (65 percent Cl) into auxiliary tank, then pump/meter into regulated flow into or through the pipe section.

4. Check the chlorine concentration at all sampling points after the line has been filled and air expelled. Check residual chlorine concentration at the end of 24 hours to confirm that 10 ppm (minimum) is present.

5. Alternate methods of disinfection such as “tablet” and “slug” methods as described in AWWA C651 will not be allowed.

C. Water Supply for Cleaning, Flushing, and Disinfection - The Owner shall supply water for testing from the nearest available source. Flush main until chlorine concentration is 2 mg/l or less prior to taking bacteriological samples. Water source connection shall incorporate a backflow preventer.

1. Check concentration at all sample point locations.

2. Disposal of chlorinated water shall be the Contractor’s responsibility and shall be done without damage to public or private property. Chlorinated water disposal shall meet all State, Federal and local regulations.

D. Collection of Samples - Two (2) satisfactory bacterial sample sets taken 24 hours apart must meet State requirements before placing the main into service.

E. Repeat Testing - Repeat flushing and disinfection procedure should initial disinfection fail to yield acceptable bacteriological results at no additional cost to the Owner.

4.5 OTHER CONNECTIONS

After new system piping has been satisfactorily tested and cleared for use, make any approved additional connections to the pre-existing distribution system. Exercise care in making connection and disinfect as needed. When total system is approved for use, the Owner or its representative shall verify that the Contractor has opened all interior valves as required. Valves connecting new installations to Owner's existing distribution system shall then be opened by the Owner or its representative.

4.6 TESTING FIRE HYDRANTS

All newly installed fire hydrants shall be flow tested by the Owner or its representative prior to final acceptance in accordance with established procedures. (Refer to AWWA-M17 and AWWA C502). Static Leak Test of hydrant shall be done in conjunction with Section 4.3 with hydrant valve open. Hydrant flow tests not meeting the minimum requirements of Bid Documents or the Owner's Design Standards shall be immediately reported to the Engineer-of-Record. The system shall not be placed into service until the system meets the minimum requirements.

END OF SECTION 025560

SECTION 025700 - GRAVITY SANITARY SEWERS

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. Earthwork Section 022000.

C. Trench Excavation, Backfill, and Compaction: Section 022210.

D. Base Replacement and Resurfacing for Trenches: Section 025140.

E. Wastewater Forcemain: Section 025760.

1.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Store materials to prevent physical damage.

B. Protect materials during transportation and installation to avoid physical damage.

1.3 GENERAL DESCRIPTION OF WORK COVERED

Furnish and install all sewer pipe, fittings and structures, and accessories required for sanitary sewer construction as indicated.

1.4 QUALITY ASSURANCE

Comply with latest published editions of American Society of Testing and Materials (ASTM) Standards:

A. ASTM C478 - Concrete Pipe Manholes.

B. ASTM D1784 - Rigid Poly (vinyl chloride) (PVC) Compounds and Chlorinated Poly (vinyl chloride (CPVC) Compounds.

C. ASTM D2321 - Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

D. ASTM D2564 - Solvent Cements for Poly Plastic Pipe and Fittings.

E. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals.

F. ASTM D3034 Type PSM - PVC Sewer Pipe and Fittings.

PART 2 - MATERIALS AND EQUIPMENT

2.1 GENERAL REQUIREMENTS

A. Pipe furnished shall be PVC for sanitary sewer construction unless shown otherwise on plans or bid forms.

B. All pipe shall be marked in accordance with applicable standard specification under which pipe is manufactured unless otherwise specified.

C. All material shall be free from defects impairing strength and durability and be of the best commercial quality for the purpose specified. It shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

D. All pipework will be inspected upon delivery and such as does not conform to the requirements of these specifications shall be rejected and must be immediately removed from the site by the Contractor. The Contractor shall furnish and provide all labor necessary to assist the Engineer in inspecting the material. The basis of rejection shall be as specified in applicable ASTM Specifications.

2.2 DELIVERY, STORAGE AND HANDLING

Certificates of Compliance with the Specifications shall be required for all materials used on the Project. All materials shall be protected during transportation, storage, handling, and installation to avoid physical deterioration due to sun and weather. The Owner reserves the right to reject material which in any way does not meet the requirements of these Specifications.

2.3 SEWER MAINS

A Polyvinyl Chloride Plastic Pipe (PVC)

1. Comply with ASTM D3034 for pipe using material conforming to ASTM D1784 for pipe and fittings. Pipe lengths shall not exceed 20 feet and provisions shall be made at each joint to accommodate expansion and contraction.

2. Minimum wall thickness shall be:

TABLE 2.3.1 – PVC PIPE MINIMUM WALL THICKNESSES						
Diameter	4"	6"	8"	10"	12"	15"
Wall Thickness	.125"	.180"	.240"	.300"	.360"	.437"

3. Use single elastomeric gasket push-on joints complying with ASTM D3212.

4. Provide pipe and fittings with minimum SDR-35-dimension ratio and a minimum "pipe stiffness" (F/Δ Y) = 46 psi at 5% deflection when tested in accordance with ASTM D2412, external loading properties of plastic pipe by paneled plate loads.

5. SDR 35 shall be used for service laterals.

6. Pipe shall be color coded by one of the following methods:

   a. Use pipe pigment to color code pipe green.
   b. 3 green stripes (½ inch high) with permanent ink along the entire length, evenly spaced around the pipe, with the word "Sewer" in ¾-inch letters every 21 inches along each stripe.

7. Each length of pipe shall be clearly marked with the following information at intervals of five feet or less:

   a. Manufacturer's name or trademark
   b. Nominal pipe size
   c. ASTM specification
   d. National Sanitation approval

B. Ductile iron pipe shall meet the requirements of ANSI A21.51, including Addenda A21.51a. Pipe dimensions shall conform to Federal Specification WW-P-421, Class 150. Each pipe shall be conspicuously marked on the outside of the barrel to readily identify it from Cast-Iron. Metal thickness shall conform to ANSI A21.51, Table 51.1, 2-1/2 to 5 feet cover.

1. Mechanical Joints: ANSI Standard Specification A21.11, Rubber Gasket Joints for Cast-Iron Pressure Pipe and Fittings.

2. Push-on Joints: ANSI Standard Specification A21.11, Rubber Gasket Joints for Cast-Iron Pressure Pipe and Fittings, Single gasket push on type.

3. Flanged Joints: ANSI Standard Specifications B16.1, Cast Iron Pipe Flanges and Flanged Fittings, 125 pounds. Screwed on flanges, faced, and drilled ANSI Class 125-pound template. The flanged joints shall be assembled by threading plain end pipe and screwing on long hub flanges. The connection shall then be power tightened and refaced across both face of flange and end of pipe. Provide one-sixteenth-inch ring gaskets of red sheet rubber meeting the requirements of Grade I, Table I of ASTM Specification D1330-66, Sheet Rubber Gaskets. Connections shall be made with machine bolts and hexagonal nuts.

4. Fittings: All fittings for ductile iron pipe shall be ductile iron mechanical joint meeting the requirements of ANSI/AWWA C153/A21.53-84 ductile iron compact fittings 3 inch through 12 inch for water and other liquids.

5. Coatings for Ductile Iron Pipe: All ductile iron pipe and fittings to be installed underground shall follow the requirements set forth in the Wastewater Forcemain specification section 02576.

6. Pipe shall be as manufactured by American Cast Iron Pipe Company, McWane Pipe Company, US Pipe Company, or equal.

7. Submittals: The Contractor shall submit catalog data for approval by the Engineer for materials to be used. This submittal shall include but not be limited to the following:

   a. Pipe
   b. Fittings
   c. Interior Coating
   d. Exterior Coating

TABLE 2.3.2 - DI PRESSURE CLASSES		
Diameter	Class	Max. Depth of Bury
3-inch & 4-inch	350	32 feet
6-inch & 8-inch	350	28 feet
10-inch & 12-inch	350	14 feet
14-inch thru 20-inch	250	10 feet
24-inch thru 64-inch	200	8 feet

8. Markings

   Each ductile iron pipe section shall be marked to indicate the weight class or nominal thickness, and casting period. The manufacturer's mark, country where cast, year in which the pipe was produced, and the letters DI or DUCTILE shall be cast or stamped on the pipe. All required markings shall be clear and legible, and all cast marks shall be on or near the bell. All letters and numerals on pipe sizes 14-inch and larger shall be not less than 0.5-inch in height.

9. Encasement

   When required, DIP shall be encased in polyethylene material in accordance with AWWA Standard C105.

2.4 STRUCTURES AND PIPE ACCESSORIES

A. Fittings

1. Fittings shall be allowed only on service laterals and drop manholes.
2. Fittings shall equal or exceed quality and strength of pipe.
3. Wyes shall be long bell type.

2.5 MANHOLES & SECTIONS

A. General:

1. Construction shall be capable of sustaining an H-20 loading.

2. Leakage shall not exceed 1 gallon per day per vertical foot of manhole.

3. Manholes shall have a minimum I.D. of 48 inches, unless otherwise noted on plans.

4. The joints between the sections shall be tongue and groove with the tongue up and the groove down and shall be sealed with round or other flexible type natural rubber joint rings. In addition to the rubber ring gaskets, the interior and exterior voids in the pipe joints shall be sealed with "RAM NEK" flexible plastic gasket manufactured by K. T. Snyder Company or approved equal. "RAM NEK" shall be installed in strict accordance with the manufacturer's recommendations.

5. In every instance where pipe enters or leaves a manhole, a fitting shall be provided which will accommodate expansion and contraction of the pipe; release strain on the pipe caused by differential settlement between pipe and manhole; and provide a rubber ring water seal between pipe and manhole. Rubber ring water seals provided shall be Kore-N-Seal or approved equal. The invert of the lowest pipe shall be a minimum of 4" above the inside floor of the base section.

B. Standard Concrete:

1. Manholes shall be pre-cast constructed in accordance with ASTM C-478, using Type II or approved equivalent with a 28-day strength of 4000 lbs. per square inch.

2. Base section shall be monolithic to a point 6" above the crown of the incoming pipe with a minimum 6” thick bottom section and 5" wall section and made in accordance with ASTM C-478.

3. Cone (top) sections shall be eccentric narrowing from 48" to 24" I.D., unless otherwise noted on plans.

4. Flat top sections shall be used in place of cone sections for manholes less than 5 feet deep. The access hole shall be offset to allow easy access to steps (if used) and shall be reinforced to support an H-20 loading.

5. Manhole Admixture: XYPEX ADMIX C-1,000R (available from SteelCon Coating Systems at 205-951-2086) shall be added to the concrete during batching operation to provide chemical resistance and water proofing. The XYPEX ADMIX C-1000R shall be added at 3.5%, including dye, of the weight of Portland Cement. The amount of cement shall remain the same and not be reduced. A colorant shall be added at the XYPEX Manufacturing Plant.

C. Glass-Fiber Reinforced Polyester (FRP) Manholes: See Specification Section 02571.

D. Polymer Concrete Manholes: See Specification Section 02572.

2.6 MANHOLE ACCESSORIES

A. Manhole Lid and Cover:

1. Gray cast iron, with nominal opening of 24 inches.

2. Cover shall be embossed with "Sanitary Sewer" and the year of order as shown on detail drawings.

3. The lifting holes shall not extend through cover.

4. The manhole frames and covers shall be U.S. Foundry No. 170E, Neenah Foundry No. R - 1600 series, Vulcan Foundry Series 1300 or equivalent and shall weigh at least 285 pounds.

5. Frames and covers shall be machined or ground at bearing surfaces to seat firmly and prevent rocking. Any set not matching perfectly shall be removed and replaced at no additional cost.

B. Manhole Riser Rings: Adjustment rings shall be Ladtech HDPE Riser Rings, or approved equal, manufactured from polyethylene as identified in ASTM D-1248, and shall be tested and qualified for usage under this standard. Recycled material meeting this requirement may be used.

1. All HDPE rings shall be manufactured utilizing the injection molding process as defined by the Society of Plastic Engineers, and shall be tested to assure compliance with impact and loading requirements of ASSHTO's Standards for Highway and Bridges. Structural Test Design of 25,250 lb. load fully centered with factor of safety. All tests to be conducted free board - with no support to rings. The load test shall be: 1,000,000-cycle load test – simulated AASHTO HS-25-wheel load Ring combinations to support HS-25 load factor from height of ¾-in. with no fatigue cracking or significant permanent deformation at 6-inch, 10-inch, and 16-inch. Cycle to heat and cold elements: Hot-mix asphaltic (287-deg.F) exposure and 5-deg. F exposure using standard 2-inch rings: Adjusting rings not to show any cracking to heat and no brittle fracture to cold.

EXPANSION-CONTRACTION TEST:		**-40 DEG F to 140 DEG F**	
	72-deg F	**-40-deg F**	**140-deg F**
Cast Iron Frame	Normal	-0.0060-in	0.0050-in
HDPE Ring	Normal	-0.1700-in	0.1350-in
Concrete Cone	Normal	-0.0065-in	0.0054-in

2. All rings must comply with ASTM D-1238 (Melt Flow Index), ASTM D-792 (Density), ASTM D-638 (Tensile Strength) standards and property values, and be certified by the manufacturer.

3. All dimensions of rings must be constant and uniform to insure watertight fit during installation. The HDPE riser rings shall be installed in accordance with manufacturers recommendation. Only butyl rubber adhesive rope will be allowed as the sealant between rings as recommended ASTM C-990. Any defected rings shall not be used and sent back to the manufacturer or recycling. All rings shall adhere to the aforementioned requirements of these standards.

C. Manhole Joint Seals

1. All new jointed manholes (precast concrete and polymer concrete) shall be completely sealed with a water infiltration barrier at all the joints and risers by the use of heat shrinkable wraparound sleeve. The heat-shrink membrane shall create a barrier to water infiltration by sealing from the cast iron frame to at least the top three inches of the corbel section and all joints in the sections below and including the corbel section.

2. All manholes that are to be rehabbed or scheduled to have the ring and cover raised or replaced, shall be completely sealed around the top crown section of the manhole with this same wraparound sleeve.

3. The heat shrink membrane shall consist of a two-piece sleeve (backing and adhesive) with a closure system and a G-type primer. It shall consist of irradiated cross-linked polyolefin sheeting, pre-coated with a layer of anti-corrosion adhesive and shall be designed to provide excellent resistance against mechanical damage during construction and in service. The backing shall have a minimum recovery of 40% for irregular or cone shapes. For symmetrical cylindrical shapes, a minimum backing recovery of 28% is required. The sleeve shall have a mastic-type adhesive, specially formulated to become fluid at temperatures achieved during installation and maintain flexibility in cold climates. Upon cooling, the adhesive shall form a tough, elastomeric protective layer, which will effectively prevent the ingress of ground water into the joints. The sleeve shall be applied with a high intensity propane torch and shall be made from materials that provide high electrical resistivity, resistance to corrosive environments, low water absorption, low moisture permeability, and effective bond to steel surfaces, concrete and to common factory applied coatings. The overall thickness of the applied sleeve shall have a nominally 101 mil. finish thickness.

4. All applicators of the Wrapid Seal products shall have prior training by representative of CCI Products before any installation will be allowed. The heat shrinkable wraparound sleeve shall be Wrapid Seal as manufactured by Canusa, and supplied by RUTT, Inc., or approved equal with the following or exceeding properties:

Product Component	Property	Test Standard	Unit	Results
Adhesive	Softening Point	ASTM E28	Deg. F	212
	Lap Shear Strength	DIN 30 672	psi	12
Backing	Tensile Strength	ASTM D638	psi	2,900
	Elongation	ASTM D638	%	600
	Hardness	ASTM D2240	Shore D	46
	Abrasion Resist.	ASTM D1044	mg	45
Sleeve	Peel Strength	ASTM D1000	psi	9
	Water Absorption	ASTM D570	%	0.05
	Low Temp. Flex.	ASTM D2671D	Deg. F	-40

D. Manhole Infill Dish

1. The dish shall be made of an ultra-high density polyethylene copolymer material that meets ASTM specifications designation D1248, Class A, Category 5, Type 111 with a minimum impact brittleness temperature of <-131° F.

2. The dish thickness shall be uniform .187 mils (3/16”). Dish size is custom to fit the casting frame and lid.

3. The dish material shall be corrosion proof from all gases associated with wastewater collection systems.

4. A lift strap shall be provided. It shall be made of a woven polypropylene web and attached to the bowl of the dish by a wide head stainless steel rivet and a stainless steel 3/4" backup washer. All cut edges are seared to insure against raveling.

5. Infill dish ventilation shall be vented. The vent shall allow a maximum release of 10 gallons of water per 24 hours and shall not affected by debris that might collect in the bottom of the dish. Sewer gas shall be vented at one P.S.I. or less.

6. A neoprene gasket shall be provided. The gasket shall be 1/8” thick by 5/8” wide.

PART 3 - EXECUTION

3.1 GENERAL

Provide all labor, equipment and materials and install all pipe, fitting, specials, and appurtenances as indicated or specified.

3.2 PIPE INSTALLATION

A. Handling

1. Handle and store pipe in a manner to insure installation in sound and undamaged condition, and in accordance with pipe manufacturer's requirements.

   a. Do not drop, bump, roll or drag.
   b. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements, and coatings.

2. Ship, move, and store with provisions to prevent movement or shock contact with adjacent units.

3. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

B. Installation

1. Utilize equipment, methods, and materials ensuring installation to lines and grades as indicated.

   a. Do not lay on blocks unless pipe is to receive total concrete encasement.
   b. Use calibrated laser or minimum of 3 batter boards for control of line and grade.
   c. The bottom of the ditch shall be graded so that when the pipe rests on the ditch bottom it will have a uniform bearing for its entire length.
   d. Bell holes shall be dug for bell placement.

2. Install pipe of size, material, strength class, and joint type with embedment shown for plan location.

3. Insofar as possible, commence laying at downstream end of line and install pipe with bell ends in direction of laying (upstream). Sewer pipe shall have spigot ends in direction of flow. Obtain approval for deviations therefrom.

4. Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.

    a. Close open ends of pipe with watertight plugs at the end of each workday.
    b. Do not let water enter trench. Pipe shall be laid in a dry trench. Include provisions to prevent pipe flotation and displacement should water control measures prove inadequate.
    c. Remove water, sand, mud, and other undesirable materials from trench before removal of end cap or plugs.

5. Inspect pipe prior to installation to determine if any pipe defects are present.

6. Brace or anchor as required to prevent displacement after establishing final position.

7. Perform only when weather and trench conditions are suitable.

8. Observe extra precaution when hazardous atmospheres might be encountered, especially when connecting to existing, active sanitary sewers.

9. Separation of Sanitary Sewer Lines and Potable Water Lines.

    a. Water mains or sewer mains that are laid in the vicinity of each other shall meet the horizontal and vertical separations specified and shown in the General Notes and Standard Drawings section.

10. Auger or jack casing in place where shown on plans.

11. Maintain minimum of 30 inches of cover unless directed by Engineer.

12. Encase sewer pipe in steel casing or use ductile iron pipe when crossing under pipe, conduit, or structure of 24 inches in diameter or greater when a 6-inch separation distance cannot be maintained. This protection shall extend a minimum of 5 feet beyond crossed structure.

C. Jointing

General Requirements

1. Perform in accordance with manufacturer's recommendations.

2. Clean and lubricate all joint and gasket surfaces with lubricant recommended.

3. Utilize methods and equipment capable of fully homing or making up joints without damage.

4. Check joint opening and deflection for specification limits.

D. Closure Pieces

1. Connect two segments of pipelines or a pipeline segment and existing structure with short sections of pipe fabricated for the purpose.

2. Observe specifications regarding location of joints, type of joints and pipe materials and strength classifications.

E. Temporary Plugs

1. Furnish, install, and secure watertight temporary plugs at each end of work for removal by others when completed ahead of adjacent contract or where indicated.

2. Remove from pipe laid under separate or prior contract in order to complete pipe connection when work by other contractor is finished prior to work at connection point under this contract.

3. Permanent Plugs

a. Use test plugs as manufactured by pipe supplier, or
b. Fabricate by Contractor of substantially same construction.
c. Must be watertight against heads up to 20 feet of water.
d. Secure in place in a manner to facilitate removal when required to connect pipe.

3.3 MANHOLE INSTALLATION

A. Precast Bases

1. Place on 12-inch layer of compacted sand, gravel or sandy material as approved by Engineer.

2. Base shall be leveled prior to installation of manhole sections.

B. Manhole Sections

1. Use precast sections sized for the application.

2. Full circumference seals between manhole sections shall use either of the following or approved equivalent.

a. Bitumastic Seal (Kent No. 2, Ram Neck)
b. Rubber "O" ring gasket

C. Cast in Place Invert Channels

1. Precast inverts in base sections are preferred.

2. Form invert channel as indicated.

3. Alternate invert and shelf may be constructed of mortar over concrete fill with approval of Engineer.

4. Make changes in direction of flow with smooth curves of as large a radius as size of manhole permits.

5. Make changes in size and grade smoothly and uniformly.

6. Slope shelf of manhole adjacent to channels, toward the channels, and rough broom finish to provide a non-slip surface.

7. Finish channel bottom smoothly without roughness, irregularity, or pockets.

8. On straight through single pipe manholes, half sections of same pipe may be used with mortar and concrete with approval of Engineer.

D. Pipe Connection into Manholes

1. Make watertight.

2. Use specified pipe to manhole seals such as Kore-N-Seal or other as approved by Owner.

E. Field applied coatings shall be applied after Engineer's approval of structure.

3.4 SERVICE CONNECTIONS

A. Service lines shall be located in accordance with details on the plans.

B. Install service connections to each residential lot or individual business lot or property, or as directed by Engineer.

C. Service laterals and fittings shall b a minimum four (4) inches in diameter with a minimum slope of 1/8 inch per foot.

D. Services wyes: install long bell type wyes, 4-inch branch diameter unless shown otherwise on plans.

E. Risers: may be used with wyes for service connections where invert of sewer is 7 feet or more below ground surface or where shown on plans. Terminate each connection as shown on plans or as directed by Engineer. Glued 45-degree bends may be used on end of lateral, within grassy, or unpaved, areas.

F. Glue cap on end of stub out.

G. Backfill trench only after recording exact location and depth of service connection.

H. Street crossings shall have a minimum of 2 feet of cover to subgrade unless approved by Engineer.

I. Drive a ½-inch metal rebar adjacent to each service connection, with top of post 1 foot below ground surface.

3.5 CONNECTION OF SERVICE LINES AND SEWER SYSTEM FACILITIES

A. Existing Service Lines and New Sewer Main:

B. Connect existing sanitary service lines which cross new sewer line through equal sized wye.

C. New Service Line Connections to Existing Manholes:

1. Insert new sewer pipe flush with inside of manhole.

2. Connect new lines to existing manholes. Seal new pipe in place to be watertight.

3. Reconstruct manhole channel and shelf to suit new connection.

4. All debris to be removed.

D. Connections to Existing Sewer

1. Build new manhole around existing sewer.

2. Break out existing sewer inside of manhole and construct channel and shelf to suit new connection.

PART 4 - ACCEPTANCE

4.1 GENERAL

A. During the test and warranty time period the manhole shall not have any leaks and shall be dry. If any infiltration (leaks) into manholes occurs, the entire structure shall be replaced with a new manhole with the new structure being subject to the same requirements. The cost of replacement shall be the responsibility of the contractor.

B. All tests to be witnessed by owner's representative.

C. All vacuum testing of the manholes shall be recorded and documented, and a detailed report by numbered manhole with test results be supplied to the owner or his representative.

4.2 ACCEPTANCE TESTS FOR SEWER PIPELINES AND MANHOLES

A. General

1. Infiltration, exfiltration, or air test may be used to prove compliance with infiltration requirement.

2. Acceptance of air test or exfiltration results will not preclude rejection of work if infiltration is measured and exceeds limitation.

3. Maximum infiltration for each manhole shall not exceed 1 gallon per vertical foot per 24 hours.

B. Inspection:

1. It is imperative that all sewers and manholes be built practically watertight, and that the Contractor must adhere rigidly to the specifications for material and workmanship. After completion, the sewers, or sections thereof, will be tested and gauged and if infiltration is above allowable limits specified, the sewer will be rejected.

2. On completion of each section of sewer, or such other time as the Engineer may direct, the section of sewer is to be cleaned, tested, and inspected. All repairs shown necessary by the tests are to be made, broken, or cracked pipe replaced, all deposits removed, and the sewers left true to line and grade as herein specified, or shown on the plans, entirely clean and ready for use. Each section of the sewer between manholes is to show from either end on examination, a full circle of light. Each manhole or other appurtenance to the system shall be of the specified size and form, be watertight, neatly, and substantially constructed, with the top set permanently to exact position and grade.

C. Air Test (Gravity Sewer Piping)

1. Furnish all facilities required including:

a. Necessary piping connections.
b. Test pumping equipment.

c. Pressure gauges or manometers.
d. Bulkheads.
e. All miscellaneous items required.

2. Obtain approval from Engineer of equipment and methods proposed for use.

3. Test pipe in sections determined by Contractor and approved by Engineer.

4. Plug ends of line and cap or plug all connections to withstand internal test pressures.

5. Introduce low pressure air until internal air pressure is 4.0 psi greater than the average back pressure of ground water above the pipe. (Add 0.43 psi for each vertical foot of ground water over the top of pipe.)

6. Allow two minutes for air pressure to stabilize.

7. Time required for pressure to decrease from 3.5 to 2.5 psi greater than average back pressure of any ground water above pipe shall not be less than time in following table for given diameters.

Pipe Diameter	
(Inches)	Minutes
6	3.0
8	4.0
10	5.0
12	5.5
15	7.0
18	8.5
21	10.0
24	11.5
27	12.75
30	14.0
36	17.0

8. Repeat test as necessary after all leaks and defects have been repaired.

D. Exfiltration Test (Gravity Sewer Piping)

1. Furnish all facilities required to plug pipe sections and fill with water to attain a minimum elevation of water in upstream manhole two feet higher than top of pipe in line being tested, or two feet above existing ground water in trench, whichever is higher elevation.

2. Maintain water level in manhole at start of test period for one hour.

3. Water added to maintain level (water lost) shall not exceed the following amounts:

   a. 8" pipe - 0.63 gallon per 100 feet.
   b. 10" pipe - 0.79 gallon per 100 feet.
   c. 12" pipe - 0.95 gallon per 100 feet.
   d. 15" pipe - 1.19 gallon per 100 feet.
   e. 18" pipe - 1.42 gallon per 100 feet.
   f. 21" pipe - 1.66 gallon per 100 feet.
   g. 24" pipe - 1.90 gallon per 100 feet.

   Allowable leakage may be increased by 5% for each foot of head above water elevation indicated above.

E. Infiltration Test (Gravity Sewer Piping)

1. May be used in lieu of air test or exfiltration test if contractor can prove that ground water conditions are such that crown of pipe is covered with not less than two feet of water at highest point in section being tested. The test head shall be maintained for not less than 24 hours before a weir measurement is made.

2. Infiltration shall be measured with weir at manhole and shall not exceed amounts stated above, Exfiltration Test.

3. Engineer will require exfiltration or air test if contractor cannot prove to satisfaction of Engineer that ground water conditions are satisfactory.

4. The allowable limit of groundwater infiltration for the entire system shall be in complete accordance with ASTM C425-71T and shall not exceed a limit of infiltration equal to 0.08 gal/inch diameter/hour/100 linear feet of pipe.

5. The test will be made by measuring the infiltration flow of water over a measuring weir set up in the invert of the sewer, or by alternate method approved by the Engineer a known distance from a temporary bulkhead or other limiting point of infiltration.

6. After the sewer or sewers have been pumped out, and normal infiltration conditions prevail, tests shall be started.

7. Tests shall be run continuously for a period of not less than three (3) hours, with weir readings taken at 20-minute intervals. The test shall be made by the Contractor. The Engineer shall be notified 24 hours in advance.

8. Where infiltration occurs in excess of the specified amount, the defective pipe or joints shall be located and repaired at the expense of the Contractor.

F. Videotaping of Lines:

All piping, 8 inches in diameter and greater shall be videotaped in the presence of the Engineer. Tape shall be provided to the Engineer and approved prior to final acceptance of the system.

G. Deflection Testing (Gravity Sewer Piping):

1. All PVC sewer lines shall be tested for diametric deflection following installation.

2. A "Go-No-Go" type mandrel will be an acceptable deflection testing device. The maximum diametric deflection allowable will be 5% of the pipe base inside diameter as defined in ASTM Specification D-3034.

3. Deflection testing will be performed prior to asphalt paving after all improvements including road base are in place.

H. Manhole Vacuum Test:

1. The test shall be conducted by the Contractor in coordination with and at the direction of Engineer. The manhole shall be tested, after assembly, as follows:

   a. All pipe openings shall be sealed by installing suitable plugs that completely isolate the manhole structure; any other openings, such as lifting holes, shall be permanently sealed. A suitable vacuum pump shall be connected to the manhole, and a vacuum of 10" of Hg drawn. The pump shall then be isolated from the manhole by valving, and the test period begun. The test shall be successful if the vacuum remains at 9" of Hg or greater according to the following table:

Manhole Diameter	Time Minimum (sec)
48"	60
60"	75
72"	90

2. The vacuum testing shall meet or exceed the Standard test method as described in ASTM C1244-11, C1244M-11, and C497-15.

3. All manholes which fail the test or that have visible leaks, even if they pass the test, shall be repaired, or replaced at the expense of the Contractor until the manhole passes the test, to the complete satisfaction of the Engineer. Manholes which have any visible leaks will not be accepted. (Ref. ASTM C1244-02)

END OF SECTION 025700

SECTION 025760 - WASTEWATER FORCEMAIN

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION OF WORK

The Contractor shall furnish and install all pipes, fittings, structures, and accessories required for wastewater forcemain transmission, distribution and/or service lines in accordance with the requirements of the Construction Plans and related Contract Documents.

1.2 COMMONLY USED ACRONYMS

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASSE	American Society of Safety Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CA	Concrete Asbestos
CI	Cast Iron
DI	Ductile Iron
DIPS	Ductile Iron Pipe Standard
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FLG	Flange
HDPE	High-Density Polyethylene
MJ	Mechanical Joint
MSS	Manufacturer's Standardization Society
NSF	National Standards Foundation
OD	Outside Diameter
PVC	Polyvinyl Chloride
SBR	Styrene Butadiene Rubber
SF	Suction Flange

1.3 QUALITY ASSURANCE

A. AWWA Standards – Construction materials and methods shall comply with the requirements of the latest published edition of American Water Works Association (AWWA) Standards. Applicable standards are listed herein these specifications; any other standards mentioned in the standards listed herein are incorporated by reference.

B. ASTM Standards – In addition, construction materials and methods shall also comply with the requirements of the latest published editions of the American Society for Testing and Materials (ASTM) Standards.

PART 2 - MATERIALS AND EQUIPMENT

2.1 GENERAL

All furnished pipe, fittings, and accessories shall be new and unused. Ductile Iron Pipe and fittings shall epoxy lined unless shown otherwise on the plans and bid documents. All pipe, fittings and accessories shall be suitable and rated for appropriate pressure use.

2.2 DELIVERY, STORAGE, AND HANDLING

Certificates of Compliance with the Specifications may be required for all materials used on the Project. All materials are to be transported, stored, handled, and installed in accordance with the Manufacturer's recommendations to avoid physical damage. All materials shall be stored to prevent physical deterioration due to sun and weather. The Owner or its representative reserves the right to reject material which in any way does not meet the requirements of these Specifications.

2.3 FORCEMAINS

A. Polyvinyl Chloride Pipe (PVC) - PVC pipe shall meet the designations on the table below and shall be provided with push-on joints with the bell integrally cast into the pipe. PVC pipe shall be installed with elastomeric gaskets meeting ASTM Standard F477 and meet the requirements of the following table.

PVC PIPE STANDARDS				
Standard	Nominal Size	Dimension Ratio	OD Classification	Pressure Rating (Psi)
ASTM 2241	2" – 3"	SDR 21	IPS	200
AWWA C900	4" – 12"	DR 25	DIPS	165
AWWA C905	14" – 36"	DR 25	DIPS	165

1. Markings - PVC pipe shall be marked to indicate the following:

   a. Nominal pipe size and OD base.

   b. Material Code Designation.

   c. Dimension Ratio.

   d. Pressure Class or Pressure Rating.

   e. Manufacture's Name or Trademark.

   f. Appropriate AWWA or ASTM Standard Number.

   g. Date Pipe Was Manufactured.

2. Color Coding - Entire pipe shall be colored with green pigment.

B. Ductile Iron Pipe (DIP) - All ductile iron pipe shall be designed and manufactured in accordance with AWWA C150 and AWWA C151, respectively and shall meet the requirements of the table below. DIP shall have a design operating pressure of up to 150 psi, installed in Class 2 Trenching conditions. Pressure class or bedding class shall be increased as required by AWWA C151 for surface loads greater than indicated or operating pressures greater than 150 psi. DIP shall be installed as push-on joints unless otherwise noted on the plans. All DIP shall meet the requirements of the following table:

DIP PIPE STANDARDS			
Standard	Nominal Size	OD Classification	Pressure Rating (Psi)
AWWA C151	3" – 12"	DIPS	350
AWWA C151	14" – 20"	DIPS	250
AWWA C151	24" – 64"	DIPS	200

1. Minimum Pipe Design Criteria –

   a. The minimum internal design working pressure shall provide/ensure: (1) a 100-psi surge allowance, (2) a safety factor of 2, and (3) a total internal design pressure of 600 psi. No reduction of safety factor for transient pressures shall be allowed.

   b. The external loads design criteria shall be a minimum of 4-foot depth of cover at 120 lbs. per cubic feet soil weight, and live load based on one AASHTO H-20 truck load. The thickness design of ductile iron pipe shall be in accordance with AWWA C150.

   c. The horizontal deflection of epoxy lined ductile iron pipe resulting from external load conditions shall not exceed three percent of the pipe diameter.

2. Joint Design –

   a. General – Ductile Iron pipe and fittings shall be furnished with push-on joints, push-on restrained joints, and flanged joints, as required.

   b. Push-on Joints – Push-on joints shall conform to AWWA C111. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR). Push-on joints shall be Fastite, as manufactured by American Cast Iron Pipe Company (ACIPCO), or equivalent. The pressure rating for push-on joints shall be a minimum of 350 psi or the specified pressure rating of the pipe, whichever is less.

   c. Restrained Joints – Restrained joints shall be "Flex-Ring" restrained joints as manufactured by ACIPCO or equivalent. When restrained joints require factory welding, the Manufacturer shall qualify all welding procedures and welders used to produce the product per the requirements of a documented quality assurance system based on ANSI/AWS D11.2. Unless otherwise specified, gasket material shall be standard SBR. Restrained joints and restrained joint pipe shall have a working pressure rating of 350 psi for 3 to 16-inch sizes and 250 psi for 18 to 48-inch sizes. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes. The Manufacturer shall furnish test results showing that restrained joints in the sizes specified have been successfully tested to at least twice the specified pressure rating of the joint without leakage or failure. Tests shall be performed on pipe with nominal metal thickness less than or equal to that specified for the project.

   d. Flanged Joints – Ductile iron pipe and fittings 3 to 54 inches for above ground service or in below ground pits shall have flanged joints and meet the following requirements:

      1) Flanged ductile-iron pipe shall conform to current AWWA/ANSI Specification C115/A21.15 and C110/A21.10 with factory-applied screwed long hub flanges except as otherwise specified hereinafter. Flanges shall be fully machined faced and drilled after being screwed tight on the pipe, with flanges true to 90 degrees with the pipe axis and shall be flush with end of pipe conforming to ANSI B161.1, 125-pound std. or Class 250, for the purpose intended. No welding of flanges or accessories in the field will be acceptable.

      2) Full face type 1/16-inch-thick red rubber ring gaskets shall conform to ANSI A21.11. Ring gaskets shall be of approved composition suitable for the required service.

3. Markings - Each ductile iron pipe section shall be marked to indicate the following:

   a. Weight class or nominal thickness.

   b. Letters DI or DUCTILE shall be cast or stamped on the pipe.

   c. The Manufacturer’s mark.

   d. Country where cast.

   e. Date in which the pipe was produced.

   f. Date when pipe was lined.

   All required markings shall be clear and legible; and all cast marks shall be on or near the bell. All letters and numerals on pipe sizes 14-inch and larger shall be not less than 0.5-inch in height.

4. Color Code - Forcemain pipe shall have 3 green stripes (1/2 inch wide) with permanent ink along the entire length of pipe with the word "FORCE MAIN" in 3/4-inch-tall letters every 21 inches along each stripe.

5. Interior Coating of Ductile Pipe - Ductile iron pipe, fittings and appurtenances including sleeves, couplings, and joints, shall have the same type of lining as specified herein. Unless otherwise noted, minimum lining thickness (nominal dry film) shall be 40 mils. Interior lining shall be Protecto 401 as manufactured by Induron Coatings (Birmingham, AL); or Permox-CTF as manufactured by The Permite Corp. (Stone Mountain, GA).

   a. Manufacturer’s Qualifications –

      1) Provide products from a company specializing in manufacture of high-performance epoxy coatings with a minimum 10 years of experience.

      2) Materials shall be products of a single manufacturer or items standard with manufacture of specified coating materials.

      3) Submit Manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.

b. Applicator's Qualifications –

1) Engage a single installer licensed or approved by the Manufacturer with a minimum of three years' experience performing this type of lining installation and with documented skill and successful experience in the installation of ceramic epoxy lining to interior of ductile iron pipe and fittings.

2) Submit name and qualifications to Engineer.

3) Submit proof of license or approval of applicator by Manufacturer to Engineer.

c. Shop Surface Preparation –

1) All internal surfaces of ductile iron pipe and fittings shall be delivered to the application facility without asphalt or any other protective lining on the interior surface. All oils, small deposits of asphalt paint and grease shall be removed in accordance with NAPF 500-03-01 Solvent Cleaning prior to abrasive blasting.

2) Uniformly rotary-abrasive blast to a NAPF 500-03-04: Internal Pipe Surface Condition, full removal of annealing oxide layer. When viewed without magnification, the interior surfaces shall be free of all visible dirt, dust, annealing oxide, rust, mold release coating and other foreign mater. The surface shall contain a minimum angular anchor profile of 3.0 mils (76.2 microns).

3) Coat surface within eight hours of surface preparation.

d. High Voltage Holiday Detection – The lining system shall be high voltage discontinuity (spark) tested to determine the presence and number of discontinuities (holidays) in the lining. High voltage discontinuity (spark) testing shall be performed in accordance with ASTM D5162 or NACE SP0188. High voltage discontinuity (spark) testing shall be performed using a Tinker & Rasor model AP/W Holiday Detector (or approved equal) with a voltage setting of 100 volts per mil thickness at minimum. Therefore, High Voltage holiday detection shall be performed at 4,000 volts minimum.

e. Prior to Shipment – Visually examine all ceramic epoxy lined pipe and fittings for film defects, including any runs, sags, and debris in the film. Shop repairs shall be made in accordance with the Manufacturer's instructions.

1) All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic dry film thickness gauge. The thickness testing shall be in according with SSPC-PA2 film thickness rating.

2) The lining installer shall provide written verification that all pipe surfaces have been discontinuity tested as listed above. Verification shall be conducted by a NACE Certificated Coatings Inspector.

6. Exterior Coating of Ductile Iron Pipe – The options for protection of the exterior of ductile iron pipe, fittings, etc. shall consist of one of the following: (1) standard shop coating and annealing oxide layer, (2) standard coating and annealing oxide layer plus polyethylene-encasement, (3) epoxy coating, or (4) epoxy coating plus heat shrink sleeves. Options (1) and (2) are typically used for buried pipe. Option (3) is typically used for pipe that is exposed, above grade. Option (4) is typically used in exposed locations where the presence of corrosive conditions may be present (e.g., ARV vaults).

a. Standard Coating – Coating type and amount per the requirements of the pipe and appurtenance Manufacturer.

b. Encasement – DIP shall be encased in the specified polyethylene material as indicated on the project plans. DIP shall be encased in 4 mil HDCL or 8 mil LLD polyethylene material in accordance with ANSI/AWWA Standard C105, using Encasement Method A (tube wrapped).

1) Location Information – The installed locations of polyethylene encasement of the DIP shall be documented on the final as-built project plans.

c. Epoxy Exterior Coating –

1) Shop Surface Preparation – Abrasive blast to remove loose annealing oxides, all rust and other contaminants. All surfaces shall have a minimum surface profile of 1.5 mils.

2) Field Surface Preparation – All abraded areas shall be abrasive blasted to remove all loose rust and shall result in a surface preparation equal to that listed above. All edges shall be feathered. All other surfaces shall be abraded to provide a sufficient surface profile for the proposed finish coat(s).

3) Coating – Utilize products by Sherwin Williams, SherGlass FF Epoxy for exposed piping, either above grade or within underground vaults, pits, etc. For pipe remaining exposed above ground, top coating with a urethane (Acrolon Ultra) for color and gloss retention is required. The table below does not include the standard shop applied primer coating.

Approved Coating Products			
Coat	Product	Color	Dft
1st	* SherGlass FF Epoxy **	White	10.0 – 20.0
2nd	* SherGlass FF Epoxy **	White	10.0 – 20.0
Final	* Acrolon Ultra **	Green	2.0 – 3.0

* Lining to be applied in a single coat
** Or approved equivalent

4) Discontinuity Testing – After cure of the lining, all surfaces shall be high voltage holiday tested in accordance with NACE RPO 188 (latest edition) and the recommendations of the Manufacturer.

d. Heat Shrink Sleeves – Heat shrink sleeve shall consist of a cross-linked and pre-stretched sheet (coated with a protective heat-sensitive adhesive) which, upon heating, will shrink to its original length. The sleeve adhesive will achieve the corrosion protection by preventing moisture and air ingress to the pipe surface. Further, the adhesive shall act to hold and anchor the backing around the joint through adhesion to the substrate and the backing. Careful attention required concerning the compatibility of the sleeves with pipe coatings. AWWA C216 covers the material and application requirements of heat-shrinkable cross-linked polyolefin coatings for the exterior of special sections, connections, and fittings for steel pipelines.

C. Polyethylene Pipe (HDPE) - HDPE pipe shall meet the requirements of the table below and shall be high performance, high molecular weight, high density polyethylene pipe and shall conform to ASTM D 1248 (Type III C, Class C, Category 5). Minimum cell classification values shall be 345464C, as referenced in ASTM D 3350 - latest edition. All pipe resin shall be manufactured by the same company that manufactures the pipe itself in accordance with these specifications to ensure complete resin compatibility and total product accountability. The fittings shall be molded or manufactured from a polyethylene

compound having a cell classification equal to or exceeding the compound used in the pipe. To ensure compatibility of polyethylene resins, all fittings supplied under this specification shall be of the same Manufacturer as the pipe being supplied.

HDPE PIPE STANDARDS				
Standard	Nominal Size	Dimension Ratio	OD Classification	Pressure Rating (Psi)
AWWA C901	1.5”	DR 9	CTS	200
AWWA C901	2”	DR 9	CTS	200
AWWA C901	3”	DR 11	IPS	200
AWWA C906	4”+	DR 11	DIPS	200

1. Quality Control - Refer to the following guidelines regarding quality control:

   a. The resin used to manufacture the pipe shall be produced by the pipe Manufacturer, thus maintaining complete control of the pipe quality. The pipe shall contain no recycled compound except that generated in the Manufacturer’s own plant from resin of the same specification and from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects, and shall be identical in color, density, melt index, and other physical properties.

   b. The Engineer may request, as part of the quality control records submittal, certification that the pipe produced is represented by the quality assurance testing. Additionally, test results from Manufacturer’s testing or random Manufacturer’s representation, may be cause for rejection of pipe represented by the testing. These tests may include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D 3350, 10.1.9.

1) Verification - The Owner or the specifying Engineer may request certified lab data to verify the physical properties of the materials supplied under this specification or may take random samples and have them tested by an independent laboratory.

2) Rejection - Polyethylene pipe and fittings may be rejected for failure to meet any of the requirements of this specification.

2. Color Coding –

a. Forcemain pipe shall have 3 green stripes (1/2 inch wide) with permanent ink along the entire length of pipe with the word "FORCE MAIN" in 3/4-inch-tall letters every 21 inches along each stripe.

b. Entire pipe shall be colored with green pigment.

D. Stainless Steel Pipe and Fittings –

1. Stainless steel pipe and fittings shall be Schedule 10, 316 Stainless steel minimum, iron pipe size (IPS), of the nominal diameter shown on the Contract Plans. Transition to ductile iron pipe size (DIPS) outside diameter(s) shall be as shown on the Contract Plans. The stainless-steel pipe and fittings shall be AISI 316L and comply with ASME/ANSI B 36.10, ASME/ANSI B36.19M, AWWA C220, latest editions and all applicable ASTM Standards.

2. All welded fabrication of pipe and fittings shall be in accordance with ANSI/AWS D10.4, latest edition. All welds shall be free from cold spots, pin holes, oxide inclusions, burrs, snags, rough projections, and other defects. Welding shall be by AWS certified welders for austenitic chromium-nickel stainless steel pipe and tubing.

3. Flanged joints shall comply with AWWA/ANSI B16.5 Standards, latest edition.

E. Welded Steel Casing –

1. Steel casing shall be used for all installations requiring casing sizes 8- inches or larger.

2. The steel casing shall be seamless or electric resistance-welded tubing for sizes up to 24-inch O.D. and standard double-submerged arc-weld for sizes over 24 inches.

3. Steel pipe shall be new, unused, ASTM A-139, Grade B, straight seam, minimum yield strength of 35,000 psi, and minimum tensile strength of 60,000 psi, with one beveled end (to 37 degrees) and other end square cut.

4. The following table shall be used for determining minimum casing size.

CASING SIZE VERSUS CARRIER SIZE				
Steel Casing Diameter	MINIMUM WALL THICKNESS		Carrier Pipe I.D.	
	Highway	Railroad	Gravity	Pressure
8”	.188"	.188"	NA	2”
10"	.188"	.188"	NA	3” or 4"
12"	.188"	.188"	4"	6"
14"	.250"	.250"	6"	8"
16"	.250"	.250"	8"	10"
18"	.250"	.250"	10"	10"
20"	.250"	.250"	12"	12"
24"	.250"	.281"	14"	14"
24"	.250"	.281"	16"	16"
30"	.250"	.312"	18"	18"
30"	.312"	.344"	20"	20"
36"	.312"	.406"	24"	24"
42"	.375"	.469"	30"	30"
48"	.500"	.532"	36"	36"
60"	.500"	.563"	42"	42"
72"	.625"	.625"	48"	48"

F. Alternate Pipe Materials - The Owner may consider other pipe materials as appropriate for the needs of the Project. Alternate pipe materials identified during design and approved for use on the Project shall be noted on the Construction Plans.

2.4 FORCEMAIN APPURTENANCES

A. Forcemain Fittings for DIP and PVC - Ductile Iron Pipe Fittings – Forcemain fittings shall include Tees, Wyes, Bends, Reducers, and other appurtenances commonly used in pipe construction. Fittings shall be ductile iron meeting AWWA Standard C110 or C153 with pressure ratings of not less than that specified for adjacent pipe. Fittings shall be constructed with mechanical joints, unless otherwise specified, and shall be supplied complete with low alloy bolts and nuts, EPR gaskets and other necessary parts required for field assembly. Fittings shall be ceramic epoxy lined as specified herein for ductile iron pipe.

B. Casing Spacers -

1. For Carrier Pipes Greater Than or Equal to16” Nominal Diameter - Casing spacer shall be a two-piece shell per carrier pipe and made from T-304 stainless steel of a minimum 14-gauge thickness. Each shell section shall be lined with a 0.090” thick, ribbed PVC extrusion with a retaining section that overlaps the edges of the shell and prevents slippage. Bearing surfaces (runners) shall be ultra-high molecular weight polyethylene (UHMW) to provide abrasion resistance and a low coefficient of friction (0.12). The runners shall be attached to support structures (risers) at appropriate positions to properly support the carrier pipe within the casing pipe and to ease installation. The runners shall be mechanically bolted to the riser. The bolt heads are welded to the inside of the risers for strength. Risers shall be made of T-304 stainless steel of a maximum 10 gauge. All risers shall be MIG welded to the shell. Bottom risers 6" and over in height shall be reinforced. All reinforcing plates shall be 10 ga. T-304 stainless steel and shall be MIG welded to mating parts. All welds and metal surfaces shall be chemically passivated. Spacing requirements shall be in accordance with manufacturer’s recommendations. Casing spacers shall be Model CCS as manufactured by Cascade Waterworks Mfg. Co. of Yorkville, IL or approved equal.

   a. Standard positioning within the casing pipe shall be sized such that the carrier rests near the bottom of the casing pipe and the height of the risers and runners are to provide a bottom clearance not less than one-half inch between the casing pipe and the extreme outside diameter of the joint (bell, seam weld, joint clamp, etc.) of the carrier pipe.

   b. Centered & restrained positioning within the casing pipe shall be sized such that the height of the risers and runners are to center the carrier pipe in the casing pipe with a top clearance of three-fourths inch minimum.

   c. Restrained positioning within the casing pipe shall be sized such that the carrier rests near the bottom of the casing pipe and the height of the risers and runners are to provide a bottom clearance not less than one-half inch between the casing pipe and the extreme outside diameter of the joint (bell, seam weld, joint clamp, etc.) of the carrier pipe and a top clearance of three-fourths inch minimum.

d. Multiple Carrier pipes within the casing pipe shall be sized such that the carrier pipes are held at fixed distances relative to each other, with the height of the risers and runners to provide not less than three-fourths inch between the casing pipe and the outside diameter of the riser/runner combinations. Special reinforcing plates may be required to stabilize and support structure.

2. For Carrier Pipes less than 16" Nominal Diameter - High density polyethylene (HDPE) casing spacer shall be non-metallic and molded in segments for field assembly with a supplied ball tip Allen wrench. The casing spacer shall have integrally molded runners extending beyond the bell, mechanical joint, or restrainer of the carrier pipe. Individual segments shall have a solid core and each runner shall be within 1.5" of the casing pipe to center the carrier pipe within the casing. Phoenix Plastic Casing Spacers shall be spaced within two feet of both ends of each individual casing pipe section with all remaining spacers assembled along the length of the pipe section at an equal distance apart not exceeding eight feet in length. All Phoenix Series Spacers are supplied with a molded TPR (Thermo Plastic Rubber) non-slip button comprised of pliable material having a high coefficient of friction that is designed to grip all types of pipe, especially good for PVC. The casing spacers shall be Cascade Phoenix Gold Series, as manufactured by Cascade Waterworks Mfg. Co., Yorkville, Illinois, or approved equal.

C. HDPE Pipe Fittings -

1. Mechanical connections of HDPE pipe (4 inch and larger) to ductile Iron or PVC piping, mechanical joint fittings, or valves shall be through a self-restraining, fusible mechanical joint adapter. Mechanical joint adapter shall be the same SDR rating as the pipe. Provide the mechanical joint adapter, including but not limited to longer tee bolts and all thread rods with nuts at the mechanical joint bell.

2. Mechanical connections of HDPE pipe sized under 4 inches to ductile iron or PVC piping, mechanical joint fittings, or valves shall be through the use of the above specified mechanical joint adapter if available. As an alternate, transition fittings of HDPE by male iron pipe threaded end installed by butt fusion may be used.

D. Pipe Couplings -

1. Pipe couplings shall be solid sleeve type with mechanical joints at each end containing a compression gasket. Couplings shall be ductile iron, 12 inches minimum in length, with low alloy bolts and nuts, and SBR gaskets. Rings and gaskets shall be sized to conform exactly to the requirements of the pipe Manufacturer.

2. For transition between asbestos cement and PVC or DI pipe types, Hymax 2000 Series, Romac Macro HP, Couplings, or approved equal, shall be used.

3. Polyethylene pipe and fittings may be joined using approved electro fusion couplings. Fittings shall be PE3408 HDPE. Electro fusion fittings shall have a pressure rating equal to the pipe.

E. Pipe Cut-In Sleeves - Cut-in sleeves shall be solid ductile iron, one end plain for insertion to female fitting, the other end flanged mechanical joint, furnished with loose attaching flange and fastener, nominal length of 20-21 inches. Specify pipe main size and type of pipe fabrication.

Approved Manufacturers – Pipe Cut-in Sleeves		
Manufacturer	**Model**	**Application**
Clow	F-1220	for centrifugally cast or sand cast pipe (special)
Clow	F-3459	for all classes of centrifugally cast pipe
Union Foundry	21-4520 21-4610 24-4800	MJ X PE FLG X PE MJ X FLG
Others as approved by Owner in writing.		

F. Repair Clamps - Repair clamps shall not be used in the installation of new pipe except with the written permission of the Engineer. Repair clamps shall be full circle and selected based on the table below.

Repair Clamp Sizes	
Pipe Diameter	
Up to 12-inch	Single Band
14-inch and above	Double Band

1. Repair clamps shall be composed of stainless-steel bands and bolts, DI lugs and full gridded virgin EPR compounded gasket.

2. Repair clamps shall be sized so that the OD of the existing pipe being repaired falls within the designated range for the clamp size. Repair clamps shall have ample length to give full gasketing at both ends.

Approved Manufacturers	
Manufacturer	Model
Ford	FS series (all SS)
Smith Blair	226, 228
Others as approved by Owner in writing.	

NOTE : See Manufacturer's catalog to complete model numbers by size.

F. Pipe Restraints – Restraints shall have set or anchor screws used to secure body to pipe with torque limit break away head design.

Approved Manufacturers	
Manufacturer	Model
Smith Blair	Cam-Lock 111, 120
Others as approved by Owner in writing.	

G. Expansion Joints –

1. Expansion joint fittings shall be used where specified on the Construction Plans. They shall be of the rigid or flexible type as specified, and manufactured of ductile iron in accordance with the DIP specification herein. They shall be capable of expanding or contracting to the extent specified by the Engineer, but in no case less than 4-inches axially, and designed to prevent separation beyond the maximum extension without the use of external tie rods.

2. Expansion joint fittings shall be flanged or provided with restrained mechanical joints, individually pressure tested to a minimum of 350 psi against their own restraints, and internally coated on all exposed surfaces with a minimum of 15 millimeters of fusion bonded epoxy conforming to AWWA C116. They shall be capable of deflecting at least 15 degrees by means of an integral ball at each joint in the case of flexible types.

Approved Manufacturers		
Type	**Manufacturer**	**Model**
Rigid	EBAA Iron, Inc.	EX-TEND 200
Flexible	EBAA Iron, Inc.	Flex-Tend
Others as approved by Owner in writing.		

H. Tapping Sleeves -

1. The minimum size tapping sleeve shall be 4 inches. Connection of 3-inch lines to existing pipes 4 inches and larger shall be made by a 4-inch tapping sleeve with appropriate reducing fitting. Tapping saddles shall be used for smaller connections.

2. Tapping sleeves shall be designed for a working pressure of 200 psig without leakage. Tapping sleeves shall be all stainless steel including stainless steel flange. The outlet branch connection shall have a recessed flanged face for connection of tapping valve with standard dimensions in accordance with Manufacturers Standardization Society (MSS) SP-60. A complete set of neoprene or other elastomer gaskets shall be furnished. Sleeves shall be furnished to fit ductile iron, cast-iron, cement-asbestos, Class 160 or C900/905 PVC pipe with side connection as shown on plans or specifications in standard pipe sizes. Sleeves shall be furnished with all necessary installation parts. All hardware shall be stainless steel.

Approved Manufacturers	
Manufacturer	**Model**
Ford	FAST
Mueller	H-304SS
JCM Industries	432
Romac	
Smith-Blair	663, 665
Others as approved by Owner in writing.	

Note: To specify exact fitting when ordering, confirm line outside diameter and material. Confirm compatibility of selected fitting with existing main material.

I. Pipe Hangers and Supports - Hangers and supports shall be in compliance with Federal Specification WW-H-171E, or Manufacturer's Standardization Society SP-69, or UL listed. Materials of construction shall be in accordance with the requirements outlined in the table below.

Approved Materials for Construction of Pipe Hangers and Supports	
Part I.D.	**Material**
Clamps	Steel - Epoxy Coated or Galvanized Cast Iron - Galvanized Malleable Iron
Hanger Rods	Steel - Electro Galvanized Steel - Stainless 304
Roller Bases/Roller Stands	Cast Iron
Fasteners/Fittings	Galvanized Steel Stainless
Hanger Rod Inserts	Steel - Cadmium Plated Steel - Galvanized Universal Concrete Insert - Cast Iron - Galvanized
Rod Attachments	Clevis - Forged Steel Turnbuckle: 1) Forged Steel, 2) Malleable Iron Sockets, Eye Nuts, Extension - Malleable Iron
Roller Bases/Roller Stands	Cast Iron
Rollers	Steel or Iron Core, Insulated from Structure

Approved Manufacturers – Pipe Hangers and Supports		
Manufacturer	**Part I.D.**	**Model No.**
Utility Pipe Sales	Clevis Hanger	590
	Socket Clamp	224 246
	<u>Concrete Inserts</u>: CB-Universal Screen Insert	 282 152
	<u>Rod Attachments:</u> Eye Nut Forged Clevis Forged Turnbuckle Carbon Steel Couplings Socket Eye Extension	 290 299 230 233 136 110R 157
	<u>Pipe Rolls:</u> Adjustable Swivel Adjustable Steel Yoke	 174 181
	Pipe Roll with Base	274
	Pipe Roll and Plate	277
Others as approved by the Owner in writing.		

J. Valves - All valves shall be manufactured in accordance with the current appropriate AWWA Standard.

1. Resilient Seated Gate Valves - Resilient seated gate valves shall be designed and fabricated in accordance with the current AWWA Standard C-509 or C-515. The basic design of the gate valves shall have a cast iron body, elastomer encapsulated iron disc, bronze stem, and operating nuts with non-rising stem design. Valves 16-inches and larger shall be equipped with right angle gears (bevel gearing) for horizontal installation. The valve working pressure for all sizes shall be a minimum of 250 psig with a test pressure of 500 psig.

a. Materials and Construction - Valves shall open counterclockwise with a 2-inch square iron operating nut secured to the valve stem by a corrosion resistant Type 304 stainless steel nut that threads onto the valve stem. The valve stem shall be made of high tensile strength bronze and shall be of one-piece construction sealed by O-Rings. The thrust collar shall be secured in place by a stuffing box or bonnet cover with a thrust washer located above the thrust collar. Valve construction shall be so that upper O-Rings can be replaced with the valve in service. The disc shall be cast iron encapsulated with an EPDM rubber material bonded in accordance with ASTM D429 and shall be secured to the threaded stem by a bronze nut. The disc shall effect a seal that is bubble-tight at-250 psig.

b. Body-Disc-Bonnet-Operating Nut Material - Cast ductile iron construction in accordance with current AWWA Standard C-509 and C-515 and AWWA Standard C-153. Body bolts shall be equipped with square or hex head bolts for easy removal.

c. Corrosion Resistant Coatings - All interior and exterior cast iron surfaces shall be coated as noted herein for ductile iron pipe.

d. Body Sizing - Valve body length shall be per ASME/ANSI B16.20 for the type of end connections specified. In the fully open position, the valve internal bore shall be smooth and obstruction-free without cavities or projections that could accumulate solids. The internal cross-sectional area of the valve shall be approximately equal to the nominal cross-sectional area of the adjoining pipe.

e. End Connections -

1) Valves shall be furnished with mechanical joint end connections, complete with accessory kits, unless otherwise specified on the plans.

2) When flanged ends are specified, they shall be flat face class 125, conforming to ASME/ANSI B16.1 with bolt holes straddling the vertical center line.

Approved Manufacturers - Resilient Seated Gate Valves						
Manufacturer & Specs			**Valve Body Connections**			
			Mechanical Joint	**Flange & Mechanical Joint**	**Flanged End**	**Mechanical Joint for Tapping**
			(MJxMJ)	**(FLGxMJ)**	**(FLGxFLG)**	**(MJxSF)**
American Flow Control		Size:	2" - 12"	2" - 12"	2" - 12"	2" - 12"
		Model No.:	AFC2500	AFC2500	AFC2500	AFC2500
Clow	C-509	Size:	2" - 12"	3" - 12"	2" - 12"	3" - 12"
		Model	F-6100	F-6106	F-6102	F-6114
	C-515	Size:	4" - 48"	4" - 48"	4" - 48"	4" - 24"
		Model	F-6100	F-6106	F-6102	F-6114
Kennedy	C-509	Size:	2" - 12"	3" - 12"	2" - 12"	4" - 12"
		Model	8571SS	8572SS	8561ASS	8950SS
	C-515	Size:	2" - 12"	3" - 12"	2" - 12"	4" - 12"
		Model	7571SS	7572SS	7561SS	7950SS
M&H	C-509	Size:	2" - 12"	3" - 12"	2" - 12"	4" - 12"
		Model	4067-01	4067-13	4067-02	4751-01
	C-515	Size:	2" - 16"	3" - 16"	2" - 16"	4" - 16"
		Model	7571	7572	7561	7950
Others as approved by Owner in writing.						

2. Resilient Seated Tapping (Gate) Valves - Resilient seated tapping gate valves shall be designed and fabricated in accordance with the specifications for resilient seated gate valves noted above.

a. Body Sizing - Valve body length shall be per ASME/ANSI B16.20 for tapping valves. Tapping valves shall conform to Specification AWWA C509 or C515, latest revision, covering gate valves except as modified for passage and clearance of tapping machine cutters. The opening through the valve shall be at least 1/4-inch larger than nominal valve diameter. Tapping valves shall allow full size shell cutters to be used.

b. End Connections - Valves shall be furnished with one end of the body with projecting face flange in accordance with specification MSS SP-60 for tapping valve/saddle connections to bolt to a standard tapping sleeve and the other end for mechanical joint.

3. Plug Valves –

a. Plug valves (Above Ground) shall be of the non-lubricated, 100 percent port eccentric type with resilient faced plugs with flanged ends, furnished with all necessary joint materials. Valves are to be rated for 150 psi (non-shock working pressure), cast-iron body, nickel seat, and hard rubber Hycar coated plug with a flushing port. Valves shall be installed with the seat on the downstream side of the flow path, to provide a positive seal when closed. Valve shall include hand- wheels for operation. Valves shall be as manufactured by M&H Style 820 X-centric, Dezurik or approved equal. All interior and exterior ferrous surfaces shall be coated as noted herein for ductile iron pipe.

b. Plug valves shall have an allowable capacity equal to 100% of the adjacent pipe area, and shall allow pigging.

c. Operation: The construction of the valve shall be eccentric utilizing a quarter-turn manual operation, so that the opening movement of the valve results in the plug rising off the seat rather than sliding from its seat. Valves 16-inches and larger shall be equipped with right angle gears (bevel gearing) for horizontal installation.

d. Construction and Performance: Plug valves shall meet or exceed AWWA C504-80 and ANSI B16 1-1975 requirements.

4. Combination Air Release and Vacuum Valves –

a. General – Forcemains shall be laid so as to minimize the number of high points. Air release valves shall be installed at all high points in forcemains shown on the project plans. Exact locations of air release valves shall be field determined. In all cases, installation should be in the furthest downstream portion of each high point.

The valve shall be designed to operate with liquids carrying solid particles such as raw sewage. The air and vacuum air valve shall discharge air at high flow rates during the filling of the system and admit air into the forcemain at high flow rates during its drainage. High velocity air cannot blow the float shut. Sewage entry to the lower portion of the valve will cause the sealing of the valve. At any time during system operation, should internal pressure of the system fall below atmospheric pressure, air will re-enter the system.

b. Working pressure range: 3 – 230 psi. Testing Pressure: 360 psi.

c. The valve's design shall prevent any contact between sewage and the sealing mechanism by creating an air gap at the top of the valve, under all operating conditions.

d. The conical body shape shall be designed to maintain the maximum distance between the liquid and the sealing mechanism.

e. A spring-loaded joint is to be furnished between the stem and the upper float. Vibrations of the lower float will not unseal the automatic valve. Release of air will occur only after enough air accumulates.

f. The funnel-shaped lower body shall be designed to ensure that residue sewage matter will re-enter the forcemain and will not remain in the valve.

g. Maintenance flushing shall be provided while the valve is under pressure, by opening a full port type 316 S.S. ball valve in the valve's lower body.

h. All inner metal parts of the valve shall be made of stainless-steel SAE 316.

i. Maximum working temperature 203°F.

j. The valve shall be provided with an AWWA/ANSI C110 flanged joint at the base of the body.

k. The valve shall be furnished with an AWWA C517 resilient seat, cast iron eccentric plug valve with a hand wheel operated, worm gear actuator.

Approved Manufacturers		
Manufacturer	Size	Model
ARI Flow Control Accessories	2"	D-025 (plastic)
	4" and Larger	D-023 (Stainless Steel)
Others as approved by Owner in writing.		

5. Horizontal Swing-Check Valves – These horizontal swing-check valves shall be the clear waterway type - designed and fabricated in accordance with the current AWWA Standard C508. Horizontal swing-check valves shall be iron body, bronze mounted with flanged ends rated for operation at 125 psi. The cover shall be cast iron with cover bolts of rust-proofed steel. The seating surfaces shall be bronze, and the disc shall be ductile or grey iron. The shaft shall be stainless steel with corrosion resistant bearing(s) at each end. Where extended outside the body, the shaft shall be sealed with double O-rings. There shall be a grease fitting between the O-rings. The check valve shall be of the adjustable external spring-loaded type. The Contractor shall adjust the tension in the spring as necessary to prevent slamming of the valve upon closing. All interior and exterior ferrous surfaces shall be coated as noted herein for ductile iron pipe.

K. Valve Vaults and Boxes –

1. Valve boxes shall be provided for all direct buried valves. Use nominal (5 ¼) inch cast-iron, screw-type pipe shaft with cover and base casting. The box top shall be set at finished grade and encased with a concrete ring in unpaved areas. Each valve box shall be furnished with a drop-in cover marked "SEWER".

2. Valve Vaults or Chambers – All valves which are not designed for direct burial shall be installed in vaults, which shall be constructed from standard precast concrete manhole sections. They shall be sized to allow sufficient room for maintenance and repair in situ.

L. Line Stops - Line stops are to be used where specified to temporarily stop water flow without depressurizing the entire line. The line stop parts and installation equipment are to be rated at a minimum of 150 psig working pressure unless otherwise specified.

1. Materials and Construction - Tapping saddles shall have 360-degree clamping on the main. All tapping saddles shall be fabricated of 304 Stainless Steel. All bolts and fasteners are to be 304 Stainless Steel, and the saddle shall be installed with Buna-N or neoprene rubber full facing gasket.

a. The stopping device attaching nozzle to be vendor's standard with connecting threads or flange face, and the nozzle I.D. to be manufactured with a shelf to provide a position stop for the closure plug.

b. The closure plug is to be fabricated carbon steel, ductile iron, or malleable iron with at least one Buna-N or neoprene O-Ring seal on the outside diameter.

2. Corrosion-Resistant Coatings - Non-stainless steel, permanently installed parts to have Manufacturer's standard red or black water-based epoxy coating on exterior. Fittings shall be ceramic epoxy lined as specified herein for the adjacent pipe.

3. Connection - Tapping saddle shall be fabricated with dimensions to fit on concrete, steel, CA, PVC, CI, DI main as specified.

4. Installation - Temporary line stops shall only be installed by vendor personnel or Contractor Personnel trained and certified for installation by the vendor.

M. Valve Insertions -

Approved Manufacturers (Main Sizes 4-inch – 42-inch)	
Manufacturer	**Contact**
Hydra-Stop, Inc.	Phone: 800-538-7867
JCM 440	Phone: 800-527-8482
Romac	Phone: 800-426-9341
Others as approved by Owner in writing.	

N. Location Aids - All new forcemain and service line installations shall include an approved method for locating lines from the ground surface after completion.

1. Tracer Wire - Tracer wire for forcemain lines shall be minimum 12-gauge copper with green PVC insulation for open trench installation. For trenchless installation, 8-gauge copper with green PVC insulation shall be used. Tracer wire systems shall be electrically continuous covering all mains and services within the project. Wire-to-wire connections shall be made with silicone-filled wire nuts. Wire-to-appurtenance attachments shall be made with lug-type terminals. Wire shall be secured to the top of each pipe joint with nylon ties or PVC tape placed on 10-foot intervals. Wire shall be secured to pipe with green colored PVC Tape.

Approved Manufacturers (Tracer Wire Silicone-filled Wire Nut Connectors)	
Manufacturer	**Model**
Ideal Industries	Twister® DB Plus
King Technology, Inc.	Failsafe™
Others as approved by Owner in writing.	

2. Curb Markers – Curb marker base material must be 30 ml. non-yellowing UVI plastic. UV resistant inks with a minimum 7-year rating will be used to decorate the marker surface. A clear urethane dome no less than 60 ml shall be applied to the surface. The dome must not yellow or pit. It must be self-healing and have a Durometer hardness of D-60. Marker must have a 12-year written warranty. Copy to be supplied by vendor. Marker must meet ADA minimum recommendations for slip resistance. Markers shall be as manufactured by DAS Manufacturing, Inc. or approved equal.

   a. Curb Marker Adhesive - Adhesive must permanently affix markers to concrete, asphalt and cast iron. Adhesive must be ready to use requiring no special surface preparation. Adhesive must have a shelf life of at least one year. Adhesive must be black in color and remain resilient for a minimum of twelve years. Adhesive must be available in a 5 oz. Re-sealable Squeeze Tube.

   b. Provide curb markers per the following table:

CURB MARKER SPECIFICS			
TYPE	**Nominal Size**	**Color**	**Designation**
Sewer Valve	2.5”	Green	#2.5 NSV
Sewer Service	2.5”	Green	#2.5 NSW

3. Composite Utility Marker

The Composite Utility Marker shall be a single piece marker capable of simple, permanent installation by one person using a manual driving tool. Upon proper installation, it shall resist displacement from wind and vehicle impact forces. The marker shall be of a constant flat "T" cross sectional design with reinforcing support ribs incorporated longitudinally along each edge to provide sheeting protection and structural rigidity. The bottom end of the marker shall be pointed for ease of ground penetration.

The Marker shall be constructed of a durable, UV resistant, continuous glass fiber and resin reinforced, thermosetting composite material which is resistant to impact, ozone, and hydrocarbons within a service temperature range of -40°F to +140°F.

The marker shall be pigmented throughout the entire cross-section so as to produce a uniform color, which is an integral part of the material. Ultraviolet resistant materials shall be incorporated in the construction to inhibit fading or cracking of the delineator upon field exposure. Color shall coincide with utility it is marking (i.e., blue for water, green for sewer, etc.).

Composite utility markers shall be as manufactured by Carsonite International Corporation, or approved equal. All markers shall be installed with a decal as noted on the typical details.

2.6 LOW PRESSURE SEWER SERVICE LINES

Service Laterals – Typical Low pressure sewer service laterals for a single-family residence shall be 1-1/2-inch green tubing with tracer wire (#12 gauge with green insulation). Larger services may be used if approved by the Owner. Services installed under the roadway shall be encased in 2-inch green PE/PVC tubing/piping. Piping shall be as specified herein.

PART 3 – EXECUTION

3.1 GENERAL

The Contractor shall provide all labor, equipment and materials as required to install all pipes, valves, fittings, and other appurtenances as indicated on the construction plans or as specified in the Contract documents.

3.2 SEWAGE FORCEMAIN LINE SEPARATION FROM POTABLE WATER LINES

New or relocated sanitary sewer forcemains must be laid to provide a horizontal separation of at least six feet, and preferably ten feet, between the outside of the sewer forcemain and the outside of the potable water pipe. In locations where it is not feasible to comply with this requirement the Contractor shall refer to the conflict details on the construction plans.

3.3 PIPE INSTALLATION

The Contractor shall utilize equipment and methods in accordance with pipe Manufacturer's requirements and standard construction practices to ensure pipe installation to line and grade as indicated.

A. Trench Excavation - Refer to Section 02221-"Trench Excavation Backfill and Compaction" or Section 02514-"Base Replacement & Resurfacing for Trenches". Contractor shall maintain a minimum of 30 inches and maximum of 36 inches of cover below finished grade unless otherwise approved by the Owner or its representative in writing.

B. Alignment - Pipe shall be installed along the alignment indicated by the construction plans. Accomplish horizontal and vertical changes in alignment of pipe with bends or other appropriate fittings. Joint deflection shall not exceed the recommendations of the pipe Manufacturer.

C. Pipe Preparation - Offloading, handling and installation of pipe shall be in accordance with AWWA standards and applicable sections of this document. The Contractor shall clean the interior of all pipes, fittings, and joints prior to installation. Pipes shall be inspected for defects prior to installation. Damaged pipe shall be rejected and removed from the project.

D. Pipe Installation -

1. Install pipe only when weather and trench conditions are suitable. Do not lay pipe in water. Join pipe in accordance with Manufacturer's recommendations.

2. Provide initial backfill or anchoring as necessary to prevent displacement and preserve alignment after establishing final position.

3. Encase forcemain pipe in steel casing or use ductile iron pipe when crossing under pipe, conduit, or structure when a 6-inch separation distance cannot be maintained. This protection shall extend a minimum of 5 feet beyond crossed structure.

E. Crossings - Where the crossing of a roadway, water body, rail, or other obstacle requires trenchless installation, the materials and installation methods shall conform to Section 02300-“Horizontal Directional Drilling” or Section 02310-“Jack and Bore”, as applicable.

F. Protection - Prevent the introduction of foreign matter into the pipe at all times. Close open ends of pipe with watertight fitting closures or plugs. Do not let water fill trench, but include provisions to prevent flotation should water control measures prove inadequate. Remove water, sand, mud, and other undesirable materials from trench before removal of pipe closure piece.

G. Cutting - PVC or PE pipe shall be cut in a neat workmanlike manner, and the spigot end shall be beveled per Manufacturer's recommendation. Ductile iron pipe shall be cut in accordance with Manufacturer’s recommendation. Do not allow excessive heat to develop. Smooth and bevel cut end as per Manufacturer’s recommendations. Use of pipe with damaged lining is unacceptable.

H. Closure Pieces - Closure pieces shall only be used where called for on plans. Closure may be accomplished with sleeve coupling as long as its length is such that gaskets are not less than 3 inches from pipe ends.

I. Restraints and Thrust Blocking - Mechanical joint restraints shall be furnished and installed for all forcemain line fittings and appurtenances. Restraints and thrust blocks are required for 90-degree bends, tapping sleeves, tees, dead-ends.

3.4 APPURTENANCE INSTALLATION

A. Valves - Valves shall be installed with operating stems vertical for valves 16 inch and smaller. For valves larger than 16 inches, the valve may be installed horizontally. Horizontal valves shall be provided with a right-angle gear drive and flush port piping to the lower clean-out. Extensions shall be provided if the valve operating nut is greater than 24 inches below finish grade. Valves shall be installed on a suitable bearing surface as shown on the project plan details, to prevent vertical displacement.

1. Air release valves shall be located and installed at the down-stream end of all high points as shown in the details and on the approved construction plans.

2. Check valves, complete with vaults if applicable, shall be installed at locations shown in the approved construction plans in accordance with the Manufacturer’s instructions.

B. Valve Boxes - Valve boxes shall be centered on the valve. The earth shall be compacted around each valve box to a distance of 4 feet on all sides of box, or to undisturbed trench face if less than 4 feet. An 18-inch diameter by 4-inch-thick collar shall be constructed and sloped to direct water away from the valve box. In lieu of the constructed collar, a 24-inch by 4-inch-thick pre-cast, sloped, concrete collar may be used.

C. Tracer Wire - Tracer wire shall be installed on all new forcemains and on all new pressure sewer service lines. The tracer wire shall be placed directly above the pipe and electrically continuous throughout the project. Tracer wire shall be secured to the pipe with PVC tape the same color as the wire insulation, at a maximum of 10-feet on center between tapings. The tracer wire shall be brought to the ground surface at each valve location in accordance with the details. Splices and/or connections in the tracer wire shall be installed with silicone-filled wire nuts designed for direct burial.

3.5 SERVICE LINE INSTALLATION

A. General - The Contractor shall install individual services with tracer wire from the new main to a convenient point on the right-of-way or property line for each house, building or unit that is proposed for service. New services for undeveloped lots shall be located 1 foot from the common property line. The installation of service lines shall be in accordance with the requirements for forcemain installation, (See Section 3.3 above).

B. Service Line Connections - Service lines shall be installed in accordance with the details. Tubing shall be installed in one continuous length from corporation stop to curb stop with no intermediate fittings. Service lines damaged after initial installation but before acceptance may be repaired by means of a single splice, except that no repair fittings will be permitted under any paving. Service taps shall be made with a tapping machine designed for the pipe material being tapped. Other types of tapping machines may be used upon prior approval by the Owner or its representative.

C. Long Service Lines - Unless otherwise noted on plans, HDPE pipe and tubing shall be installed at the shallowest depth that can safely and reasonably be achieved (but no less than 36 inches minimum). Depth shall consider all utility conflicts, bend radius of the pipe, and bend radius of the drill stem. Where utilities cross under roads, the service line shall be encased in accordance with these specifications and the typical details. The depth of cover shall comply with applicable permits and shall be adequate to provide reasonable measures to avoid damage to the road surface and/or road base.

3.6 TAPS ON PRESSURIZED LINES

Taps for service lines of 2-inch and smaller shall be made using a tapping saddle. The Contractor shall perform taps on pressurized lines for the installation of pipes other than service lines of 2-inch and smaller in accordance with these requirements:

A. Materials - All materials used for taps on pressurized lines shall meet the requirements of these specifications. Tapping sleeves shall be properly sized for the pipe being tapped. Resilient seated tapping valves shall be furnished with special end connections. All other material used to accomplish the tap shall meet the standards set forth by the relevant AWWA Standards.

B. Procedure - The Contractor shall notify the Owner or its representative three working days in advance of work. The Contractor shall in the presence of the Owner or its representative:

1. Expose the existing pipe at the location shown on the plans, and clean the section of the pipe to receive the tapping sleeve.

2. Check the tapping sleeve and valve for defects and make sure the gate fully retracts in the valve to allow the shell cutter free passage.

3. Assemble the tapping sleeve on the pipe, then install the tapping valve.

4. Hydrostatically pressure test the tapping sleeve and valve after it has been assembled on the pipe main using the test plug on the sleeve. The test shall be 150 psi minimum. The duration of the test shall be 15 minutes.

5. Provide adequate joint restraint on the branch piping in accordance with the manufacturer's recommendations and the Joint Restraint charts provided on the construction plan details. Also, provide a concrete pad or suitable bearing surface sufficient to support the weight of the sleeve, valve, and tapping machine.

6. Assemble an approved tapping machine and proceed to make the necessary cut-in accordance with the recommendation of the tapping machine Manufacturer. Approved tapping machines shall be:

   a. In good working condition.

   b. Designed for and having a cutting bit for the pipe material to be cut.

   c. Equipped with a depth of cut gauge.

   d. Designed to capture the coupon.

   e. Equipped with the Manufacturer's recommended diameter shell cutter for the tap to be made.

   f. Tapping machine power head to be hydraulic or pneumatic drive; use of electric motor drives expressly prohibited.

7. The following tapping chart may be used for field reference only:

Tap Size Reference Chart		
Nominal Main Size	**Tapping Valve ID AWWA Standard**	**Tapping Machine Shell Cutter OD**
2-inch	2 1/8-inch	1½ -inch
3-inch	3 1/8-inch	2½-inch
4-inch	4 1/4-inch	3½ -inch
6-inch	6 1/4-inch	5½ -inch
8-inch	8 1/4-inch	7½ -inch
10-inch	10 1/4-inch	9½ -inch
12-inch	12 1/4-inch	11½ -inch
14-inch	14 1/4-inch	Per Manufacturer's Recommendation.
16-inch	16 1/4-inch	Contractor shall submit shop drawings for valves and tapping machine for approval, prior to use. Per Manufacturer's Recommendation.
18-inch	18 1/4-inch	
20-inch	20 1/4-inch	
24-inch	24 1/4-inch	

8. Tap coupon shall be given to the Owner or its representative. If the coupon is lost in the main, Contractor shall, at his expense, dismantle main to retrieve the coupon. Main will be reassembled, and pressure tested as required at Contractor's expense.

PART 4 - ACCEPTANCE REQUIREMENTS

4.1 INSPECTION

Upon completion of the installation, the system shall be inspected to ascertain that valves, fittings, etc. are located in conformance with the plans, and confirm that all 'as-built' measurements have been accurately taken. The Owner or its representative shall observe all appropriate activities related to properly placing the line in service including flushing, pressure, and leakage testing. Final connections shall be accomplished after final clearance of lines. Tracer wire shall be tested for continuity by the Contractor with the Owner or its representative present. The Contractor, with the Owner or its representative, shall make sure all valves are open.

4.2 NEW FORCEMAIN CLEANING

All newly installed forcemain lines shall be flushed with potable water to remove any sediment, solids and/or foreign matter prior to testing. The Owner will make water available to the Contractor. Flushing shall be conducted at a sufficient velocity to clear the pipe. Discharge of flushing water must be through a 2-inch diameter pipe (or larger) and must be controlled so as not to cause any property damage. Chlorinated water must be disposed of in an acceptable manner. Flush water source connection shall incorporate backflow preventer and meter when required by the Owner or its representative.

A. If flushing is unsuccessful in satisfactorily removing debris from the forcemain or for larger diameter lines (12" or larger) if designated on the plans, cleaning shall be performed by swabbing (pigging). Pipes shall be flushed and swabbed a minimum of 3 passes until line is clear. To facilitate this process, pigging launch stations and receiving pits shall be installed and incorporated into system.

4.3 PRESSURE/LEAKAGE TEST

A. General - All newly installed forcemain lines and appurtenances shall be pressure/leak tested to assure the strength of materials and quality of workmanship of the installation. Testing shall be conducted in accordance with the details and the requirements of AWWA Manual 23 for PVC and other flexible pipe or AWWA C600 for Ductile Iron Pipe. Leakage testing may be conducted concurrently with the pressure test.

B. Procedure -

1. Contractor shall notify the Owner or its representative three working days prior to a scheduled test. Tests are to be conducted in segments not to exceed three thousand (3,000) feet of pipe. Water in the new line shall be pumped up to a pressure of 150 psi minimum. This pressure shall be maintained for a minimum of two (2) hours by pumping a quantifiable amount of water into the line and record the amount of water added during the test period. This represents the leakage.

2. Pressure/leakage tests shall be deemed acceptable when leakage does not exceed that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133200} \text{ (or 11.65 gpd/mi/inch/dia)}$$

or $$L = \frac{ND\sqrt{P}}{7400} \text{ for DI pipe 18' lengths}$$

or $$L = \frac{ND\sqrt{P}}{6600} \text{ for PVC pipe 20' lengths}$$

where:

L = Maximum leakage, in gallons per hour.
S = Length of pipe under test, in feet.
N = Number of pipe joints in segment under test.
D = Nominal internal diameter of pipe, in inches.
P = Average actual leakage test pressure, psig.

3. Record all data for submission with as-built plans.

4. The Owner or its representative shall be present during test.

5. Refit and replace all pipe not meeting the leakage requirements. Repair clamps are not permitted.

6. Repair all visible leaks regardless of the amount of leakage.

4.4 OTHER CONNECTIONS

After new system piping has been satisfactorily tested and cleared for use, make any approved additional connections to the pre-existing distribution system. When total system is approved for use, the Owner or its representative shall verify that the Contractor has opened all interior valves as required. Valves connecting new installations to Owner's existing distribution system shall then be opened by the Owner or its representative.

END OF SECTION 025760

SECTION 026000 - STORMWATER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

B. Florida Department of Transportation, Standard Specifications for Road and Bridge Construction (FDOT Specs), Sections 425 and 430, latest edition. Work shall comply with requirements of FDOT Specs as modified herein.

1.2 SUMMARY

A. This Section includes stormwater system piping and appurtenances. All labor, material, equipment, appurtenances, services, and other work or costs necessary to construct the facilities and place them into operation shall be furnished by the Contractor.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 2 Section 022000 “Earthwork” for excavation and backfill required for stormwater system structures.
2. Division 2 Section 022210 "Trench Excavation, Backfill, and Compaction" for pipework installation.
3. Division 2 Section 025140 "Base Replacement and Resurfacing for Trenches" for pipework installation across roadways.
4. Division 2 Section 025150 "Cast-in-Place Concrete (Sitework)" for concrete and reinforcement requirements.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract.

B. Product data for storm drainage piping and specialties.

C. Shop drawings for precast concrete storm drainage manholes and catch basins, including frames, covers, and grates.

D. Shop drawings for cast-in-place concrete or field-erected masonry storm drainage manholes and catch basins, including frames and covers.

E. Coordination drawings as required by Owner or its representative showing pipe sizes, manholes and catch basins locations and elevations. Include details of underground structures and connections. Show other piping in the same trench and clearances from stormwater system piping. Indicate interface and spatial relationship between piping and adjacent structures.

F. Sustainable Design Submittals:

1) Product Certificates: For products and materials required to comply with requirements for regional materials, indicate location and distance from project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.4 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to stormwater systems.

B. Utility Compliance: Comply with local utility regulations and standards pertaining to stormwater systems.

1.5 PROJECT CONDITIONS

A. Site Information: Perform site inspection, research public utility records, and verify existing utility locations. Verify that stormwater system piping may be installed in compliance with design plans and referenced standards.

1. Locate existing stormwater system piping and structures that are to be removed, abandoned, or closed.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate connection to existing drainage system with Owner.

B. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include but are not limited to the following:

1. Roof Drain Piping System:

a. Advanced Drainage Systems (ADS).

b. PVC - Comply with ASTM D3034/ASTM D1784 for pipe and fittings. Use single elastomeric gasket push-on joints complying with ASTM D3212. Provide pipe and fittings with minimum SDR-35 dimension ratio.

2. Stormwater piping system – meet the requirements of FDOT specifications latest edition.

Reinforced Concrete Pipe	Section 449
Round Rubber Gaskets	Section 942
Corrugated Polyethylene Pipe	Section 948
Polyvinyl Chloride (PVC)	Section 948
Polypropylene Pipe	Section 948

a. Pipe shall be as specified on the Construction Drawings.
b. Concrete Pipe shall be conventional steel reinforced RCP – Class III or elliptical equivalent (excludes fiber reinforced concrete pipe). All joints shall be filter wrapped. The pipe system shall be water-tight prior to acceptance.

2.2 PIPE AND FITTINGS

A. General: Provide pipe and pipe fitting materials compatible with each other. Where more than one type of material or product is indicated, selection is installer's option.

All pipe will be inspected upon delivery. Pipe which does not conform to the requirements of this specification shall be rejected and immediately removed by the Contractor. The Contractor shall furnish and provide all labor necessary to assist the Owner or its representative in inspecting the material.

B. Reinforced Concrete Pipe and Fittings: ASTM C 76, Class III, Wall B, for rubber gasket joints.

1. Gaskets: ASTM C 443, rubber.

C. Couplings: Rubber or elastomeric sleeve and stainless-steel band assembly fabricated to match outside diameters of pipes to be joined.

1. Sleeves: ASTM C 443, rubber for concrete pipe; and ASTM F 477, elastomeric seal for plastic pipe. Sleeves for dissimilar or other pipe materials shall be compatible with pipe materials being joined.

2. Bands: Stainless steel, one at each pipe insert.

D. Couplings: Rubber or elastomeric compression gasket, made to match pipe inside diameter or hub, and adjoining pipe outside diameter.

1. Gaskets: ASTM C 443, rubber for concrete pipe; and ASTM F 477, elastomeric seal for plastic pipe. Gaskets for dissimilar or other pipe materials shall be compatible with pipe materials being joined.

2.3 MANHOLES

A. Precast Concrete Manholes: ASTM C 478, precast reinforced concrete, of depth indicated with provision for rubber gasket joints.

1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having a separate base slab or base section with integral floor.
2. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
3. Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top of cone to match grade rings.
4. Grade Rings: Provide reinforced concrete rings, of 6 to 9 inches total thickness and match 24-inch diameter frame and cover.
5. Gaskets: ASTM C 443, rubber.
6. Steps: Cast into base, riser, and top sections sidewall at 12-to 16-inch intervals.
7. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
8. Channel and Bench: Concrete.

B. Cast-in-Place Manholes: Reinforced concrete of dimensions and with appurtenances indicated.

1. Bottom, Walls, and Top: Reinforced concrete.
2. Channel and Bench: Concrete.
3. Steps: Cast into sidewall at 12- to 16-inch intervals.

C. Manhole Steps: Wide enough for an adult to place both feet on one step and designed to prevent lateral slippage off the step.

1. Material: Steel-reinforced plastic.

D. Manhole Frames and Covers: Castings shall be gray cast iron conforming to ASTM-A48 Class 30, free from blowholes, shrinkages, or other imperfections. Units shall be of heavy-duty construction capable of supporting an H-20 loading. Units used in curb inlets shall be U.S. Foundry Model 1265, Type E, or approved equal.

All other units shall be U.S. Foundry Model 170, Type E, or equal. All units shall bear the lettering "STORM SEWER" cast into cover. All proposed substitutes must have equal or greater opening sizes and weights.

2.4 CLEANOUTS

A. In Paved Areas: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, grooved cast-iron cover.

B. In Unpaved Areas: Provide PVC cleanouts with PVC screw cap.

C. Cleanouts shall be one-way or two-way as specified on the Construction Drawings.

2.5 CATCH BASINS

A. Precast Concrete Catch Basins: Construct In accordance Florida Department of Transportation, Standard Specifications for Road and Bridge Construction (FDOT Specs) Section 449.

1. Base Section: Base riser section and separate base slab, or base riser section with integral floor.
2. Riser Sections: Sections shall be of lengths to provide depth indicated.
3. Top Section: Flat slab type with opening to match grade rings.
4. Grade Rings: Provide reinforced concrete rings, of 6 to 9 inches total thickness.
5. Gaskets: ASTM C 443, rubber.
6. Steps: Cast into riser sidewall at 12- to 16-inch intervals.
7. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
8. Channel and Bench: Concrete.

B. Cast-in-Place Catch Basins: Reinforced concrete of dimensions and with appurtenances indicated.

1. Bottom, Walls, and Top: Reinforced concrete.
2. Channel and Bench: Concrete.

C. Catch Basin Steps: Wide enough for an adult to place both feet on one step and designed to prevent lateral slippage off the step.

1. Material: Steel-reinforced plastic.

D. Catch Basin Frames and Grates: Per FDOT Standard Frame and Grates.

E. Curb Inlets: Precast concrete, brick, or other materials, of dimensions conforming to FDOT standards.

2.6 OUTFALLS

A. General: Construct of reinforced concrete pipe, head wall, apron, tapered sides, and with rip rap, as indicated.

2.7 MASONRY

A. Bricks for accessories shall be hard common clay brick.

Mortar shall be one part Portland cement and three parts masonry sand to which shall be added lime putty in the amount of 50% of the volume of cement. Special commercial mortar mixes may be used if approved by the Owner or its representative. All masonry materials shall conform to the latest applicable ASTM specifications. Set all masonry units in full beds of mortar, with full joints and strike all joints flush. Masonry reinforcements shall be galvanized Dur-O-Wal, or approved equal, and shall be installed at every other bed joint.

2.8 CURING MATERIALS

A. Conform to TT-C-800, with 30-percent minimum solids content.

B. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yard, complying with AASHTO M-182, Class 2.

C. Moisture-Retaining Cover: One of the following, complying with ASTM C-171.

1. Waterproof paper
2. Polyethylene film
3. White burlap-polyethylene sheet

D. Clear Solvent-Borne Liquid Membrane-Forming Curing Compound: This is a solvent-borne membrane-forming curing compound. Revise to Type II and verify manufacturer's products when a white pigmented curing compound is required. Do not use if waterborne low-VOC emissions compounds are required. ASTM C-309, Type I, Class A or B, wax free.

E. Clear Waterborne Membrane-Forming Curing Compound: This is a waterborne membrane-forming curing compound. Use when low VOC emissions are required. ASTM C-309, Type I, Class B.

1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 mg per liter.

F. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete surfaces for temporary protection from rapid moisture loss.

PART 3 - EXECUTION

3.1 PREPARATION OF FOUNDATION FOR BURIED STORMWATER SYSTEMS

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid, and backfill with clean sand or pea gravel to indicated level.

C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamped sand backfill. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

3.2 INSTALLATION - GENERAL

A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of the underground stormwater system piping. Location and arrangement of piping layout consider many design considerations. Install the piping as indicated, to the extent practical.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert, unless approved otherwise by the Owner or its representative. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

The pipe shall be carefully examined for defects and the inside cleaned. After placing pipe in the ditch, the ends shall be wiped free from all dirt, sand, and foreign material. All pipe and joints shall be made, handled, and installed in strict accordance with the manufacturer's recommendations and instructions.

1. Install concrete pipe in accordance with applicable provisions of American Concrete Pipe Association "Concrete Pipe Field Manual", unless otherwise indicated.

2. Place concrete pipe with elliptical reinforcing so that the reference lines indicating top of pipe are not more than 5 degrees from vertical plane through longitudinal axis of pipe.

C. Use manholes or catch basins for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing storm sewer is indicated. The Owner or its representative shall be notified at least 24 hours before the pouring of any concrete is to be started, and such pouring shall not be started until the reinforcement has been approved as placed.

D. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

E. Install piping pitched down in direction of flow, at minimum slope per plans.

F. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed, by tunneling, jacking, or a combination of both.

3.3 PIPE AND TUBE JOINT CONSTRUCTION AND INSTALLATION

A. Join concrete pipe and fittings with rubber gaskets in accordance with ASTM C 443, and install piping in accordance with applicable provisions of ACPA "Concrete Pipe Installation Manual."

C. Join different types of pipe with standard manufactured couplings and fittings intended for that purpose.

3.4 MANHOLES

A. General: Install manholes complete with accessories as indicated. Form continuous concrete or split pipe section channel and benches between inlets and outlet. Set tops of frames and covers flush with finish surface where manholes occur in pavements. Elsewhere, set tops 3 inches above finished grade, unless otherwise indicated.

B. Place precast concrete manhole sections as indicated, and install in accordance with ASTM C 891.

C. Construct cast-in-place manholes as indicated.

D. Provide rubber joint gasket complying with ASTM C 443 at joints of sections.

3.5 CATCH BASINS

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.6 OUTFALLS

A. Construct outfalls of reinforced concrete which will attain 28-day compressive strength of not less than 4000 psi.

3.7 TAP CONNECTIONS

A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work. Connections shall be watertight.

B. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap, with not less than 6 inches of 4000-psi 28-day compressive-strength concrete.

C. Make branch connections from side into existing 15 to 18-inch piping by removing section of existing pipe and installing wye fitting into existing piping. Encase entire wye with not less than 6 inches of 4000-psi 28-day compressive-strength concrete.

D. Make branch connections from side into existing 24-inch or larger piping or to underground structures by cutting opening into existing unit sufficiently large to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

1. Provide concrete that will attain minimum 28-day compressive strength of 4000 psi, unless otherwise indicated.

2. Use epoxy bonding compound as interface between new and existing concrete and piping materials.

E. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.

3.8 CLOSING ABANDONED STORMWATER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping that is indicated to remain in place. Provide sufficiently strong closures to withstand hydrostatic or earth pressure that may result after ends of abandoned utilities have been closed.

1. Close open ends of concrete pipe or structures with not less than 8-inch-thick brick masonry bulkheads.

2. Close open ends of other piping with plastic plugs, or other acceptable methods suitable for size and type of material being closed. Wood plugs are not acceptable.

B. Abandoned Structures: Remove structure and close open ends of the remaining piping or remove top of structure down to not less than 3 feet below final grade; fill structure with stone, rubble, gravel, or compacted dirt, to within 1 foot of top of structure remaining, and fill remainder of structure with concrete.

3.9 FIELD QUALITY CONTROL

A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction. All sampling and testing shall be conducted by a testing laboratory under the direction of a Professional Engineer, licensed in the State of Florida, at the contractor's expense. Submit test results directly to the Owner or its representative.

B. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.

2. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.

3. Flush piping between manholes, to remove collected debris.

C. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after pipe between manholes has been installed, cleaned and approximately 2 feet of backfill is in place, and again at completion of project. Each section of pipe between structures is to show from either end on examination, a full circle of light. Each appurtenance to the system shall be of the specified size and form, to be neatly and substantially constructed, with the top set permanently to exact position and grade.

2. If inspection indicates poor alignment, debris, displaced pipe, infiltration, bellies, or other defects, correct such defects, and re-inspect. All repairs shown necessary by the inspections are to be made, broken or cracked pipe replaced, all deposits removed, and the pipe left true to line and grade as herein specified, or shown on the plans, entirely clean and free from abnormalities and ready for use.

D. Limits of Infiltration and Methods of Testing: The allowable limit of groundwater infiltration for the entire system of new stormwater systems or any one trunk, or interceptor shall be in complete accordance with ASTM C425-71T and shall not exceed a limit of infiltration equal to 0.2 gal/inch diameter/hour/100 linear feet of pipe.

1. The test will be made by measuring the infiltrated flow of water over a measuring weir set up in the invert of the sewer, or by an alternate method approved by the Engineer, a known distance from a temporary bulkhead or other limiting point of infiltration. After the sewer or sewers have been pumped out, and normal conditions prevail, tests shall be started.

2. Tests shall be run continuously for a period of not less than three (3) hours, with weir readings taken at 20-minute intervals. The tests shall be made by the Contractor. The Engineer shall be notified 24 hours in advance. Where infiltration occurs in excess of the specified amount, the defective pipe or joints shall be located and repaired at the expense of the Contractor. If the defective portions cannot be located, the Contractor, at his own expense, shall remove, reconstruct, and retest as much of the original work as necessary to obtain a sewer within allowable infiltration limits.

E. Clean-up: Before final inspection and acceptance, the Contractor shall clean ditches, shape shoulders, and restore all disturbed areas, including street crossings, grass plots, to as good as condition as existed before work started. All trenches shall be leveled, and loose material removed from pavement gutters, sidewalks, pipelines, and inlet sediment traps, employing hand labor, if necessary.

END OF SECTION 026000

SECTION 027000 - SUBMERSIBLE GRINDER PUMPING STATIONS

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. Earthwork Section 023000.

C. Gravity Sanitary Sewers: Section 025700.

D. Sanitary Sewer Force Mains: Section 025760.

1.2 DESCRIPTION OF WORK

A. Work under this Section applies to all submersible grinder sewage lift stations within the wastewater collection system project. Lift stations shall include wetwell, plumbing and piping, valve box, pumps, control panel, electrical service, control system, guide rails and all appurtenances or other items required to provide a fully operational system.

B. The installation shall comply with all local, state, and federal laws and ordinances applicable to electrical installation and with the regulations of the latest edition of the published National Electrical Code where such regulations do not conflict with those laws and ordinances. The contractor shall obtain all permits, and after completion of the work, shall furnish the Engineer a certificate of final inspection and approval from the applicable local inspection departments.

C. Furnish and install a complete Duplex Stainless Steel "C" Channel Non-Sparking Rail Package as shown on the plans. The package shall consist of a fiberglass basin, a cover with 2" NPT vent, Non-sparking "C" channel rail assembly, stainless steel discharge piping and fittings, stainless steel check valves, stainless steel ball valves, level controls, and control panel in NEMA 4X Enclosure with Air Break Box. Panel, Air Break Box and Aluminum Backboard must be powder coated forest green to match wet well and valve pit covers.

1.3 DESIGN/PERFORMANCE REQUIREMENTS

A. Grinder Pumps - Provide submersible grinder sewage pumps suitable for continuous duty operation underwater without loss of water-tight integrity to a depth of 65 feet. Unit shall be designed with a grinder system to macerate material found in normal domestic and commercial sewage including reasonable amounts of wood chips, plastics, disposable diapers, sanitary napkins etc., into a fine slurry. Pump(s) shall be mounted on a guide rail system such that the pump(s) will be automatically connected to the discharge piping when lowered into place on the discharge connection. The pump shall be easily removable for inspection or service, requiring no bolts, nuts, or other fasteners to be disconnected, or the need for personnel to enter the wet well.

1. The motor and pump shall be designed, manufactured, and assembled by the same manufacturer.
2. Submersible grinder stations shall be duplex installations. Installations shall be per the plan details.
3. Barnes, ABS Pirannah, Ebara or approved equal grinder pumps shall be allowed.

1.3 SUBMITTALS

A. Prior to ordering pumps, the Contractor shall submit copies of catalog data for approval by the Engineer for materials to be used. Submittal shall include, but not be limited to the following:

1. Pumps
2. Motors
3. Level Controls
4. Electrical Control Panel
5. Valves
6. Piping

B. At completion of the work, four (4) copies of written operation and maintenance manuals and certified pump curves shall be furnished to the Engineer.

PART 2 - MATERIALS AND EQUIPMENT

2.1 PACKAGE DESIGN

A. Wetwell Basin - The basin diameter shall be sized as shown on the plans with integral 48 diameter x 36" deep valve pit with floor pitched back towards wet well. Valve Pit sump floor will have floor drain with a P-Trap and Floating ball check valve in wet well side. Construction shall be custom molded fiberglass. The wall thickness shall be sufficient to withstand a water-saturated sand load of 120 lbs per cubic foot. A 4inch Flexible pipe fitting or plastic pipe adapter for inlet shall be furnished for field cut to assure accuracy for gravity flow. A square ballast support flange shall be provided as an integral part of the basin assembly, which shall extend a minimum of three inches (76.2mm) on the radius of the basin. The bottom of wet well must be steel encased in fiberglass. Sides of wet well floor must be sloped back towards center of wet well so as to direct solids towards pumps. Slope shall be 1 on 1:12" bench.

B. Basin Cover -The basin cover shall be of diamond plate aluminum construction with a minimum thickness of ¼ inch, and shall have a minimum diameter four inches greater than the I.D. of the basin. Both inside and outside surfaces of the cover shall be sandblasted to remove scale and shall be completely powder coated with “forest green” paint. A hinged door shall be an integral part of the cover, and shall have locking provisions. The cover shall be securely mounted to the basin with stainless steel bolts threaded into stainless steel inserts in the top collar of the basin. All hardware shall be stainless steel. The cover shall have a 2" NPT screened bug-free vent that is corrosion resistant. When cover is opened 2/3 of the cover shall swing open to expose wet well interior. 1/3 of the cover will be fixed and bolted. Cover will be Frog mouth type.

C. Guide Rail System - The slide rail assemblies shall consist of 300 series stainless steel upper pump guide brackets, lower pump guide brackets, and "C" channel rail assembly of 10-gauge 300 series stainless steel. The stationary portion of the hydraulically sealed discharge coupling assembly shall be machined cast iron and the movable of 85-5-5-5 brass. The upper rail bracket shall mount to the basin wall and position the upper end of the stainless-steel guide rail while the lower rail bracket positions the lower end of the guide rail. The stainless-steel rail shall support the pump at the required distance from the basin floor to provide unrestricted flow of material into the pump. The guide brackets shall be attached to the pump for positioning of the unit on the guide rail during installation or removal of the unit within the basin. The stationary fitting shall have a fiber reinforced neoprene diaphragm clamped between the stainless-steel rail and the stationary cast iron discharge. The brass moveable fitting, when in position shall be held against the stationary fitting by the construction of the stainless-steel rail, aligning the movable fitting to the flexible diaphragm for proper sealing of the two surfaces under pressure. The discharge piping shall contain an anti-siphon device located below the check valve. A polypropylene rope with a minimum breaking strength of 3750 pounds shall be provided for each pump's installation and removal. The stainless-steel C Channel must be easily removable for easy maintenance by simple upward pull of fixed stainless steel "T" handle.

D. Discharge piping - The discharge piping shall consist of 1-1/4-inch schedule 40 stainless steel pipe. A stainless-steel ball check valve shall be installed in the vertical position between the pump discharge and the movable fitting. Each valve shall be 1-1/4 inches in size and shall consist of three major components: body, access plug, and flapper. The design of the valve shall be such that it keeps solids, stringy material, grit, rags, etc., moving without the need for back flushing.
In the operating mode, the flapper shall not impede flow through the check valve. The operating flow area shall be equal to the nominal size of the valve.

E. Wiring - Pump and control wiring shall run continuously to the control panel through conduit and sealed fittings as required by state and local codes. All incoming power and control wires must pass through cord grips and sealed fittings with sealing compound as required by Underwriters Laboratories.

F. Floats - A quantity of four (4) liquid level controls with 30ft. of SJOW cable, shall be provided to control operation of the pump off, lead and lag pump on, and high-water alarm. The level sensors shall be fiber optic type pilot duty devices mounted in a corrosion resistant polypropylene housing. The level controls shall be suspended and attached to stainless steel hook assembly as shown in the plans. Sufficient cable shall be supplied to reach the control panel with no splices in the basin. Level controls shall be set at the elevations indicated on the plans. Float Switches shall be rated for explosion proof areas and must be warranted for period of five (5) years.

G. High Level Alarm - Alarm flashing light and horn, to be supplied in separate NEMA 3R (stainless steel) enclosure for mounting at the control box. Alarm light shall glow bright and flash under alarm conditions. Alarm light and horn may be mounted on main panel, so light is visible in all directions. If mounted on the main panel, the alarm light shall be mounted off of the side of the panel as shown on the detail sheet.

2.2 OPERATION OF SYSTEM

On sump level rise lower mercury switch shall first be energized, then upper-level switch shall next energize and start lead pump. With lead pump operating, sump level shall lower to low switch turn-off setting and pump shall stop. Alternating relay shall index on stopping of pump so that lag pump will start on next operation. If sump level continues to rise when lead pump is operating override switch shall energize and start lag pump. Both lead and lag pump shall operate together until low level switch turns off both pumps. If level continues to rise when both pumps are operating, alarm switch shall energize and signal the alarm. If one pump should fail for any reason, the second pump shall operate on the override control and if level rises above override control, alarm shall signal. All level switches shall be adjustable for level setting, from the surface.

2.3 LIFT STATION ELECTRICAL

A duplex control panel shall be furnished in NEMA 4X Stainless Steel enclosure for 230 Volts, Single Phase, 60 Hertz power supply. For each pump motor there shall be included; a combination circuit breaker/overload unit providing overload protection, short circuit protection, reset and disconnect for all phases, across-the-line magnetic contactors, push button start, overload relay properly sized for motor characteristics, 120-volt control panel pilot circuitry. A 120-volt control transformer with fused overload protection for external pilot circuitry shall be included. An automatic electric alternator with lead-lag selector switch shall be included to provide alternating operation of the pumps under normal condition or simultaneous operation in cases of high level. Single phase panels shall be provided with a start capacitor, run capacitor, and start relay for each pump motor if not provided in the pump. A panel mounted moisture sensor relay with warning light shall be included for each pump to indicate moisture in the pump seal cavity. The moisture sensor relay shall have a test circuit consisting of a push-to-test button with neon indicating lamp for checking the moisture sensing components. Each panel shall be equipped with terminals for temperature sensors. These thermostats are wired in line with the pump motor starter coil and will turn the motor off with temperature rise. Intrinsically Safe relays shall be included for reducing voltage power supply to the level controls, one required for start & stop, one for lag start and one for alarm function. Telemetry must be included in the panel to provide alarm with loss of power, low level, and high level. The control panel assembly and all components therein shall be UL listed.

PART 3 - EXECUTION

3.1 GENERAL

Provide all labor, equipment and materials and install all pipe, fitting, specials, and appurtenances as indicated or specified.

3.2 PIPE INSTALLATION

Refer to section 02576: Sanitary Sewer Forcemains.

3.3 WETWELL INSTALLATION

Refer to section 02570: Gravity Sanitary Sewers.

3.4 ELECTRICAL SYSTEM INSTALLATION

The lift station electrical system shall be installed per the manufacturer's recommendations, applicable sections of the NEC, and the plans.

PART 4 - ACCEPTANCE

4.1 ACCEPTANCE TESTS FOR SUBMERSIBLE PUMPING STATIONS

Prior to final approval of the station, a lift station start-up shall be performed in the presence of the Engineer and the Owner. The Contractor shall be responsible for providing all of the labor and materials necessary to start-up the station and shall have completed a satisfactory mock start-up before requesting an official one.

END OF SECTION 027000

SECTION 029500 - MAINTENANCE OF TRAFFIC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specifications Sections, apply to work of this section.

B. Unless otherwise specified on the plan sheets or in other sections of this contract, all materials and work shall conform to the applicable requirements in the following documents:

1. Florida Department of Transportation Design Standards, latest edition.

2. Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Section 102, latest edition.

3. USDOT, Federal Highway Administration Manual on Uniform Traffic Control Devices for Streets and Highways, latest edition, Part 6 Temporary Traffic Controls.

4. FDOT Minimum Specifications for Traffic Control and Devices, latest edition.

1.2 SUMMARY OF WORK

The work under this section includes the maintenance of traffic within the limits of the project for the duration of construction.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 RESPONSIBILITIES OF CONTRACTOR

A. Control and maintain traffic and provide for the safety of the work in accordance with Maintenance and Traffic Plan included in the contract documents. Conduct operations in a manner that will not interrupt pedestrian and vehicle traffic except as approved by the Engineer. Confine the work area to the smallest area practical to allow the maximum use of the street and sidewalk and to reduce any hazard to vehicles and pedestrians to a minimum.

B. Maintain access to properties that adjoin the work. Contact property owners and assure that access is coordinated prior to commencing work that may block access.

C. Furnish all labor, materials, tools, supplies, equipment, and machinery needed to fully comply with the specifications described on the plan sheets and in this Section. At all times, the Contractor shall use workers and traffic control devices necessary to comply with all applicable provisions contained in the reference documents listed in Section 1.1.

D. The Contractor shall notify the agencies and media listed below in writing, 48 hours in advance, of any work within the road right-of-way that may interfere with vehicle and/or pedestrian traffic.

1. Local Radio (WCOA 850-478-6011)
2. Local News Paper (Pensacola News Journal 850-435-8542)
3. Escambia County Public Safety Emergency Communications (850-471-6315)
4. Florida Highway Patrol (850-484-5000)
5. FDOT Public Information Office (888-638-0250)
6. Escambia County Public Works Traffic and Transportation (850-595-3422)
7. Escambia County Sheriff's Office (850-436-9630)
8. Escambia County School District (850-469-5591)
9. Escambia County Area Transit (850-595-3228)
10. Escambia County Para Transit Services (850-595-0501)

3.2 PENALTIES AND SUSPENSION OF WORK

The Engineer may verbally direct the Contractor to immediately suspend work if violation of safety regulations is found. In such an event, Contractor shall immediately stop work and secure any potential hazards from the public until the violation is corrected to the satisfaction of the Engineer. Law enforcement officers may be called to assist the Engineer in suspending work if the Contractor is not responsive. Suspension of work for violation of safety regulations shall not be grounds for a contract time extension.

END OF SECTION 029500

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Formwork for cast-in-place concrete.
   2. Shoring, bracing, and anchorage.
   3. Architectural form liners.
   4. Form accessories.
   5. Form stripping.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
   2. ACI 301 - Specifications for Structural Concrete.
   3. ACI 318 - Building Code Requirements for Structural Concrete.
   4. ACI 347 - Guide to Formwork for Concrete.

B. American Forest and Paper Association:
   1. AF&PA - National Design Specifications for Wood Construction.

C. The Engineered Wood Association:
   1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

D. American Society of Mechanical Engineers:
   1. ASME A17.1 - Safety Code for Elevators and Escalators.

E. ASTM International:
   1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
   2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

F. West Coast Lumber Inspection Bureau:
   1. WCLIB - Standard Grading Rules for West Coast Lumber.

1.3 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to design and applicable code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

1.4 PERFORMANCE REQUIREMENTS

A. Vapor Retarder Permeance: Maximum 1 perm when tested in accordance with ASTM E96, Procedure A.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347, ACI 301, ACI 318.

B. For wood products furnished for work of this Section, comply with AF&PA.

C. Perform Work in accordance with MDOT standards.

1.6 COORDINATION

A. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

A. Form Materials: At discretion of Contractor.

2.2 FORMWORK ACCESSORIES

A. Form Ties: Removable or Snap-off type, metal, adjustable length, cone type, with waterproofing washer, inch back break dimension, free of defects capable of leaving holes larger than 1 inch in concrete surface.

B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.

C. Form Anchors and Hangers:
1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
3. Penetration of structural steel members is not permitted.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

B. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

3.2 INSTALLATION

A. Earth Forms:
   1. Trench earth forms neatly, accurately, and at least 2 inches wider than footing widths indicated on Drawings.
   2. Trim sides and bottom of earth forms.
   3. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.
   4. Form sides of footings where earth sloughs.
   5. Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.

B. Formwork - General:
   1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
   2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
   3. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
   4. Complete wedging and bracing before placing concrete.

C. Forms for Smooth Finish Concrete:
   1. Use steel, plywood or lined board forms.
   2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
   3. Install form lining with close-fitting square joints between separate sheets without springing into place.
   4. Use full size sheets of form lines and plywood wherever possible.
   5. Tape joints to prevent protrusions in concrete.
   6. Use care in forming and stripping wood forms to protect corners and edges.
   7. Level and continue horizontal joints.
   8. Keep wood forms wet until stripped.

D. Architectural Form Liners:
   1. Erect architectural side of formwork first.
   2. Attach form liner to forms before installing form ties.
   3. Install form liners square, with joints and pattern aligned.
   4. Seal form liner joints to prevent grout leaks.
   5. Dress joints and edges to match form liner pattern and texture.

E. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

F. Framing, Studding and Bracing:

1. Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood.
2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum of 2 inches thick.
4. Distribute bracing loads over base area on which bracing is erected.
5. When placed on ground, protect against undermining, settlement or accidental impact.

G. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301 and ACI 318.

H. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores..

I. Install void forms in accordance with manufacturer's recommendations.

J. Do not patch formwork.

3.3 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer’s specifications. Do not coat forms for concrete indicated to receive “scored finish”. Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Position recessed reglets for brick veneer masonry anchors in accordance with spacing and intervals indicated on Drawings.

E. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

F. Install water stops continuous without displacing reinforcement. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

H. Form Ties:
1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
2. Place ties at least 1 inch away from finished surface of concrete.
3. Leave inner rods in concrete when forms are stripped.
4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.

I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Construction Joints:
1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
4. Arrange joints in continuous line straight, true and sharp.

K. Embedded Items:
1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Specification sections.
4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

L. Openings for Items Passing Through Concrete:
1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.
3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

M. Screeds:
1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.

2. Slope slabs to drain where required or as shown on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

N. Screed Supports:
1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
2. Staking through membrane is not be permitted.

O. Cleanouts and Access Panels:
1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Leave forms in place for minimum number of days as specified in ACI 347.

3.7 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

B. Notify Architect/Engineer after placement of reinforcing steel in forms, but prior to placing concrete.

C. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

SECTION 03 20 00 - CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Reinforcing steel bars.
   2. Steel wire fabric.
   3. Reinforcement accessories.

1.2 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 301 - Structural Concrete for Buildings.
   2. ACI 318 - Building Code Requirements For Reinforced Concrete.
   3. ACI SP-66 - American Concrete Institute - Detailing Manual.

B. American Society for Testing and Materials (ASTM):
   1. ASTM A 184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
   2. ASTM A 615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
   3. ASTM A 704 - Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.

C. American Welding Society (AWS):
   1. AWS D1.4 - Structural Welding Code for Reinforcing Steel.

D. Concrete Reinforcing Steel Institute (CRSI):
   1. CRSI - Manual of Practice.
   2. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.
   3. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

1.3 SUBMITTALS

A. Submittals: Procedures for submittals.
   1. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel [and wire fabric, bending and cutting schedules, and supporting and spacing device. Include special reinforcement required for openings through concrete structures.
   2. Assurance/Control Submittals;
      a. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
      b. Submit certified copies of mill test report of reinforcement materials analysis.
      c. Welder's Certificates.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice ACI 301, ACI SP-66, ACI 318, and ASTM A 184.

B. Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State where the Project is located.

C. Welders' Certificates: Submit certificate, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Steel: ASTM A 615, 60 ksi yield grade; deformed billet steel bars, unfinished.

B. Reinforcing Steel Mat: ASTM A 704, ASTM A 615, 60 ksi yield grade; steel bars or rods, unfinished.

C. Reinforcing Steel Mesh: ASTM A185

2.2 SYNTHETIC FIBER REINFORCEMENT: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III.

A. Products:
1. Axim Concrete Technologies; Fibrasol IIP.
2. Euclid Chemical Company (The); Fiberstrand 100.
3. FORTA Corporation; Forta Mono.
4. Grace Construction Products, W. R. Grace & Co.; Grace MicroFiber.
5. SI Concrete Systems; Fibermix Stealth.

2.3 ACCESSORIES

A. Tie Wire: Minimum 16 gage annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type(CRSI, Class 1) or stainless steel protected(CRSI, Class 2); size and shape as required.

2.4 FABRICATION

A. Fabricate concrete reinforcing in accordance with ACI SP-66 and ACI 318.

B. Weld reinforcement in accordance with AWS D1.4.

C. Locate reinforcing splices not indicated on drawings, at point of minimum stress. Review location of splices with Architect/Engineer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.

B. Report in writing to Architect/Engineer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcing in accordance with ACI 318.

3.3 FIELD QUALITY CONTROL

A. Section 011400 – Quality Control: Field Inspection.

B. Inspect reinforcing locations, bar types and sizes, wire ties, and welding (if applicable).

END OF SECTION

SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Cast-in-place (CIP) concrete in building frame elements, walls, foundations, foundation walls, slabs-on-ground, and mechanical equipment pads.
2. Finishing of concrete floor slabs and toppings. Concrete liquid surface treatment, sealer, and slip-resistant coatings.
3. Expansion and contraction, control joints in CIP concrete.
4. Concrete curing and protection.
5. Non-shrink grout including installation and forming.

1.2 REFERENCES

A. American Concrete Institute (ACI):
1. ACI 121R, “Quality Assurance Systems for Concrete Construction.”
2. ACI 301, “Specification for Structure /Concrete.”
3. ACI 302.1R, “Guide for Concrete Floor and Slab Construction.”
4. ACI 304.2-R, "Placing Concrete by Pumping Methods."
5. ACI 305, “Hot Weather Concreting.”
6. ACI 306, “Cold Weather Concreting.”
7. ACI 315, "Manual of Standard Practice for Detailing Concrete Structures."
8. ACI 347, "Recommended Practice for Concrete Formwork."
9. ACI 503.2, “Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive.”
10. ACI SP-15, "Field Reference Manual" which includes ACI 301 "Specifications for Structural Concrete for Buildings" and reference standards specified therein.

B. American Society for Testing and Materials (ASTM):
1. ASTM A615, "Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement."
2. ASTM C33, "Specification for Concrete Aggregates."
3. ASTM C39, "Test Method for Compressive Strength of Cylindrical Concrete Specimens."
4. ASTM C94, "Specification for Ready-Mixed Concrete."
5. ASTM C114, "Test Method for Chemical Analysis of Hydraulic Cement."
6. ASTM C138, "Test Method for Unit Weight, Yield, and Air Content of Concrete."
7. ASTM C143, "Test Method for Slump of Hydraulic Cement."
8. ASTM C150, "Specification for Portland Cement."
9. ASTM C156, "Test Method for Water Retention by Concrete Curing Materials."
10. ASTM C171, "Specification for Sheet Materials for Curing Concrete."
11. ASTM C173, "Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method."
12. ASTM C227, "Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations."

13. ASTM C231, "Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method."
14. ASTM C260, "Specification for Air Entraining Admixtures for Concrete."
15. ASTM C309, "Specification for Liquid Membrane-Forming Compounds for Curing Concrete."
16. ASTM C311, "Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete."
17. ASTM C387, "Specification for Packaged, Dry, Combined Materials for Mortars and Concrete."
18. ASTM C494, "Specification for Chemical Admixtures for Concrete."
19. ASTM C618, "Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete."
20. ASTM C685, "Specification for Concrete Made by Volumetric Batching and Continuous Mixing."
21. ASTM C989, "Specification for Ground Iron Blast-Furnace Slag for Use in Concrete and Mortars."
22. ASTM E154, "Test Methods for Water Vapor Retarders Used in Contact with Earth Under Slabs, On Walls, or as Ground Cover."
23. ASTM E1155, "Test Method for Determining Floor Flatness and Levelness Using The F-Number System."
24. ASTM D2240, "Standard Test Method for Rubber Property-Durometer Hardness."

C. American Welding Society (AWS):
   1. AWS D1.4 - Structural Welding Code for Reinforcing Steel.

D. Concrete Reinforcing Steel Institute (CRSI):
   1. CRSI - Manual of Practice.
   2. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.
   3. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

1.3 SUBMITTALS

A. Submittals: Procedures for submittals.
   1. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel [and wire fabric, bending and cutting schedules, and supporting and spacing device. Include special reinforcement required for openings through concrete structures.
   2. Assurance/Control Submittals;
      a. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
      b. Submit certified copies of mill test report of reinforcement materials analysis.
      c. Welder's Certificates.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice ACI 301, ACI SP-66, ACI 318, and ASTM A 184.

B. Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State where the Project is located.

C. Welders' Certificates: Submit certificate, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C150 - Type unless otherwise approved.
1. Assume full responsibility for the quality and soundness of cement. Cement is to be of one type and from the same mill; it is to be of uniform color for all concrete with permanently exposed concrete finishes.

B. Admixtures: The following admixtures are permitted when approved in writing prior to use or are required as specified herein and shall be used in strict accordance with the manufacturer's specifications or recommendations:

C. Calcium chloride: Conform to ACI 301. The chloride ion level shall not exceed 0.3 percent.

D. Air-entraining admixtures: ASTM C260 shall be used to achieve the specified air content in all permanently exposed exterior concrete. For steel trowel interior slab finish, do not use air entrainment admixtures and total air entrainment must not exceed 3%. For steel trowel exterior slab finish, comply with ACI 318 and ACI 302.

1. Euclid: AEA-92 or Air Mix 200.

E. Water-reducing admixtures: Conform to ASTM C494, Type A, containing not more chloride ions than allowed in paragraph A., above.
1. Euclid: Eucon WR series or Eucon MR.

F. Water-reducing/accelerating admixtures: Conform to ASTM C494, Type C or E having long-term test results showing non-rusting on metal deck and reinforcing steel.
1. Euclid: Accelguard series.

G. Water-reducing/retarding admixtures: Conform to ASTM C494, Type D containing not more than 1 percent chloride ions.
1. Euclid: Eucon Retarder series.

H. High-range/water-reducing (HRWR) admixtures: Conform to ASTM C494, Type F or G super plasticizers containing 1 percent maximum chloride ions may be used with low slump (3 inches maximum) concrete to produce flowable concrete (up to 8 inches slump) with early strength gain and 28-day strengths equal to reference concrete. HRWR admixture may be used providing not more than 60 minutes is allowed from addition of admixture to final placement of concrete. HRWR admixture shall be used in concrete with a maximum water/ cement ratio of 0.50 or less and is suggested in the following:

1. In pumped concrete.
2. In concrete topping slabs
3. In lieu of the specified water-reducing admixture (Type A) where confinement of placing due to heavy reinforcement or narrow space requires flowable concrete.
4. Where more than 30 minutes is required between the addition of admixtures to final placement of the concrete, a combination of water-reducing, set controlling admixtures (ASTM C494, Types A, D, & E) as in Master Builders Company "Synergized Performance System" may be used.
   a. Euclid: Eucon 37 or Eucon 537.

I. Fly ash: Conform to ASTM C618. The use of a quality fly ash is required as a cement-reducing admixture (minimum 15 percent and maximum 25 percent). The fly ash shall meet all of the requirements of ASTM C618, Class C or Class F, with the following special requirements: The loss on ignition in Table 1 shall not exceed 3 percent. Compliance to Table 1A shall apply. The amount retained on the 325 sieve in Table 2 shall not exceed 34 percent. The chemical analysis of the fly ash shall be reported in accordance with ASTM C311. Quality assurance testing and reports for a minimum of six months shall be submitted by the fly ash supplier.

J. Fly ash: Conform to ASTM C618. The use of a quality fly ash will be permitted as a cement-reducing admixture (minimum 15 percent and maximum 25 percent). The fly ash shall meet all of the requirements of ASTM C618, Class C or Class F, with the following special requirements: The loss on ignition in Table 1 shall not exceed 3 percent. Compliance to Table 1A shall apply. The amount retained on the 325 sieve in Table 2 shall not exceed 34 percent. The chemical analysis of the fly ash shall be reported in accordance with ASTM C311. Quality assurance testing and reports for a minimum of six months shall be submitted by the fly ash supplier. The option to use fly ash must be approved prior to use.

K. Granulated Blast Furnace Slag is an alternative to fly ash and shall conform to ASTM C989. Granulated blast furnace slag may be used as a substitute for a maximum of 30 percent of Portland cement.

L. Certification: Certification of the above requirements is required from the admixture manufacturer prior to mix design review and approval by the Contracting Officer. Upon request by the Contracting Officer, a qualified representative is to be provided to assure proper use of admixtures. Use of admixtures, other than listed above will be permitted only when approved.

M. Aggregates:

1. Normal-weight concrete - ASTM C33. For slabs, also conform to combined aggregate grading recommendations of ACI 302 and ACI 302.1R, unless otherwise permitted.
2. All concrete exposed to the weather shall conform to the limits of deleterious substances and physical properties of Table 3, ASTM C 33.
3. Local aggregates: Local aggregates not complying with ASTM C33 but which have been shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the Contracting Officer.
4. Maximum size of coarse aggregates: ACI 301.
5. Abrasive aggregates non-slip finishes: Fused aluminum oxide grits, or crushed emery, as abrasive for non-slip finish with emery aggregate containing not less that 40 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, non- glazing, and unaffected by freezing, moisture, and cleaning materials.

N. Water: Clean and not detrimental to concrete; drinkable.

2.2 GROUT/MORTARS

A. Cement grout: Conform to ASTM C387 "Dry packaged mixtures" or:
1. Mix at the site, in composition of one volume of Portland cement to 2-1/2 volumes of fine aggregate.
2. Mix the materials dry; then add sufficient water to make the mixture flow under its own weight.
3. Field service: When required by the contracting officer, provide a qualified concrete technician employed by the Grout Manufacturer to assist in the initial grouting operations.
4. Euclid: NS Grout or Hi Flow Grout.

2.3 CURING/SEALING/HARDENERS

A. Liquid membrane-forming compounds for curing concrete; Conform to ASTM C309, Type 1. Curing compound shall be compatible with floor sealer or finish used. Low VOC.
1. Euclid: VOX series; waterborne products .
2. W.R. Meadows: Vocomp series or 1100 series .
3. ChemREX: Sooneborn Kure-N-Seal 30.
4. Section 01600 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Method of curing shall be approved by the finish flooring applicator where finishes are indicated.

C. Moisture-retaining cover: Complying with ASTM C171, synthetic fiber mat with plastic backing, waterproof, heavy kraft paper, polyethylene film (min. 6 mils thick), or polyethylene-coated burlap.
1. Reef Industries, Transguard 4000.
2. Substitutions: Permitted.

D. Absorptive Cover: Burlap cloth made from jute of kenaf, weighing approximately 9 ounces per square yard complying with AASHTO M182, Class T.

E. Curing and Sealing: ACI 301, Chapter 12 and Federal Specification TT-C-800, Type I - Chlorinated rubber or styrene-butadiene-based compounds with 30 percent solids content minimum and having moisture retention tests (ASTM C156) by an independent testing laboratory showing a maximum moisture loss of 0.03 gm/cm^2 at a coverage of 300 square feet per gallon. Manufacturer's Certification required.
   1. Super Aqua-Cure VOX (30 percent solids).
   2. Master Builders: Masterkure N- Seal- HS.
   3. Applied Concrete Technology: Protecrete
   4. Substitutions: Permitted.

F. Exterior Sealers: applied to horizontal concrete surfaces permanently exposed to salts, deicer chemicals and moisture, including parking decks. The manufacturer shall provide a five year labor and materials warranty on performance of the sealer. Sealer shall be compatible with the curing compound used.
   1. Euclid: Eucoguard or Diamond Clear or Super Diamond Clear.
   2. ChemREX: Hydrozo Clear 40.
   3. Substitutions: Permitted.

G. Interior Dustproofing Sealer to be applied on floors cured with membrane-forming liquid curing compound. Apply after the slab is fully cured at a time acceptable to the Contracting Officer. The sealing compound shall be compatible with the curing compound and tile or carpet adhesive where applicable.
   1. Euclid: Super Floor Coat.
   2. Master Builders: Masterkure N- Seal VOC.
   3. Substitutions: Permitted.

H. Liquid Sealers/Hardener: to be applied on exposed concrete floors cured with moisture retentive or absorptive covers.

   1. Euclid: Euco Diamond Hard (Liquid Sealer and Hardener)
   2. L&M Construction Chemicals: Seal Hard (Liquid Sealer and Hardener)
   3. Curecrete Chemical Company: Ashford Formula (Liquid Sealer and Hardener)
   4. Midwest Floor Care: Structure Formula (Liquid Sealer and Hardener)
   5. Or approved equal.

2.4 JOINTS AND EMBEDDED ITEMS:

A. Construction and Contraction Joints: Comply with ACI 301 and recommendations of ACI 302.1R. Sealant shall be two-part semi- rigid epoxy, and shall have minimum Shore A Hardness of 80 when measured with ASTM D2240. Sealant is not required in contraction or construction joints in slabs to receive asphalt plank.

B. Isolation Joints: Fillers shall consist of 1/8 inch width strips of neoprene, synthetic rubber, or approved substitute, extending the full depth of the slab. Sealant shall be two-part elastomeric type, polyurethane base.

2.5 VAPOR BARRIER/RETARDER

A. Provide cover over prepared base material at slabs-on- ground unless otherwise noted on the plans. Use only materials which are resistant to decay when coated in accordance with ASTM E154.

2.6 PROPORTIONING

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If laboratory trial batch method is used, use an independent testing facility acceptable to Contracting Officer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing and inspection unless otherwise acceptable to Contracting Officer.

B. Submit written reports to the testing laboratory of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed and approved. Include the following information for each concrete mix design:
1. Method used to determine the proposed mix design.
2. Gradation of fine and coarse aggregates, plus combined aggregate gradation for slabs, ACI 302.
3. Proportions of all ingredients including all admixtures added either at the time of batching or at the job site.
4. Water-cement ratio.
5. Slump, ASTM C143.
6. Certification of the chloride content of individual admixtures and of the mixes as proposed.
7. Air Content: ASTM C173 (Volumetric Method).
8. Unit weight of concrete, ASTM C138.
9. Strength at 4, 7, and 28 days, ASTM C39.
10. Method of recording batch proportions.
11. Substantiating test reports.

C. Concrete types and strengths: Minimum 28 Day Compressive Strength shall be per design requirements but not less than:
1. Slabs on ground, paving base, columns, beams, walls, foundations, and footings: 4,000 psi.
2. Normal or Lightweight concrete on metal deck: 4,000 psi.
3. Tilt-up: 4,000 psi.
4. All concrete exposed to weather shall be air entrained (ASTM C260).
5. All concrete shall be normal weight except as noted above.

Also, see general and specific notes on structural drawings.

D. Weights: All concrete shall be normal-weight concrete unless otherwise designated on the structural drawings.

E. Durability: Conform to ACI 301.
   1. All concrete exposed to potentially destructive weathering, such as freezing and thawing, or to de-icer chemicals is to be air-entrained, 6 percent +1percent, six sacks cement/cu. yd. min., 4" max. slump.
   2. Water-cement ratio: For concrete subject to freezing and thawing or deicer chemicals, the water-cement ratio shall not exceed 0.53 by weight including any water added to meet specified slump in accordance with the requirements of ASTM C94 unless otherwise noted.

F. Slump: Conform to ACI 301.
   1. 4 ½ inch maximum for consolidation by vibration
   2. 5 inch maximum for consolidation by other methods
   3. 8 inch maximum for flowable concrete. Concrete containing HRWR admixture (super plasticizer): 3 inch maximum before addition of HRWR
   4. Where field conditions require slump to exceed that specified above, the increased slump shall be obtained by the use of a superplasticizer only, and the Contractor shall obtain written approval from the Contracting Officer who may require an adjustment to the mix.

G. Production of concrete: Conform to ACI 301:
   1. Ready-mixed concrete:
      a. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C94.
      b. All concrete shall be proportioned conforming to the approved mix designs and of the materials contained in those approved mixes. A certified copy of the design weights for each mix shall be kept at the producing plant for each class of concrete used on the project.
      c. Plant equipment and facilities are to conform to the "Check List for Certification of Ready -Mixed Concrete Production Facilities" of the National Ready-Mixed Concrete Association and have NRMCA or approved certification within the past year.
   2. All other concrete: Conform to ACI 301
   3. Concrete produced by on-site volumetric batching and continuous mixing if approved shall conform to ASTM C685.
   4. Use of accelerating admixtures in cold weather and retarding admixtures in hot weather shall not relax placement requirements specified herein.
   5. Admixtures: ACI 301. All concrete placed at ambient temperatures below 50 degrees F is to contain an approved accelerator. All concrete placed at ambient temperatures above 80 degrees F is to contain an approved retarder. All concrete required to be air-entrained is to contain an approved air-entraining admixture. When improved workability, pumpability, lower water-cement ratio, or high ultimate and/or early strength is required, the HRWR admixture (super plasticizer) may be used.
   6. Ensure air content for slabs with steel trowel finish is less than 3.0 percent.

7. The concrete shall be of such consistency and composition that it can be worked readily into the corners and angles of the forms and around reinforcement without permitting materials to segregate or free water to collect on the surfaces. Within the limiting requirements, adjust the consistency of the concrete as may be necessary to produce mixtures which will be placeable with reasonable methods of placing and compacting. Maintain on the job at all times adequate extra cement to be used at rate of 1/2 sack cement per cubic yard concrete for each 2" slump increase for corrections due to wetness desired or obtained. No water shall be added to concrete except under the direct awareness of the project inspector.
8. Adjustments to concrete mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant at no additional cost to Contracting Officer. Laboratory test data for revised mix design and strength results must be submitted and accepted before using in work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

B. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost

3.2 INSTALLATION – GENERAL

A. Install all cast-in-place concrete work in accordance with ACI 301 except as herein specified.

3.3 INSTALLATION – FORMWORK

A. Construction and Contraction Joints: Conform to ACI 301 and recommendations of ACI 302.1R.

3.4 REINFORCEMENT

A. Placement: Section 032000 Concrete Reinforcement

3.5 CONCRETE (CONVEYING AND DEPOSITING)

A. Placement: Conform to ACI 301:

1. Maintain concrete cover around reinforcing as per Section 3.3 above and ACI 301.
2. Pumping concrete: ACI 304.2-R.
3. Cold-Weather Placement: Comply with provisions of ACI 306.1 “Standard Specifications for Cold-Weather Concreting” and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
4. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
    a. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
    b. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
5. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305R “Standard Specification for Hot-Weather Concreting” and as specified.
    a. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
    b. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
    c. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
    d. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Contracting Officer.

B. Protection of cast concrete: Conform to ACI 301.

C. Repair of surface defects: ACI 301.
1. Inspect concrete surfaces immediately upon removal of forms. Patch imperfections as needed or as directed by the Contracting Officer.
2. Modify or replace concrete not conforming to required thickness, lines, details, and elevations.
3. Repair or replace concrete with excessive honeycombing and other defects due to improper placement. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Contracting Officer for each individual area.
4. Tie holes shall be filled solid with patching mortar.

3.6 FINISHING

A. Finishing of formed surfaces: ACI 301:
1. Tops of forms:
    a. Strike concrete smooth at tops of forms.
    b. Float to texture comparable to formed surfaces.
2. Formed surfaces:

a. Permanently exposed surfaces and surfaces to be painted: ACI 301 - "Smooth Form Finish" with the fins ground smooth and air holes or honeycomb filled with mortar.
b. Surfaces in unfinished areas unexposed to public view: ACI 301- "Rough Form Finish".

B. Slabs: Minimum slab surface tolerance must satisfy ACI 301 and ACI 302.1R as measured in accordance with ASTM E1155.
1. Slabs-on- ground:
a. Preparation of sub-grade: Provide vapor barrier below all slabs on ground unless specifically noted otherwise on plans.
b. Place floor slabs-on- ground by "strip cast" method. Contraction joints where shown on drawings shall be saw-cut (as soon as slab has set enough to allow working on but not before it has set enough to prevent raveling) 1/4 of the depth of slab thickness or a "Zip Cap" control joint former as manufactured by Green Streak Plastic Products, or approved equal installed in accord with the Manufacturer's recommendations. It is recommended to use a SOFF-CUT saw and blades (between 1 to 4 hours after finish typically with 1 inch minimum depth) for all contraction joints as per manufacturer recommendations.
c. For exposed slabs, install semi-rigid epoxy sealant in construction and contraction joints after slab has fully dried.
d. Separate slabs-on- ground from vertical surfaces with 1/2 inch-thick joint filler. Extend joint filler from bottom of slab to within 1/8 inch of finished slab surface.
e. All slabs on ground to satisfy a minimum overall tolerance of FF35 and minimum local tolerance of FF24. In addition, all floor slabs shall be flat and level within a maximum variation of 1/4 inch per 10 feet and satisfy a minimum overall tolerance of FL25 and minimum local tolerance of FL17.
2. Suspended Floor Slab:
a. Minimum surface tolerances: FF25 & FL20 overall FF20 & FL15 local.
3. Concrete Finishes:
a. Floor Slabs: Steel trowel finish unless otherwise noted on the plans. Exposed concrete slabs shall be sealed or sealed and hardened using a liquid compound compatible with the curing method used. .
b. Exterior Concrete Finishes: Steel trowel with broom finish unless otherwise noted on the plans. Apply exterior sealer to surfaces exposed to deicer chemicals.
c. Exposed Ramps, Landings and Stair Treads: Steel trowel with broom finish unless otherwise noted on the plans. Surfaces shall be sealed or sealed and hardened using a liquid compound compatible with the curing method used.

3.7 CURING AND PROTECTION

A. All exposed surfaces of concrete including floor slabs, whether or not they receive a finish flooring, shall be protected from premature drying for a minimum of seven days. Freshly placed concrete shall be protected against wash by rain. If a liquid curing compound is used, apply the curing compound at a rate equivalent to the rate of application at which the curing compound was originally tested for conformance to the requirements of ASTM C309. Do not use membrane curing when freezing weather is anticipated during first few days of curing period.

B. All curing methods shall be placed immediately after final finishing (i.e., within two hours). Contractor's attention is directed to the fact that experience shows the most important time of curing is from three to four hours after placing and extending five to six hours thereafter. It is extremely important, therefore, to prevent loss of moisture, particularly during this period when concrete is especially vulnerable to shrinkage cracks.

C. During the first 2 day period of curing, no traffic on or loading of the floors will be permitted.

D. All floor slabs shall be cured using products and methods compatible with selected floor adhesives, toppings, and other finish materials.

E. Protect all slabs and joints from potentially destructive construction equipment.

3.8 PATCHING AND REPAIR

A. Comply with ACI 301 and ACI 503.2 for standard specifications for bonding plastic concrete to hardened concrete with a multiple component epoxy adhesive.

3.9 GROUTING

A. After steel columns have been installed and leveled, grout the space between the bottom of the plate and concrete, using cement grout completely filling the space and forming solid bearing for the column base plate.

3.10 FIELD QUALITY CONTROL

A. Section 01450 - Quality Control: Field testing and inspection.

B. Requirements:
   1. Provide and maintain an adequate program of quality control for the materials, production methods, and workmanship to assure conformance of all work to the project contract documents. ACI 121R outlines the essential elements of the Material Control portion of the QA program.
   2. All materials, equipment, and methods shall be subject to verification inspections and/or testing as specified herein; ACI 121R.
   3. Testing and Evaluation:
      a. Furnish and pay for the services of an independent Testing Laboratory satisfactory to the Contracting Officer. The testing laboratory shall have prime responsibility for review, verification inspection, and testing of the concrete producer's materials, operations, facilities, and quality control procedures and evaluating the results for conformance with these specifications complying with ACI 121R.

b. The Testing Laboratory will be required to provide evidence of recent inspection of its facilities by the Cement and Concrete Reference Laboratory of the National Bureau of Standards (NBS) and to show that any deficiencies have been corrected.
c. In addition to the requirements and duties in ACI 301 the testing laboratory shall provide the following:

    1) One or more additional test cylinders shall be taken during cold weather concrete placement and cured on the job site under conditions of concrete represented to determine safe form-stripping period.
    2) Sample (and test when directed by the contracting officer) each shipment of cement and aggregates and verify approved admixtures. Store samples in a protected place until authorized to dispose of them.
    3) Inspect concrete batching, mixing, and delivery operations periodically or as directed by the Contracting Officer.
    4) Review manufacturer's reports and/or certification for each shipment of cement and reinforcing steel and/or conduct laboratory tests or spot checks of the materials as received for compliance with specifications.
    5) Submit to the Contracting Officer and concrete producer, during construction, the results of concrete tests.
    6) Include the following information:

        a) Weight of concrete - ASTM C138
        b) Slump - ASTM C143
        c) Air content of freshly-mixed concrete by the pressure method, ASTM C231 or the volumetric method, ASTM C173.
        d) Concrete temperature (at placement time).
        e) Air temperature (at placement time).
        f) Strength determined in accordance with ASTM C39.
        g) Other testing or inspection as required.

d. The Testing Laboratory shall assess and report floor flatness and levelness in accordance with ASTM E1155.
e. Field and concrete plant inspections are to be made by a competent representative of the Testing Laboratory during all structural concreting operations including periodic audit and spot check of the Producer's and/or Contractor's quality control procedures to assure proper and adequate control. When it appears that any material furnished fails to fulfill specification requirements, the Testing Laboratory is to report such deficiency immediately to the Contracting Officer and appropriately record it in his report.

END OF SECTION

SECTION 03 35 00 – CONCRETE FINISHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Floor surface treatment.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 301 – Specifications for Structural Concrete
   2. ACI 302.1 – Guide for Concrete Floor and Slab Construction.

B. ASTM International:
   1. ASTM E1155 – Standard Test Method for Determining Floor Flateness and of Levelness Using the F-Number System.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and ACI 302.1.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum 3 years' experience.

B. Applicator or Installer: Company specializing in performing work of this section with minimum 3 years' experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's packaging including application instructions.

1.6 ENVIRONMENTAL REQUIREMENTS

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

1.7 COORDINATION

A. Coordinate the Work with concrete floor placement and concrete floor curing.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1. Dayton Superior Corp.
   2. Euclid Chemical Co.
   3. Scofield: L M Scofield Co.
   4. Sika Corp.

2.2 SLIP RESISTANT TREATMENT

A. Slip Resistant Finish: Aluminum oxide or Silica sand type, color as selected from manufacturer's standard range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify floor surfaces are acceptable to receive the Work of this section.

3.2 FLOOR FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1.

B. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, and thin set ceramic tile.

C. Steel trowel surfaces which are indicated to be exposed.

D. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains as indicated on Drawings.

3.3 FLOOR SURFACE TREATMENT

A. Apply slip resistant finish as scheduled on floor surfaces.

B. Apply sealer as scheduled on floor surfaces.

3.4 TOLERANCES

A. ACI 317

B. Measure for F(F) and F(L) tolerances for floors in accordance with ASTM E1155, within 48 hours after slab installation.

C. Correct defects in defined traffic floor by grinding or removal and replacement of defective Work. Areas requiring corrective Work will be identified. Re-measure corrected areas by same process.

END OF SECTION

SECTION 042113 - BRICK MASONRY

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. Section Includes:
1. Face brick.
2. Mortar and grout.
3. Ties and anchors.
4. Embedded flashing.
5. Miscellaneous masonry accessories.

B. Related Sections:

1. Division 04 Section "Cast Stone Masonry" for furnishing cast stone trim.

2. Division 05 Section "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
3. Division 05 Section "Metal Fabrications" for furnishing steel lintels and shelf angles for brick masonry.

4. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:
1. Face brick.
2. Colored mortar.
3. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:
1. Face brick.
2. Special brick shapes.

3. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
4. Weep holes and vents.
5. Accessories embedded in masonry.

E. Material Certificates: For each type and size of the following:

1. Masonry units.

   a. Include data on material properties.
   b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
   c. For exposed brick, include test report for efflorescence according to ASTM C 67.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Anchors, ties, and metal accessories.

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

1.4 QUALITY ASSURANCE

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.

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

D. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.

1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high.
2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
3. Clean one-half of exposed faces of panels with masonry cleaner indicated.
4. Protect approved sample panels from the elements with weather-resistant membrane.
5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.

2. Build mockups for each type of exposed unit masonry construction in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness, including accessories.

a. Include a sealant-filled joint at least 16 inches (400 mm) long in mockup.
b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
c. Include through-wall flashing installed for a 24-inch (600-mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).
d. Include metal studs, sheathing, building wrap, sheathing joint-and-penetration treatment, air barrier, veneer anchors, flashing, and weep holes in mockup.

3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
4. Clean exposed faces of mockups with masonry cleaner as indicated.
5. Protect accepted mockups from the elements with weather-resistant membrane.
6. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 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 designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and 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.

1.6 PROJECT CONDITIONS

A. 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.

1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. 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.

C. 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 ACI 530.1/ASCE 6/TMS 602.

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.

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

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: Facing brick complying with ASTM C 216.

1. Products:

a. The following to be used for field brick:

1. Field Brick: As indicated on drawings.

2.3 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

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

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C 91.

2.4 REINFORCEMENT

A. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

2.5 TIES AND ANCHORS

A. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).

2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 213 or D/A 210 with D/A 700-708.
2) Heckmann Building Products Inc.; 315-D with 316 or Pos-I-Tie.
3) Hohmann & Barnard, Inc.; DW-10HS or DW-10-X.
4) Wire-Bond; 1004, Type III.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Weep/Vent Products: Use the following unless otherwise indicated:

1. Wicking Material: Absorbent rope, made from cotton, 1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity. Use only for weeps.

2.7 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

2.8 MORTAR 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.
2. Use masonry cement or mortar cement mortar unless otherwise indicated.
3. 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. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide Type N unless another type is indicated.

C. Pigmented Mortar: Use colored cement product.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.

3. Mix to match Architect's sample.
4. Application: Use pigmented mortar for exposed mortar joints with the following units:
   a. Face brick.
   b. Cast stone trim units.

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.

B. 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 the 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.

C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

D. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

E. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

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 (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) 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 (6 mm in 3 m), or 1/2 inch (12 mm) 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.

7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm); do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
2. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

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; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking 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.

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

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

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow brick as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With entire units, including areas under cells, fully bedded in mortar at starting course on footings.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.

3. Wet joint surfaces thoroughly before applying mortar.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.

3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

4. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally with not less than 1 anchor for each 3.5 sq. ft. (0.33 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

3.7 EXPANSION JOINTS

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

B. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches (100 mm) in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.

3.8 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.9 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and 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 masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under building paper or building wrap, lapping at least 4 inches (100 mm).
3. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.

4. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
5. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.

6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
7. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
8. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

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

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.

4. Trim wicking material flush with outside face of wall after mortar has set.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.10 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

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

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 brick by bucket-and-brush hand-cleaning method described in "BIA Technical Notes 20."
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
8. Clean stone trim to comply with stone supplier's written instructions.
9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

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 (100 mm) 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 Division 31 Section "Earth Moving."

3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

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

END OF SECTION 042113

SECTION 05 31 00 – STEEL DECK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel roof deck and accessories.
   2. Framed openings up to 10 inches by 10 inches.
   3. Welding, fasteners, and accessories for attachment of deck.

1.2 REFERENCES

A. American Iron and Steel Institute (AISI):
   1. Specification for the Design of Cold-Formed Steel Structural Members.

B. American Society for Testing and Materials (ASTM):
   1. ASTM A 611 - Specification for Structural Steel, Sheet, Carbon, Cold-Rolled.

C. American Welding Society (AWS):
   1. AWS D1.1 - Structural Welding Code.
   2. AWS D1.3 - Structural Welding Code - Sheet Steel.

D. Steel Deck Institute (SDI):
   1. Design Manual for Composite Decks, Form Decks, Roof Decks, (Publication No. 25).
      a. Code of Recommended Standard Practice.
      b. Specifications and Commentary for Steel Roof Deck.
   2. SDI Diaphragm Design Manual 1st Edition.

E. Steel Structures Painting Council (SSPC):
   1. SSPC-Paint 20 Type II - Zinc Rich Primers - Organic.
   2. SSPC-Paint 25 - Red Iron Oxide, Zinc Oxide, Raw Linseed Oil, and Alkyd Primer.

1.3 SUBMITTALS

A. Submittal Procedures: Procedures for submittals.
   1. Product Data: Deck profile characteristics and dimensions, structural properties, and finishes.
   2. Shop Drawings: Indicate deck plan, support locations, projections, openings and reinforcement, pertinent details, and accessories.
   3. Assurance/Control Submittals:
      a. Certificates: Certify welders employed on Work, verifying AWS qualification within previous 12 months.
      b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Fabricator: Company specializing in performing the work of this section with minimum 5 years documented experience.
   2. Erector: Company specializing in performing the work of this section with minimum 5 years documented experience, certified by AISC Quality Certification Program.
   3. Qualifications for Welding Work: Qualify welding operators in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed in work have satisfactorily passed AWS qualification tests within previous 12 months. If recertification of welders is required, provide without additional cost to Owner.

1.5 DELIVERY, STORAGE AND HANDLING

A. Section 01600 – Product Requirements: Transport, handle, store, and protect products.

B. Prevent damage to edges, ends and surfaces.

C. Cut plastic wrap to encourage ventilation. Keep materials dry.

D. Separate sheets and store materials on dry wood sleepers off ground or concrete; slope for positive drainage.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sheet Steel:
   1. ASTM A 446, Grade A structural quality; with G60 or G90 galvanized coating conforming to ASTM A 525.

B. Bearing Plates and Angles: ASTM A 36 steel.

C. Welding Materials: AWS D1.1.

D. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

E. Touch-Up Primer for Galvanized Surfaces: SSPC 20, Type 1, inorganic.

F. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to decking.

G. Closure Strips, Cover Plates, and related Accessories: Fabricated of metal of same type and finish as deck.

H. Screw Fasteners: Self-drilling, self tapping No. 12 HWH Teks, by ITW-Buildex Corp., Itasca, IL, (800) 323-0720.
   1. Substitutions: Permitted

I. Powder Actuated Fasteners: Minimum 0.145 inch diameter knurled hardened steel shank; minimum 0.5625 inch diameter washer; meet SDI design requirements.
   1. ENP2-21-L15, by Hilti, Inc., Tulsa, Oklahoma, (918) 252-6000, (800) 879-8000.
   2. Substitutions: Permitted.

J. Air Actuated Fasteners: Minimum 0.130 inch diameter knurled hardened steel shank; minimum 0.500 inch diameter steel washer or head; meet SDI design requirements.
   1. X-EDNK22 HSN or X-EDN19 HSN, by Hilti, Inc., Tulsa, Oklahoma, (918) 252-6000.
   2. K-65056 or SDK-63075, by Pneutek, Inc., Hudson, New Hampshire, (603) 883-1660, (800) 431-8665.
   3. Substitutions: Permitted.

K. Side Lap Fasteners: Self-drilling screws; #10-16 TEKS/1, by ITW-Buildex Corp., Itasca, IL, (800) 323-0720, or acceptable substitute.

2.2 FABRICATION

A. Steel Roof Deck: Minimum gage sheet steel as indicated on Drawings, 1-1/2 inch high, fluted profile to SDI WR; multiple span; lapped joints.

B. Fabricate metal decking in accordance with the SDI Design Manual for Composite Decks, Form Decks, Roof Decks, and AISI, to accommodate maximum working stress of 20,000 psi and maximum span deflection of 1/240.

C. Fabricate roof sump pan of 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

B. Report in writing to Architect/Engineer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2 INSTALLATION

A. Erect metal decking and connect to structure in accordance with SDI Design Manual for Composite Decks, Form Decks, Roof Decks. Coordinate attachment sequence and procedure with placing of units; show on shop drawings.

B. On steel support members provide 1-1/2 inch minimum bearing. On masonry support surfaces provide 3 inch minimum bearing.

C. Align and level deck on supports.

D. Provide welds, fasteners, and side lap connectors of size, spacing, and location as indicated on Drawings.

E. Install Hilti powder actuated fasteners using the DX-450 or DX-750 decking system, by Hilti. Installed pin height shall be in accordance with manufacturer's recommendations, and verified with manufacturer approved inspection gage. Determine power level by jobsite testing.

F. Install Hilti air actuated fasteners using the R4x12 decking system, by Hilti. Installed pin height shall be in accordance with manufacturer's recommendations, and verified with manufacturer approved inspection gage. Determine power level by jobsite testing.

G. Install Pneutek air actuated fasteners using decking system, by Pneutek. Install pins in accordance with manufacturer's recommendations. Pin head shall clamp deck tightly to supporting member without gaps between underside of head and top side of deck. Pin shall not cause excessive dimpling of the deck greater than 1/2 the thickness of the pin head.

H. Powder and air actuated fasteners shall be installed by a tool operator licensed by the pin manufacturer. A representative of the pin manufacturer shall be on site to verify proper installation of fasteners, and shall submit written verification to Owner.

I. Welding: In accordance with AWS D1.1 and D1.3. Provide welding washers when welding 26 gauge or lighter steel deck.

J. Install 6 inch wide sheet steel cover plates where deck changes direction. Spot weld in place 12 inches on center maximum. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.

K. Position roof sump pans with flange bearing on top surface of deck. Weld at each deck flute.

L. Immediately after welding deck in place, touch-up welds, burned areas, and surface coating damage with compatible primer paint.

3.3 FIELD QUALITY CONTROL

A. Section 01450 – Quality Control: Field testing and inspection.

B. Inspection:

1. Select 6 random sheets for each type of deck used. Inspect for deck thickness, type, and material.
2. Inspect 10 percent of deck welds over entire roof area for size and spacing (CWI to perform inspection).
3. Inspect 10 percent of side lap connectors over entire roof area for type, size, and spacing of side lap connectors.

END OF SECTION

SECTION 054000 - COLD-FORMED METAL FRAMING

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 includes the following:

1. Exterior non-load-bearing wall framing.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on structural drawings.

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than indicated on structural drawings:

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."

2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

G. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. Allied Studco.
2. AllSteel Products, Inc.
3. Clark Steel Framing.
4. Consolidated Fabricators Corp.; Building Products Division.
5. Craco Metals Manufacturing, LLC.
6. Custom Stud, Inc.
7. Dale/Incor.
8. Dietrich Metal Framing; a Worthington Industries Company.
9. Formetal Co. Inc. (The).
10. Innovative Steel Systems.
11. MarinoWare; a division of Ware Industries.
12. Southeastern Stud & Components, Inc.
13. Steel Construction Systems.
14. Super Stud Building Products, Inc.
15. United Metal Products, Inc.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).

2. Flange Width: 1-5/8 inches (41 mm).

3. Section Properties: Minimum 6” depth with section properties as required by structural performance.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/2 inches (38 mm).

C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Dietrich Metal Framing; a Worthington Industries Company.
    b. MarinoWare, a division of Ware Industries.
    c. SCAFCO Corporation
    d. The Steel Network, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Dietrich Metal Framing; a Worthington Industries Company.
    b. MarinoWare, a division of Ware Industries.
    c. SCAFCO Corporation
    d. The Steel Network, Inc.

3. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
4. Flange Width: 1 inch (25 mm) plus the design gap for 1-story structures and 1 inch (25 mm) plus twice the design gap for other applications.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:

    a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
    b. Flange Width: 1 inch (25 mm) plus the design gap for 1-story structures and 1 inch (25 mm) plus twice the design gap for other applications.

2. Inner Track: Of web depth indicated, and as follows:

    a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
    b. Flange Width: Dimension equal to sum of outer deflection track flange width plus 1 inch (25 mm).

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C or mechanically deposition according to ASTM B 695, Class 50.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches (406 mm) or as indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
4. Connect drift clips to cold formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

    a. Install solid blocking at maximum 96-inch (2440-mm) centers.

2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

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. Section Includes:

1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.

3. Metal ladders.
4. Ladder safety cages.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Division 05 Section "Structural Steel Framing."
3. Division 05 Section "Metal Stairs."

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Aluminum Ladders: Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Structural Performance of Alternating Tread Devices: Alternating tread devices shall withstand the effects of loads and stresses within limits and under conditions specified in ICC's International Building Code.

D. 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.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

B. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Qualification Data: For qualified professional engineer.

D. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.

E. Welding certificates.

F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.6 PROJECT CONDITIONS

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

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. Steel Tubing: ASTM A 500, cold-formed steel tubing.

D. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

C. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.
3. Provide stainless-steel fasteners for fastening nickel silver.
4. Provide bronze fasteners for fastening bronze.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Eyebolts: ASTM A 489.

D. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

E. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).

F. Wood Screws: Flat head, ASME B18.6.1.

G. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

H. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

I. Anchors, General: 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.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

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

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

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

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

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

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.7 METAL LADDERS

A. General:

1. Comply with ANSI A14.3 unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.

B. Aluminum Ladders:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ACL Industries, Inc.
b. Alco-Lite Industrial Products.
c. Halliday Products.
d. O'Keeffe's Inc.
e. Precision Ladders, LLC.
f. Royalite Manufacturing, Inc.
g. Thompson Fabricating, LLC.

2. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
3. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches (64 mm) deep, 3/4 inch (19 mm) wide, and 1/8 inch (3.2 mm) thick.
4. Rungs: Extruded-aluminum tubes, not less than 3/4 inch (19 mm) deep and not less than 1/8 inch (3.2 mm) thick, with ribbed tread surfaces.
5. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.

6. Provide platforms as indicated fabricated from pressure-locked aluminum bar grating , supported by extruded-aluminum framing. Limit openings in gratings to no more than 1/2 inch (12 mm) in least dimension.

7. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted aluminum brackets.
8. Provide minimum 72-inch- (1830-mm-) high, hinged security door with padlock hasp at foot of ladder to prevent unauthorized ladder use.

2.8 LADDER SAFETY CAGES

A. General:

1. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
2. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet (6 m) o.c. Provide secondary intermediate hoops spaced not more than 48 inches (1200 mm) o.c. between primary hoops.
3. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners unless otherwise indicated.

B. Aluminum Ladder Safety Cages:

1. Primary Hoops: 1/4-by-4-inch (6.4-by-100-mm) flat bar hoops.
2. Secondary Intermediate Hoops: 1/4-by-2-inch (6.4-by-50-mm) flat bar hoops.
3. Vertical Bars: 1/4-by-2-inch (6.4-by-50-mm) flat bars secured to each hoop.

2.9 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

C. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.11 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

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. Section Includes:

1. Steel pipe railings.

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for wood blocking for anchoring railings.
2. Division 09 Section "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 72 percent of minimum yield strength.

C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Infill load and other loads need not be assumed to act concurrently.

D. 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.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

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

1.4 SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

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

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.

3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.6 PROJECT CONDITIONS

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

1.7 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Steel Pipe and Tube Railings:

a. Pisor Industries, Inc.
b. Wagner, R & B, Inc.; a division of the Wagner Companies.
c. Approved equal.

2.2 METALS, GENERAL

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

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

2.3 STEEL AND IRON

A. Tubing: ASTM A 513.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.4 FASTENERS

A. General: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 for zinc coating.

2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
3. Aluminum Railings: Type 304 stainless-steel fasteners.
4. Stainless-Steel Railings: Type 304 stainless-steel fasteners.

B. 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.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.

3. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or 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.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shop Primers: Provide primers that comply with Division 09 painting SectionsUniversal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

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.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) 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. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

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

G. Connections: Fabricate railings with welded or nonwelded connections unless otherwise indicated.

H. 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.

I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

K. Form changes in direction as follows:

1. As detailed.
2. By bending or by inserting prefabricated elbow fittings.

L. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

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

N. 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 (6 mm) or less.

O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. 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.

P. 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.

Q. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

R. For removable railing posts, fabricate slip-fit sockets from stainless-steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

2.7 FINISHES, GENERAL

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 from damage by applying a strippable, temporary protective covering before shipping.

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

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 STEEL AND IRON FINISHES

A. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning.":

1. Exterior Railings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Railings Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Railings Indicated to Receive Primers Specified in Division 09 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Railings: SSPC-SP 3, "Power Tool Cleaning."

C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated railings with primers specified in Division 09 painting Sections are indicated.

2. Do not apply primer to galvanized surfaces.

D. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Color: As selected by Architect from manufacturer's full range.

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.

1. 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.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).

3. 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 (5 mm in 3 m).

C. Corrosion Protection: Coat concealed surfaces of aluminum 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 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.4 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) 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 nonshrink, nonmetallic grout and placed to comply with anchoring material manufacturer's written instructions.

C. Cover anchorage joint with flange of same metal as post, attached to post with set screws.

D. Leave anchorage joint exposed with 1/8-inch (3-mm) buildup, sloped away from post.

E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
2. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
3. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends or connected to railing ends using nonwelded connections.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

C. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch (38-mm) 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.

1. Use type of bracket with[flange tapped for concealed anchorage to threaded hanger bolt.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. 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.
2. For hollow masonry anchorage, use toggle bolts.
3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.

4. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

5. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

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

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.7 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 055213

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

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. Section Includes:

1. Framing with dimension lumber.
2. Rooftop equipment bases and support curbs.
3. Wood blocking, cants, and nailers.
4. Wood furring and grounds.
5. Wood sleepers.
6. Utility shelving.
7. Plywood backing panels.

B. Related Requirements:

1. Division 06 finish carpentry Sections for nonstructural carpentry items exposed to view and not specified in another Section.
2. Division 31 Section "Termite Control" for site application of borate treatment to wood framing.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NHLA: National Hardwood Lumber Association.
3. NLGA: National Lumber Grades Authority.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 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. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. 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.
3. 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.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 INFORMATIONAL SUBMITTALS

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

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.
6. Metal framing anchors.

1.6 QUALITY ASSURANCE

A. 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.

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

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

1. Factory mark each piece of lumber with grade stamp of grading agency.

2. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. 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].

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Application: Treat items indicated on Drawings, and the following:]

1. Wood cants, 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 and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawl spaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-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 (3.2 m) beyond the centerline of the burners at any time during the test.

1. Use treatment that does 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 ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841. Retain option in first paragraph below if required for plywood backing panels.

C. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

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

D. 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.

E. Application: Treat items indicated on Drawings, and the following:

1. Framing for raised platforms.
2. Concealed blocking.
3. Roof framing and blocking.
4. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
5. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide Construction or No. 2 and the following species:

1. Mixed southern pine; SPIB.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:

1. Mixed southern pine, [No. 2] [No. 3] grade; SPIB.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

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. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.6 FASTENERS

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

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.

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

G. 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.

H. 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. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

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 furring, 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. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

E. Do not splice structural members between supports unless otherwise indicated.

F. 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.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal (38-mm actual) thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.

4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.

H. 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.

I. 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.

J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

K. 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 GROUND, SLEEPER, 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.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size (19-by-63-mm actual-size) furring horizontally at 24 inches (610 mm) o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size (19-by-38-mm actual-size) furring vertically at 16 inches (406 mm) o.c.

3.4 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 061053

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

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 includes the following:

1. Interior standing and running trim.
2. Interior frames and jambs.
3. Rails.
4. Flush wood paneling.
5. Interior ornamental work.
6. Wood cabinets.
7. Plastic-laminate cabinets.
8. Plastic-laminate countertops.
9. Solid-surfacing-material countertops.
10. Shop finishing of interior woodwork.

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

2. Division 06 Section "Finish Carpentry" for interior carpentry exposed to view that is not specified in this Section.

3. Division 06 Section "Wood Paneling."
4. Division 09 Section "Stone Facing" for stone countertops.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including cabinet hardware and accessories, handrail brackets 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. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, and other items installed in architectural woodwork.

3. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

C. Samples for Initial Selection:

1. Plastic laminates.
2. Solid-surfacing materials.
3. Thermoset decorative panels.
4. Shop-applied transparent finishes.

D. Samples for Verification:

1. Lumber with or for transparent finish, not less than 50 sq. in. (300 sq. cm), for each species and cut, finished on 1 side and 1 edge.
2. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
3. Veneer-faced panel products with or for transparent finish, 8 by 10 inches (200 by 250 mm), for each species and cut. Include at least one face-veneer seam and finish as specified.
4. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
5. Thermoset decorative-panels, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with edge banding on 1 edge.
6. Solid-surfacing materials, 6 inches (150 mm) square.
7. Corner pieces as follows:

    a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
    b. Miter joints for standing trim.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

G. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers.

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.

E. Mockups: 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork 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. Field Measurements: Where woodwork is 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.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish: Cherry, Plain Sliced.

C. Wood Species for Opaque Finish: Any closed-grain hardwood.

D. Wood Products: Comply with the following:

1. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.

2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

E. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.

F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
   a. Wilsonart International; Div. of Premark International, Inc.

G. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Wilsonart International; Div. of Premark International, Inc.
b. Corian

2. Colors and Patterns: As indicated in drawings.

2.2 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.

C. Back-Mounted Pulls: BHMA A156.9, B02011.

D. Wire Pulls: Back mounted, Stainless Steel] :

a. Product (see drawings for location):

Wire Pull 1: Doug Mockett DP7B 4" Wire Pull, satin chrome

Wire Pull 2: Doug Mockett DP55A 6” pull, finish SSS

E. Catches: Magnetic catches, BHMA A156.9,

F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

G. Shelf Rests: BHMA A156.9, B04013; metal

H. Drawer Slides: BHMA A156.9, B05091.

1. Standard Duty (Grade 1, Grade 2, and Grade 3): Side mounted full-extension type; zinc-plated steel with polymer rollers.

2. Box Drawer Slides: Grade 1; for drawers not more than 6 inches (150 mm) high and 24 inches (600 mm) wide.
3. File Drawer Slides: Grade 1HD-100; for drawers more than 6 inches (150 mm) high or 24 inches (600 mm) wide.
4. Pencil Drawer Slides: Grade **1**; for drawers not more than 3 inches (75 mm) high and 24 inches (600 mm) wide.

I. Door Locks: BHMA A156.11, E07121.

J. Drawer Locks: BHMA A156.11, E07041.

K. Grommets for Cable Passage through Countertops: 2-inch (51-mm OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Product: Subject to compliance with requirements, provide "SG series" by Doug Mockett & Company, Inc. Color to be selected from manufacturer's full color line.

L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for 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 sleeves for drilled-in-place anchors.

C. Handrail Brackets: Cast from stainless steel with wall flange drilled for exposed anchor and with support arm for screwing to underside of rail. Sized to provide 1-1/2-inch (38-mm) clearance between handrail and wall.

D. Adhesive for Bonding Plastic Laminate: Woodworker's Option.

1. Adhesive for Bonding Edges: Hot-melt adhesive

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).

D. Complete fabrication, including assembly, finishing, 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.

1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, 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.

1. Seal edges of openings in countertops with a coat of varnish.

2.5 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Custom

B. Wood Species and Cut: Cherry, Plain Sawn.

C. For trim items wider than available lumber, use veneered construction. Do not glue for width.

D. For rails wider or thicker than available lumber, use veneered construction. Do not glue for width or thickness.

E. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

F. Assemble casings in plant except where limitations of access to place of installation require field assembly.

G. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.

2.6 RAILS

A. Grade: Custom.

B. Wood Species and Cut for Transparent Finish: Cherry, Plain Sawn**.**

2.7 INTERIOR ORNAMENTAL WORK FOR TRANSPARENT FINISH

A. Interior ornamental work for transparent finish includes the following:

1. Paneling.

B. Grade: Premium

C. Wood Species and Cut: Cherry, Plain Sawn.

2.8 PLASTIC-LAMINATE CABINETS

A. Grade: Custom.

B. AWI Type of Cabinet Construction: Flush overlay

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.

D. Materials for Semiexposed Surfaces:

1. Adjustable Shelves: Thermoset decorative panels.

2. Drawer Sides and Backs: Thermoset decorative panels.
3. Drawer Bottoms: Thermoset decorative panels.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. Colors, Patterns, and Finishes: As indicated in drawings.

2.9 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Custom.

B. High-Pressure Decorative Laminate Grade: HGS.

C. Colors, Patterns, and Finishes: As indicated in drawings.

D. Grain Direction: Parallel to cabinet fronts.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces

F. Core Material: Medium-density fiberboard

G. Core Material at Sinks: Medium-density fiberboard made with exterior glue or exterior-grade plywood.

H. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.10 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Grade: Premium.

B. Solid-Surfacing-Material Thickness: 1/2 inch (13 mm).

C. Colors, Patterns, and Finishes: As indicated in drawings.

D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied backsplashes

E. Drill holes in countertops for plumbing fittings in shop.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches (900 mm) long, except where shorter single-length pieces are necessary

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

G. Cabinets: Install 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.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.

3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips.

H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.

3. Secure backsplashes to walls with adhesive.
4. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

J. Refer to Division 09 Sections for final finishing of installed architectural woodwork.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023

SECTION 072100 - THERMAL INSULATION

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. Section Includes:

1. Foam-plastic board insulation.
2. Glass-fiber blanket insulation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.4 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.

1.5 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. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

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 ice, rain, or snow at any time.

C. Extend insulation to envelop entire area 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 PROTECTION

A. Protect installed insulation and vapor retarders 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 072100

SECTION 072500 - WEATHER BARRIERS

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. Section Includes:

1. Building wrap.
2. Flexible flashing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); Styrofoam Weathermate Plus Brand Housewrap.
b. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap
c. Reemay, Inc.; Typar HouseWrap.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than .030 inch (0.8 mm) .

1. Products: Subject to compliance with requirements, provide one of the following:

a. DuPont (E. I. du Pont de Nemours and Company); DuPont Flashing Tape.
b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Butyl Self Adhered Flashing.
c. Protecto Wrap Company; BT-25 XL.
d. Raven Industries Inc.; Fortress Flashshield.

e. Advanced Building Products Inc.; Wind-o-wrap.
f. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
g. Fiberweb, Clark Hammerbeam Corp.; Aquaflash 500.
h. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Plus Self-Adhered Flashing.
i. MFM Building Products Corp.; Window Wrap.

B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

C. Nails and Staples: ASTM F 1667.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches (100 mm) except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over water-resistive barrier at bottom and sides of openings.

4. Lap water-resistive barrier over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 072500

SECTION 076200 - SHEET METAL FLASHING AND TRIM

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. Section Includes:

1. Formed Products:

a. Formed roof drainage sheet metal fabrications.
b. Formed low-slope roof sheet metal fabrications.
c. Formed wall sheet metal fabrications.

B. Related Sections:

1. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section for installing sheet metal flashing and trim integral with membrane roofing.
3. Division 07 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Fabricate and install roof edge flashing capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

1. Wind Zone 3: For velocity pressures of 46 to 104 lbf/sq. ft. (2.20 to 4.98 kPa): 208-lbf/sq. ft. (9.96-kPa) perimeter uplift force, 312-lbf/sq. ft. (14.94-kPa) corner uplift force, and 104-lbf/sq. ft. (4.98-kPa) outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
7. Details of special conditions.
8. Details of connections to adjoining work.

9. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches (1:5) .

C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
3. Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

E. Qualification Data: For qualified fabricator.

F. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

G. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Copper Sheet Metal Standard: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof eave, including fascia, approximately 10 feet (3.0 m) long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

1. Surface: Smooth, flat.

2. Exposed Coil-Coated Finishes:

a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish 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.

3. Color: As selected by Architect from manufacturer's full range.

4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.2 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).

3. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
c. Henry Company; Blueskin PE200 HT.
d. Metal-Fab Manufacturing, LLC; MetShield.
e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

B. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing

and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Through-Wall Ribbed Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond. Manufacture through-wall flashing with snaplock receiver on exterior face to receive counterflashing.

B. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cheney Flashing Company.
b. Fry Reglet Corporation.
c. Heckmann Building Products Inc.
d. Hickman, W. P. Company.
e. Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
f. Keystone Flashing Company, Inc.
g. National Sheet Metal Systems, Inc.
h. Sandell Manufacturing Company, Inc.

2. Material: Aluminum, 0.024 inch (0.61 mm) thick.

3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
5. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
6. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
7. Accessories:

    a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
    b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

8. Finish: With manufacturer's standard color coating.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

G. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

H. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

I. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

J. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

K. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates.

1. Joint Style: Butt, with 12-inch- (300-mm-) wide, concealed backup plate.

2. Fabricate from the following materials:

a. Aluminum: [0.050 inch (1.27 mm)] <Insert thickness> thick.

B. Counterflashing: Fabricate from the following materials:
1. Aluminum: 0.032 inch (0.81 mm) thick.

C. Flashing Receivers: Fabricate from the following materials:
1. Aluminum: 0.032 inch (0.81 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 UNDERLAYMENT INSTALLATION

A. General: Install underlayment as indicated on Drawings.

B. Polyethylene Sheet: Install polyethylene sheet with adhesive for anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches (50 mm).

C. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

D. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Coat back side of [uncoated aluminum] [and] [stainless-steel] sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetratewood sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws, metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

F. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at 16-inch (400-mm) centers.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with sealant. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

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. Section Includes:
   1. Roof hatches.

B. Related Sections:

   1. Division 05 Section "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
   2. Division 05 Section "Pipe and Tube Railings" for safety railing systems not attached to roof-hatch curbs.
   3. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

D. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.

3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

E. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

F. Warranty: Sample of special warranty.

1.5 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.6 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.

1. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

B. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

C. Steel Tube: ASTM A 500, round tube.

D. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.

E. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

C. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

E. Elastomeric Sealant: ASTM C 920, elastomeric [polyurethane] [silicone] polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AES Industries, Inc.
    b. Babcock-Davis.
    c. Bilco Company (The).
    d. Bristolite Skylights.
    e. Custom Solution Roof and Metal Products.
    f. Dur-Red Products.
    g. Hi Pro International, Inc.
    h. J. L. Industries, Inc.
    i. Metallic Products Corp.
    j. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
    k. Naturalite Skylight Systems; Vistawall Group (The).
    l. Nystrom.
    m. O'Keeffe's Inc.
    n. Pate Company (The).
    o. Precision Ladders, LLC.

B. Type and Size: Single-leaf lid, 30 by 36 inches (750 by 900 mm).

C. Loads: Minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.

D. Hatch Material: Aluminum sheet, 0.090 inch (2.28 mm) thick.

1. Finish: Two-coat fluoropolymer.

2. Color: As selected by Architect from manufacturer's full range..

E. Construction:

1. Insulation: Polyisocyanurate board.

2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.

3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
4. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.

5. Fabricate curbs to minimum height of 12 inches (300 mm) unless otherwise indicated.
6. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

F. Hardware: Stainless-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.

1. Provide two-point latch on lids larger than 84 inches (2130 mm).

2. Provide remote-control operation.

G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

1. Height: 42 inches (1060 mm) above finished roof deck.

2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches (31 mm) in diameter or galvanized-steel tube, 1-5/8 inches (41 mm) in diameter.
3. Flat Bar: Galvanized steel, 2 inches (50 mm) high by 3/8 inch (9 mm) thick.

4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches (533 mm) in diameter.

5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
8. Fabricate joints exposed to weather to be watertight.
9. Fasteners: Manufacturer's standard, finished to match railing system.
10. Finish: Manufacturer's standard.

a. Color: As selected by Architect from manufacturer's full range] <Insert color.

H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.

2. Height: 42 inches (1060 mm) above finished roof deck.
3. Material: Steel tube.

4. Post: 1-5/8-inch- (41-mm-) diameter pipe.
5. Finish: Manufacturer's standard baked enamel or powder coat.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

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

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof-Hatch Installation:

1. Install roof hatch so top surface of hatch curb is level.
2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
3. Attach safety railing system to roof-hatch curb.
4. Attach ladder-assist post according to manufacturer's written instructions.

D. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Division 09 painting Sections.

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 079200 - JOINT SEALANTS

1. PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Preparation of sealant substrate surfaces.
B. Installation of backing and sealant.

1.2 RELATED SECTIONS

A. Section 04810: Unit Masonry Assemblies.
B. Section 08800: Glazing.
C. Section 08411: Aluminum-Framed Storefronts.

1.3 SUBMITTALS

A. Submit manufacturer's product data and installation instructions under the provisions of Section 01300 for each type of sealant required.

B. Submit product data indicating sealant chemical characteristics, limitations, and color availability. Include the following for submission of physical samples for selection of product color. If samples are to be field applied, omit this paragraph and include the article on Mock-Ups.

C. Submit two samples 6 inches in size illustrating color of sealants to be installed.

D. Submit manufacturer's letter of certification, under the provisions of Section 01300, that products meet or exceed specified requirements and are appropriate for the uses indicated.

E. Submit manufacturer's standard twenty year warranty under the provisions of Section 01700. Include coverage of installed sealants and accessories against failure to achieve airtight or watertight seal or loss of adhesion, cohesion or color stability.

F. Submit manufacturer's letters stating that actual samples have been tested for adhesion and compatibility, and surface preparation recommendations are made based upon those tests.

1.4 QUALITY ASSURANCE

A Applicator: Company specializing in the installation of sealants with a minimum of five years experience.

A. Field quality assurance procedures can be obtained from a Dow Corning distributor or representative.

1.5 MOCK-UP

A. Construct a mock-up sample panel of 3 feet long by 2 feet wide, showing sealant types, colors and tooled surfaces. Locate as directed by Architect. Mock-up may not be used as part of the final installation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original unopened packages with manufacturer's labels, instructions and product identification and lot numbers intact and legible.

B. Store materials protected from the weather, in original containers or unopened packages, in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 SEALANTS

A. Exterior: Sonneborne NP-1 Urethane

B. Interior: Pecora AC-20

C. Color: to be selected by Architect.

2.2 ACCESSORIES

A. A primer may be needed for good adhesion of sealants to some surfaces. Consult manufacturer for specific recommendations for various substrates.

B. Joint Cleaner: As recommended by *manufacturer.*

D. Backer Rod: Open cell polyurethane foam or closed cell polyethylene foam, compatible with sealant, sized and shaped to provide proper compression upon insertion in accordance with manufacturer's recommendations. Contractor must consult manufacturer for recommendation on backer rod type.

E. Bond Breaker: Pressure sensitive adhesive polyethylene, TEFLON®[1].

F. Masking Tape: Pressure sensitive adhesive paper tape.

1. "TEFLON" is a registered trademark of E.I. du Pont de Nemours & Company.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and joint openings are free of defects, are in the specified dimensions, including tolerances, and are ready to receive the work.

B. Beginning of installation means installer accepts existing surfaces.

3.1 PREPARATION

B. Cleaning: Clean joint surfaces, using joint cleaner as necessary, to remove dust, dirt, oil, grease, rust, lacquers, laitance, release agents, moisture, frost or other matter that might adversely affect adhesion of sealant.

C. Masking: Mask areas adjacent to joints.

C. If required, prime substrate surfaces following manufacturer's instructions.

D. Mixing: When required, mix components of sealant materials in accordance with manufacturer's instructions to achieve required characteristics of sealant.

3.3 INSTALLATION

A. Install backing material in joints using blunt instrument to avoid puncturing. Do not twist the backing rod while installing. Install backing rod so that joint depth is 50 percent of joint width, but a minimum of 1/8-inch deep and a maximum of 3/8-inch deep.

B. Apply sealant in joints using a pressure gun with nozzle cut to fit joint width. Ensure sealant is deposited in a uniform, continuous bead without gaps or air pockets.

C. Tool joints to the required configuration within 10 minutes of sealant application. Remove masking materials immediately after tooling.

3.4 CLEANING

A. Remove all excess materials adjacent to joints by mechanical means or mask to prevent evidence of spillage or damage to adjacent surfaces.

1. Leave finished work in neat, clean condition with no evidence of spillovers onto adjacent surfaces.

B. When using flammable solvents, avoid heat, sparks and open flames. Provide necessary ventilation. Follow all precautions and safe handling recommendations from the solvent manufacturer and pertinent local, state and federal regulations.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

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. Section Includes:

1. Standard hollow metal doors and frames.

B. Related Sections:

1. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification:

1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).

2. For the following items, prepared on Samples about 12 by 12 inches (305 by 305 mm) to demonstrate compliance with requirements for quality of materials and construction:

   a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
   b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow metal panels and glazing if applicable.

E. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

F. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies 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. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 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 257 or UL 9. Label each individual glazed lite.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld Building Products, LLC.
2. Benchmark; a division of Therma-Tru Corporation.
3. Ceco Door Products; an Assa Abloy Group company.
4. Curries Company; an Assa Abloy Group company.
5. Deansteel Manufacturing Company, Inc.
6. Firedoor Corporation.
7. Fleming Door Products Ltd.; an Assa Abloy Group company.
8. Habersham Metal Products Company.
9. Karpen Steel Custom Doors & Frames.
10. Kewanee Corporation (The).
11. Mesker Door Inc.
12. Pioneer Industries, Inc.
13. Security Metal Products Corp.
14. Steelcraft; an Ingersoll-Rand company.
15. Windsor Republic Doors.

2.2 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. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

1. 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. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-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 (102 mm), as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Division 08 Section "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

1. Design: Flush panel.

2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

3. Vertical Edges for Single-Acting Doors: Beveled edge.

a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).

4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 1 and Physical Performance Level C (Standard Duty), Model 1 (Full Flush) .

a. Width: 1-3/4 inches (44.5 mm).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 1 and Physical Performance Level C (Standard Duty), Model 1 (Full Flush).

a. Width: 1-3/4 inches (44.5 mm).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped corners.

2. Fabricate frames as face welded unless otherwise indicated.
3. Frames for Level 1 Steel Doors: 0.042-inch- (1.0-mm-) thick steel sheet.
4. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
5. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
6. Frames for Level 4 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.

1. Fabricate frames with mitered or coped corners.

2. Fabricate frames as face welded unless otherwise indicated.

3. Frames for Level 1 Steel Doors: 0.042-inch- (1.0-mm-) thick steel sheet.

4. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
5. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
6. Frames for Level 4 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet.
7. Frames for Wood Doors: 0.042-inch- (1.0-mm-) thick steel sheet.
8. Frames for Borrowed Lights: 0.042-inch- (1.0-mm-) thick steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) 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.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

D. Terminated Stops: Where indicated on interior door frames, terminate stops 6 inches (152 mm) above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

1. Provide terminated stops where indicated.

2.8 LOUVERS

A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- ((0.5-mm-)) thick, cold-rolled steel sheet set into 0.032-inch-(0.8-mm-) thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other, any angle.

3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.

2.9 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

2.10 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.

3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

        1) Two anchors per jamb up to 60 inches (1524 mm) high.
        2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.

    b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

        1) Three anchors per jamb up to 60 inches (1524 mm) high.
        2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
        5) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.

    c. Compression Type: Not less than two anchors in each jamb.
    d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door

Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8 .
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.11 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.12 Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-protection-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable glazing stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.

4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
9. 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 (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

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. Section Includes:

1. Solid-core doors with wood-veneer faces.

2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Sections:

1. Division 06 Section "Interior Architectural Woodwork" for requirements for veneers from the same flitches for both flush wood doors and wood paneling.
2. Division 08 Section "Glazing" for glass view panels in flush wood doors.
3. Division 09 Sections "Interior Painting" and "Staining and Transparent Finishing" for field finishing doors.

1.3 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection ratings for fire-rated doors.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish.

E. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Source Limitations: Obtain flush wood doors[and wood paneling] from single manufacturer.

C. Quality Standard: In addition to requirements specified, comply WI's "Manual of Millwork."

1. Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.

D. 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. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.6 PROJECT 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 ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. 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 (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which 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 (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Algoma Hardwoods, Inc.
2. Ampco, Inc.
3. Buell Door Company Inc.
4. Chappell Door Co.
5. Eagle Plywood & Door Manufacturing, Inc.
6. Eggers Industries.
7. Graham; an Assa Abloy Group company.
8. Haley Brothers, Inc.
9. Ideal Architectural Doors & Plywood.
10. Ipik Door Company.
11. Lambton Doors.
12. Marlite.
13. Marshfield Door Systems, Inc.
14. Mohawk Flush Doors, Inc.; a Masonite company.
15. Oshkosh Architectural Door Company.
16. Poncraft Door Company.
17. Vancouver Door Company.
18. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

A. WDMA I.S.1-A Performance Grade: Standard Duty.

B. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-1.

2. Particleboard: Straw-based particleboard complying with ANSI A208.1, Grade LD-2 or M-2, except for density.

3. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
c. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.

4. Provide doors with glued-wood-stave instead of particleboard cores for doors indicated to receive exit devices.

C. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Comply with specified requirements for exposed edges.

3. Pairs: Provide formed-steel edges and astragals.

a. Finish steel edges and astragals with baked enamel.

b. Finish steel edges and astragals to match door hardware (locksets or exit devices).

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Custom (Grade A faces).

2. Species: White Maple

3. Cut: Plain Sliced

4. Match between Veneer Leaves: Book match.

5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. 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 20 feet (6 m) or more.

8. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.

9. Transom Match: Continuous match

10. Exposed Vertical Edges: Same species as faces or a compatible species.

11. Core: Particleboard.

12. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.

13. WDMA I.S.1-A Performance Grade: Standard Duty.

2.4 LOUVERS AND LIGHT FRAMES

A. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.

1. Wood Species: Same species as door faces.

B. Metal Louvers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Air Louvers Inc.
b. Anemostat; a Mestek company.
c. Hiawatha Incorporated.
d. L & L Louvers, Inc.
e. LL Building Products, Inc.; a division of GAF Materials Corporation.
f. Louvers & Dampers, Inc.; a Mestek company.
g. McGill Architectural Products.

2. Blade Type: Vision-proof, inverted V.

3. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, with baked-enamel- or powder-coated finish.

C. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

2.5 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 requirements in NFPA 80 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, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

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 meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings: Cut and trim openings through doors in factory.

1. Light 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 Division 08 Section "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.6 SHOP PRIMING

A. Doors for Transparent Finish: Shop prime doors with stain (if required), other required pretreatments, and first coat of finish as specified in Division 09 Section Interior Painting Staining and Transparent Finishing." Seal all four edges, edges of cutouts, and mortises with first coat of finish.

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 bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.

C. Transparent Finish:

1. Grade: Custom.

2. Finish: WI System 5 catalyzed polyurethane.
3. Staining: Custom color to match architect’s sample

4. Sheen: Satin.

D. Opaque Finish:

1. Grade: Custom.

2. Finish: WI System 5 catalyzed polyurethane.
3. Color: Custom color to match architect’s sample

4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that 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 Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.

a. Comply with NFPA 80 for fire-rated doors.

2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.

3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. 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 081416

SECTION 083613 - SECTIONAL DOORS

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. Section includes manually and electrically operated sectional doors.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Sectional doors shall meet performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

B. Delegated Design: Design sectional doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Performance: Exterior sectional doors shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Wind Loads: As indicated on Drawings

2. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components. Deflection of door in horizontal position (open) shall not exceed 1/120 of the door width.

D. Air Infiltration: Maximum rate not more than indicated when tested according to ASTM E 283.

E. Windborne-Debris-Impact-Resistance Performance: Provide glazed sectional doors that pass large-missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and ASTM E 1996.

F. Operation Cycles: Provide sectional door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.4 SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory. Include the following:

1. Construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Qualification Data: For qualified Installer.

E. Maintenance Data: For sectional doors to include in maintenance manuals.

F. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain sectional doors from single source from single manufacturer.

1. Obtain operators and controls from sectional door manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Standard for Sectional Doors: Fabricate sectional doors to comply with DASMA 102 unless otherwise indicated.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sectional 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, but not limited to, excessive deflection.
    b. Faulty operation of hardware.
    c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
    d. Delamination of exterior or interior facing materials.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 STEEL DOOR SECTIONS

A. Exterior Section Faces and Frames: Fabricate from zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated zinc coating and thickness.

1. Fabricate section faces from single sheets to provide sections not more than 24 inches (610 mm) high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weathertight seal, with a reinforcing flange return.

2. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.

B. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch- (1.63-mm-) nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than 0.064-inch- (1.63-mm-) thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches (1219 mm) apart.

C. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile.

D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place.

E. Provide reinforcement for hardware attachment.

F. Foamed-in-Place Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard polyurethane insulation, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load, and with

maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within steel sections that incorporate the following interior facing material, with no exposed insulation:

1. Interior Facing Material: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated thickness.
2. Interior Facing Material: Manufacturer's standard prefinished hardboard panel, 1/8 inch (3 mm) thick and complying with ANSI A135.5.

G. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

2.2 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances shown on Drawings, and complying with ASTM A 653/A 653M for minimum G60 (Z180) zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced 2 inches (51 mm) apart for door-drop safety device. Slope tracks at proper angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.

B. Track Reinforcement and Supports: Galvanized-steel track reinforcement and support members, complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.

1. Vertical Track Assembly: Track with continuous reinforcing angle attached to track and attached to wall with jamb brackets.
2. Horizontal Track Assembly: Track with continuous reinforcing angle attached to track and supported at points from curve in track to end of track by laterally braced attachments to overhead structural members.

C. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

D. Windows: Manufacturer's standard window units of type and size indicated and in arrangement shown. Set glazing in vinyl, rubber, or neoprene glazing channel for metal-framed doors and elastic glazing compound for wood doors, as required. Provide removable stops of same material as door-section frames.

2.3 HARDWARE

A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch- (2.01-mm-) nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails

with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges where required, for doors over 16 feet (4.88 m) wide unless otherwise recommended by door manufacturer.

C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- (76-mm-) diameter roller tires for 3-inch- (76-mm-) wide track and 2-inch- (51-mm-) diameter roller tires for 2-inch- (51-mm-) wide track.

D. Push/Pull Handles: For push-up or emergency-operated doors, provide galvanized-steel lifting handles on each side of door.

2.4 LOCKING DEVICES

A. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.5 COUNTERBALANCE MECHANISM

A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.

B. Weight Counterbalance: Counterbalance mechanism consisting of filled pipe weights that move vertically in a galvanized-steel weight pipe. Connect pipe weights with cable to weight-cable drums mounted on torsion shaft made of steel tube or solid steel.

C. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to 16 feet (4.88 m) long and two additional brackets at one-third points to support shafts more than 16 feet (4.88 m) long unless closer spacing is recommended by door manufacturer.

D. Cables: Galvanized-steel lifting cables with cable safety factor of at least 7 to 1.

E. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.

F. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.

G. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.6 MANUAL DOOR OPERATORS

A. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.

B. Push-up Operation: Lift handles and pull rope for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf (111 N).

2.7 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.

1. Trolley: Trolley operator mounted to ceiling above and to rear of door in raised position and directly connected to door with drawbar.

2. Jackshaft, Center Mounted: Jackshaft operator mounted on the inside front wall above door and connected to torsion shaft with an adjustable coupling or drive chain.

3. Jackshaft, Side Mounted: Jackshaft operator mounted on the inside front wall on right or left side of door and connected to torsion shaft with an adjustable coupling or drive chain.

D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11 Section "Common Motor Requirements for Equipment" unless otherwise indicated.

1. Electrical Characteristics:

a. Per drawings.

2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.

3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.

4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

6. Use adjustable motor-mounting bases for belt-driven operators.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensor device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.

2. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

a. Self-Monitoring Type: Four-wire configured device designed to interface with door-operator control circuit to detect damage to or disconnection of sensor edge.

G. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."

1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

2. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.

H. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

I. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

2.8 DOOR ASSEMBLY

A. Steel Sectional Door: Sectional door formed with hinged sections.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Amarr Garage Doors.
b. Arm-R-Lite.
c. C.H.I. Overhead Doors.
d. Clopay Building Products; a Griffon company.
e. Fimbel Architectural Door Specialties.
f. General American Door Company.

g. Haas Door; a Nofziger company.
h. Martin Door Manufacturing.
i. Overhead Door Corporation.
j. Raynor.
k. Rite-Hite Corporation.
l. Wayne-Dalton Corp.
m. Windsor Republic Doors.

B. Operation Cycles: Not less than 20,000.

C. [Installed]R-Value: 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W.

D. Steel Sections: Zinc-coated (galvanized) steel sheet with G90 (Z275) zinc coating.

1. Section Thickness: 1-3/8 inches (35 mm).
2. Exterior-Face, Steel Sheet Thickness: 0.064-inch- (1.63-mm nominal coated thickness.

a. Surface: Flat.

3. Insulation: Foamed in place.

4. Interior Facing Material: Zinc-coated (galvanized) steel sheet of 0.028-inch- (0.71-mm-) nominal coated thickness.
5. Interior Facing Material: Hardboard panel.

E. Track Configuration: Contour.

F. Weatherseals: Fitted to bottom and top and around entire perimeter of door. Provide combination bottom weatherseal and sensor edge.

G. Windows: Size per drawings, with square corners, and spaced apart the approximate distance as indicated on Drawings; at height indicated on Drawings; installed with insulated glazing of the following type:

1. Clear Acrylic Plastic: 3 mm thick, transparent, smooth or polished, and formulated to be UV resistant.

H. Roller-Tire Material: Manufacturer's standard.

I. Counterbalance Type: Torsion spring.

J. Electric Door Operator:

1. Usage Classification: Standard duty, up to 60 cycles per hour.
2. Operator Type: Jackshaft, center mounted.

3. Motor Exposure: Exterior, dusty, wet, or humid.
4. Emergency Manual Operation: Push-up type.

5. Obstruction-Detection Device: Automatic photoelectric sensor.

a. Sensor Edge Bulb Color: Black.

6. Remote-Control Station: Interior.

K. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color and gloss as selected by Architect from manufacturer's full range.

2. Finish of Interior Facing Material: Match finish of exterior section face.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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.

2.10 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

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

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Tracks:

1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches (610 mm) apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing,

diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

3. Repair galvanized coating on tracks according to ASTM A 780.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weathertight fit around entire perimeter.

D. Align and adjust motors, pulleys, belts, sprockets, chains, and controls according to manufacturer's written instructions.

E. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 08 3614 – FOUR-FOLD BAY DOORS

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. This Section includes Four-Fold metal doors, tested and approved for High Velocity Hurricane Zones, up to 120psf and approved by Florida Building Code, #FL17136.

B. Operation of Four-Fold metal doors includes overhead mounted electro-mechanical operators.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified consisting of manufacturer's technical Product Data and installation instructions for each type of door required, including data substantiating that products comply with requirements.

C. Submittal Drawings showing fabrication and installation of Four-Fold metal doors including plans, elevations, sections, details of components, hardware, operating mechanism, and attachments to the other units of Work. Include wiring diagrams for coordination with electrical trade.

D. Reference list including (5) successful installations of this type of hurricane rated doors within the past two (2) years.

1.4 QUALITY ASSURANCE

A. Doors shall be designed to withstand external or internal horizontal wind loads of 120 pounds minimum per square foot. The maximum allowable deflection shall not exceed 1/120 of the span. Fiber stresses in main members shall be limited to 27,000 pounds per square inch. Steel frames shall be designed in accordance with the AISC "Steel Construction Manual".

1.5 DELIVERY, STORAGE AND HANDLING

A. Store delivered materials and equipment in dry locations with adequate ventilation, free from dust and water, and so as to permit access for inspection and handling.

B. Handle materials carefully to prevent damage.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of four fold doors that fail in materials or workmanship within specified warranty period.

1. Structural failures including, but not limited to, excessive deflection.
   a. Faulty operation of hardware.
   b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
   c. Delamination of exterior or interior facing materials.

2. Warranty Period: Five (5) years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: Ten (10) Years from date of Substantial Completion.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturers: Four-Fold industrial metal doors manufactured by Door Engineering and Manufacturing, 400 Cherry Street, Kasota, MN 56050, (800)- 959-1352. Equal products by other manufacturers approved in advance, including State of Florida (FBC) approval.

2.2 MATERIALS

A. Steel Tube: ASTM A513 and ASTM A500/A500M

B. Steel Sheets: Steel sheets of commercial quality, complying with ASTM A1011/A1011M hot-rolled steel sheet.

C. Hardware: Manufacturer's standard components.

D. Fasteners: Zinc-coated steel.

2.3 FOUR-FOLD DOORS

A. Basis-of-Design Product: The drawings and specifications are based on the FF701 Series, Glazed or Solid Sheeted Four-Fold Doors as manufactured by Door Engineering and Manufacturing, LLC; Kasota, MN.

Construction: Door framing shall be minimum 11-gauge structural steel tube with 14- gauge sheet steel on the exterior and interior faces. Sheeting shall be formed on the vertical edges with no visible welds or caulked sheet edges on the interior or exterior panel faces. All frames and framing members shall be true to dimension and

square in all directions, and no door shall be bowed, warped, or out of line, in the vertical or horizontal plane of the door opening by more than 1/8 inch in 20 feet. Exposed welds and welds which interfere with the installation of various parts shall be ground smooth and flush.

B. Surface Mounted Tube Frame: Supply pre-hung tube frame system constructed of TS6x6x0.25, designed to anchor to masonry wall construction or weld to steel structure. All hinges, track supports and operator supports shall be factory attached.

C. Factory finish: Operator and operating hardware shall be powder coated manufacturer's standard gray. Panels, frame and all other hardware shall be finished as follows:

a. All exposed steel shall be finished with manufacturer's standard zinc rich primer and polyurethane topcoat, PPG Spectracron or equal. Customer to select from Manufacturer's standard color chart of "fire engine red".

D. Operating Hardware: Hardware shall include guide tracks and brackets, trolleys, center guides, not less than three pairs of jamb and fold hinges per opening, and all bolts, nuts, fasteners, etc. necessary for complete installation and operation. Jamb hinges shall be dual shear and have two thrust bearings and two needle bearings. Jamb hinges shall be gusseted. Fold hinges shall be dual shear with two thrust bearings. Fold hinges shall be stainless steel. All bearings shall be completely sealed within the hinge barrel and include grease zerks. All hinge pins shall be minimum ¾" diameter hardened steel. All trolleys shall be equipped with two (2) Nylatron rollers.

E. Hinge Guards: Provide plastic guards at jamb hinges to prevent access through hinge space.

F. Weatherstripping: Material shall be adjustable and readily replaceable and provide a substantially weather-tight installation. Weatherstripping at center shall be 1/16" cloth inserted neoprene. No exposed fasteners shall be required to attach the center bulb weather seals. Weatherstripping at sill shall include two 1/16" cloth inserted neoprene sweeps with an aluminum retainer. The retainer shall be attached to the door with adhesive.

G. Perimeter Weatherstripping: Provide jamb and head weatherstripping of 1/16" cloth- inserted neoprene bulb (or closed cell neoprene).

H. Vision Panels: Provide 9/16" impact safety glass of the size, shape and location as noted on the drawings.

I. Hurricane Locking System: Locking bolts shall be completely concealed within the door panel. Locking bolts shall extend into the floor and into the header tube. A limit switch shall disable the operator when the locks are engaged.

2.4 OPERATOR

Each Four-Fold door shall be operated by an overhead mounted electro-mechanical drive unit designed for high cycle operation. Operator consists of an electric motor,

gear reducer, and rotating drive arm. The door shall be operated with connecting rods attached to the rotating drive arm on the operator and to control arms attached to the jamb door section and to the door lintel. The connecting rods shall be positive drive, keeping the door under firm control at all times. The connecting rods shall be fitted with spherical bearings and control arms shall be equipped with oil impregnated bronze bearings on polished shafts.

A. Operator shall be instantly reversible, open and close rapidly and start and stop gradually. Operator shall be adjustable to allow door to fully clear the opening. Operator shall automatically lock the door in the closed position. Operator shall be equipped with disengaging mechanism to convert to manual operation.

B. Electric motor shall be of sufficient size to operate doors under normal operating conditions at no more than 75 percent of rated capacity. The motor shall be wound for three phase 208/260/480 VAC, 60 Hertz operation.

C. Electric Controls: Controls shall be furnished by the door manufacturer and shall be complete for each door and built in accordance with the latest NEMA standards. Incoming electrical shall be :120VAC single phase.

1. Control panel assemblies shall be UL listed as per NFPA70.

2. Controls shall include a programmable logic controller with digital message display. Controller shall include programmable close timers and programmable inputs/outputs

3. Motor starters shall be magnetic reversing, factory wired with overload and under voltage protection and equipped with mechanical interlocks. All control components shall be enclosed in one enclosure with a wiring diagram placed on the inside of the cover.

4. If incoming voltage is single phase, control panel shall include a variable frequency drive to convert voltage to 3-phase for the motor

5. Enclosures shall be NEMA 4 with disconnect switch.

6. Pushbuttons (interior) for each door shall have one momentary pressure three-button push-button station marked “OPEN”, “CLOSE” and “STOP”. Push button enclosure shall be NEMA 4.

7. Limit switches shall be provided to stop the travel of the door in its fully open or fully closed position. Provide cremone bolt limit switch to be used for HVAC or exhaust removal system.

8. Safety edges: Provide 4-wire fail-safe electric safety edges on leading edge of all doors to reverse door upon contact with obstruction.

9. Photo eyes: Provide (1) exterior, jamb mounted, light Curtain type photo eyes, NEMA 4 rated. Photo eye shall cover from floor level to 72” above floor.

10. Presence Sensor: Provide (1) interior, overhead mounted, presence sensor with pre-open and pre-close safety fields. Sensor shall be LZR-Widescan or equal.

Radio controls: Provide one (1) radio receiver and (1) single button remotes per door. Remotes to open and close doors with single button.

11. Timer Activation Loop Detectors (fire station applications): Provide “pulse on exit type” loop detector to activate auto close timer once loop has been activated and cleared, include hand/auto switch to deactivate timer. G.C. to coordinate installation of preformed loop with installer prior to exterior apron being poured.

12. Warning Horn/Strobe: Provide warning light and strobe. Include outputs PLC to allow for activation while door is in motion both opening and closing, along with activation prior to closing. Include programmable “delay-to-close” timer which activates the warning horn for a set time, prior to the door closing.

13. Wiring: Door manufacturer shall supply controls and components only. Electrical contractor shall install controls and furnish and install conduits and wiring for jobsite power and control wiring.

14. Integrate four fold door bay doors into fire alarm system tor emergency egress purposes.

15. Accessibility: Install four fold bay doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Four-Fold metal doors in strict accordance with the approved drawings by qualified door erection crews. All door openings shall be completely prepared by the general contractor prior to the installation of the doors. Permanent or temporary electric wiring shall be brought to the door opening before installation is started and shall be completed so as not to delay the inspection test.

B. Doors shall be set plumb, level, and square, and with all parts properly fastened and mounted. All moving parts shall be tested and adjusted and left in good operating condition.

3.2 ADJUSTING AND CLEANING

A. Inspection of the doors and a complete operating test will be made by the installer in the presence of the general contractor or architect as soon as the erection is complete. Any defects noted shall be corrected. After door approval in the above test, the general contractor must assume the responsibility for any damage or rough handling of the doors during construction until the building is turned over to the owner and final inspection is made.

B. Clean surfaces and repaint abraded or damaged finished surfaces to match factory- applied finish.

END OF SECTION 08 3613

SECTION 084113 - ALUMINUM STOREFRONTS (HURRICANE RESISTANT)

PART 1 - GENERAL

1.01 SUMMARY

A. Related Documents: Conditions of the Contract, Division 1 - General Requirements, and Drawings apply to Work of this Section.

B. Section Includes:
1. Storefront system, complete with reinforcing, fasteners, anchors, and attachment devices.
2. Accessories necessary to complete work.

C. Related Sections:

1. Section 06100 - Rough Carpentry.
2. Section 07900 - Joint Sealers.
3. Section 08710 - Door Hardware.
4. Section 08810 - Glazing.

1.02 REFERENCES

A. Aluminum Association (AA):
1. DAF-45 Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association (AAMA):
1. 501.2 Field Check of Metal Curtain Walls for Water Leakage.
2. 2605 Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
3. 606.1 Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
4. 607.1 Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
5. 608.1 Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.
6. 701.2 Specifications for Pile Weatherstripping.
7. Manual #10 Care and Handling of Architectural Aluminum From Shop to Site.
8. SFM-1 Aluminum Storefront and Entrance Manual.

C. American National Standards Institute (ANSI):
1. A117.1 Safety Standards for the Handicapped.
2. Z97.1 Safety Glazing Materials used in Buildings – Safety Performance Specifications and Methods of Test.

D. American Society for Testing and Materials (ASTM):
1. A36 Structural Steel.
2. A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. B209 Aluminum and Aluminum - Alloy Sheet and Plate.
4. B221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
5. B308 Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded.
6. E283 Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.

7. E330 Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
8. E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

E. Federal Specifications (FS):
1. TT-P-641G(1) Primer Coating, Zinc Dust-Zinc Oxide (For Galvanized Surfaces).
2. TT-P-645A Primer, Paint, Zinc Chromate, Alkyd Type.

F. Steel Structures Painting Council (SSPC):
1. Paint 12 Cold-Applied Asphalt Mastic (Extra Thick Film).

1.03 SYSTEM REQUIREMENTS

A. Design Requirements:
1. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage, or moisture disposal.
2. Requirements shown by details are intended to establish basic dimension of units, sight lines and profiles of members.
3. Provide concealed fastening.
4. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
5. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
6. Anchors, fasteners and braces shall be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
7. Where anchor inspections are required, sill design with appropriate access will be provided.
8. Provide for expansion and contraction due to structural movement without detriment to appearance or performance.

B. Performance Requirements:
1. Air infiltration: Air leakage through fixed light areas of storefront shall not exceed 0.06 cfm per square foot of surface area when tested in accordance with Miami – Dade County Building Code Compliance Office (BCCO) protocol (PA-202) and ASTM E283 at differential static pressure of 6.24 psf.
2. Water infiltration: No uncontrolled leakage when tested in accordance with Miami – Dade County Building Code Compliance Office (BCCO) protocol (PA-202) and ASTM E331 at test pressure of 13.5 psf.

C. Thermal Requirements:
1. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180°F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.
2. Ensure doors function normally within limits of specified temperature range.

D. Hurricane Resistance Requirements
1. Large Missile Impact per Miami – Dade County Building Code Compliance Office (BCCO) protocol (PA-201) test requirements.
2. Cyclic Load Test per Miami – Dade County Building Code Compliance Office (BCCO) protocol (PA-203) test requirements.
3. Forced Entry Resistance per South Florida Building Code (SFBC) Section 3603.2 (b) 5 test requirements.

4. Uniform Static Load Test per Dade – County Building Code Compliance Office (BCCO)

E. Structural Requirements, as measured in accordance with ANSI/ASTM E330:
   1. Wind loads for exterior assemblies:
      a. Basic loading:

      Storefront Manufacturer to certify wind load certification based on wind speed at local jurisdiction.

F. Testing Requirements: Provide components that have been previously tested by an independent testing laboratory certified by Miami – Dade County Building Code Compliance Office (BCCO).

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01300.
B. Product Data:
   1. Submit manufacturer's descriptive literature and product specifications.
   2. Include information for factory finishes, hardware, accessories, and other required components.
   3. Include color charts for finish indicating manufacturer's standard colors available for selection.
C. Shop Drawings:
   1. Submit shop drawings covering fabrication, installation and finish of specified systems.
   2. Include following:
      a. Fully dimensioned plans and elevations with detail coordination keys.
      b. Locations of exposed fasteners and joints.
   3. Provide detailed drawings of:
      a. Composite members.
      b. Joint connections for framing systems and for entrance doors.
      c. Anchorage.
      d. System reinforcements.
      e. System expansion and contraction provisions.
      f. Glazing methods and accessories.
      g. Internal sealant requirements.
   4. Schedule of finishes.
D. Samples:
   1. Submit manufacturers standard samples indicating quality of finish.
   2. Where normal texture or color variations are expected, include additional samples illustrating range of variation.
   3. Submit samples for each type of glass, 12 x 12 inch size.
E. Test Reports:
   1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of retesting. Include other supportive data as necessary.
F. Qualification Data:
   1. Submit installer qualifications verifying years of experience.
G. Manufacturer's Instructions: Submit manufacturer's printed installation instructions.

1.05 QUALITY ASSURANCE

A. Single Source Responsibility:

   1. To ensure quality of appearance and performance, obtain materials for systems from

either a single manufacturer or from manufacturer approved by systems manufacturer.

B. Installer Qualifications: Certified in writing by system manufacturer as qualified for installation of specified systems.

C. Perform Work in accordance with AAMA SFM-1 and manufacturer's written instructions.

D. Conform to requirements of ANSI A117.1 and local amendments.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01600.

B. Protect finished surfaces as necessary to prevent damage.

C. Do not use adhesive papers or sprayed coatings, which become firmly bonded when exposed to sun.

D. Do not leave coating residue on any surfaces.

E. Replace damaged units.

1.07 WARRANTY

A. Provide warranties in accordance with Section 01700.

B. Provide written warranty in form acceptable to Owner jointly signed by manufacturer, installer and Contractor warranting work to be watertight, free from deflective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 1 year from date of Substantial Completion.

C. Warranty shall cover following:

1. Complete watertight and airtight system installation within specified tolerances.
2. System is structurally sound and free from distortion.

D. Provide written warranty stating organic coating finish will be free from fading more than 10%, chalking, yellowing, peeling, cracking, pitting, corroding or non-uniformity of color, or gloss deterioration beyond manufacturer's descriptive standards for 1 year from date of Substantial Completion and agreeing to promptly correct defects.

PART 2 - PRODUCTS

2.01 MANUFACTURERS AND PRODUCTS

A. Subject to compliance with requirements indicated, provide products by one of the following:

1. Vistawall Architectural Products.
2. EFCO Corportation.
3. Kawneer Company, Inc.
4. YKK, Inc.

B. Substitutions: Submit under provisions of Section 01630, a minimum of 10 days prior to bid date.

C. Acceptable Storefront Framing Systems:

Flush Glazed System, center set, exterior loaded:
Vistawall Series 5000 or equal – 2 ½" x 5" mullion profile; accommodates laminated glazing.

Note: A non-thermal storefront system meeting the same specifications will be accepted.

2.02 FRAMING MATERIALS AND ACCESSORIES

A. Aluminum:
   1. ASTM B221, alloy 6063-T6 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.
   2. Minimum thickness of [0.080] inch for main framing members.

B. Internal Reinforcing:
   1. ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
   2. (1 ¼" x 4 9/16" x ¼") steel channel (vertical mullions) and (1 ¼" x 4 11/16" x 12 ga) steel channel (vertical jambs).
   3. Steel components factory coated with alkyd type zinc chromate primer complying with FS TT-P-645.

C. Anchorage Devices:
   1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.
   2. Hot-dip galvanize steel assemblies after fabrication; comply with ASTM A123, 2.0 ounce minimum coating.

D. Fasteners:
   1. Aluminum, non-magnetic stainless steel or other non-corrosive materials compatible with items being fastened.
   2. Provide concealed fasteners wherever possible.
   3. For exposed locations, provide Phillips flathead screws with finish matching item fastened.
   4. For concealed locations, provide manufacturer's standard fasteners.

E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.

F. Protective Coatings: Cold-applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.

G. Touch-Up Primer for Galvanized Components: Zinc oxide conforming with FS TT-P-641.

H. Glazing Gaskets:
   1. Compression type design, replaceable extruded, of neoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM) at exterior gasket. Profile and hardness as required to maintain uniform pressure for watertight seal.
   2. Dow – Corning #795 structural silicone sealant at interior gasket with Norton "V-2110" SSA spacer tape.

I. Weatherstripping:
   1. Provide D-1913 EPDM fin seal in AS-6 adjustable astragal.
   2. Provide D-174 silicone weatherstripping in bottom door rail.

J. Internal Sealants and Sealant Tapes.

2.03 GLASS AND GLAZING ACCESSORIES

A. Refer to Section 08810.

2.04 FABRICATION

A. Coordination of Fabrication:
   1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
   2. Fabricate units to withstand loads, which will be applied when system is in place.

B. General
   1. Conceal fasteners wherever possible.
   2. Reinforce work as necessary for performance requirements, and for support to structure.
   3. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or preformed separators, which will prevent contact and corrosion.

4. Comply with Section 08810 for glazing requirements.

C. Aluminum Framing:
   1. Provide members of size, shape and profile indicated, designed to provide for glazing from interior.
   2. Fabricate frame assemblies with joints straight and tight fitting.
   3. Reinforce internally with structural members as necessary to support design loads.
   4. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
   5. Seal horizontals and direct moisture accumulation to exterior.
   6. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
   7. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without detrimental to appearance or performance.
   8. Make provisions in framing for minimum edge clearance, nominal edge cover and nominal pocket width for thickness and type of glazing or infill used in accordance with recommendations of manufacturer and FGMA Glazing Manual.

D. Welding:
   1. Comply with recommendations of the American Welding Society.
   2. Use recommended electrodes and methods to avoid distortion and discoloration.
   3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.

E. Flashings: Form from sheet aluminum with same finish as extruded sections. Material thickness as required to suit condition without deflection or "oil canning".

2.05 FINISHES

A. Organic Coating (high performance fluorocarbon):
   1. Comply with requirements of AAMA 2605.
   2. Surfaces cleaned and given conversion coating pre-treatment prior to application of 0.3 mil dry film thickness of epoxy or acrylic primer following recommendations of finish coat manufacturer.
   3. Manufacturer's standard colors as selected by Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01400.

3.02 INSTALLATION

A. Erection Tolerances:
   1. Limit variations from plumb and level:
      a. 1/8 inch in 10'-0" vertically.
      b. 1/8 inch in 20'-0" horizontally.
   2. Limit variations from theoretical locations: 1/4 inch for any member at any location.
   3. Limit offsets in theoretical end-to-end and edge-to-edge alignment: 1/16 inch from flush surfaces not more than 2 inches apart or out-of-flush by more than 1/4 inch.

B. Install doors and hardware in accordance with manufacturer's printed instructions.

C. Set units plumb, level and true to line, without warp or rack of frame.

D. Anchor securely in place, allowing for required movement, including expansion and contraction.

E. Separate dissimilar materials at contact points, including metal in contact with masonry or

concrete surfaces, with bituminous paint or preformed separators to prevent contact and corrosion.

F. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weathertight construction.

G. Coordinate installation of perimeter sealant and backing materials between assemblies and adjacent construction in accordance with requirements of Section 07920.

H. Glazing: Refer to requirements of Section 08810.

3.03 ADJUSTING

A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation.

3.04 CLEANING

A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.

B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION 08411

SECTION 087100 - DOOR HARDWARE

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. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 01 Section "General Conditions”.
2. Division 06 Section “Rough Carpentry”.
3. Division 06 Section “Finish Carpentry”.
4. Division 08 Section “Operations and Maintenance”.
5. Division 08 Section “Hollow Metal Doors and Frames”.
6. Division 08 Section “Flush Wood Doors”.
7. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
8. Division 26 Section "Electrical”

D. Codes and References: Comply with the version adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI/SDI A250.13 - Testing and Rating of Severe Windstorm Resistant Components for Swing Door Assemblies.
3. ASTM E1886 - Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
4. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure difference.
5. ASTM E1996 - Standard specification for performance of exterior windows, curtain walls, doors and storm shutters impacted by Windborne Debris in Hurricanes.
6. ICC/IBC - International Building Code.

7. NFPA 70 - National Electrical Code.
8. NFPA 80 - Fire Doors and Windows.
9. NFPA 101 - Life Safety Code.
10. NFPA 105 - Installation of Smoke Door Assemblies.
11. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data,

Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Proof of Qualification: Provide copy of manufacturer(s) Factory Trained Installer documentation indicating proof of status as a qualified installer of tornado or hurricane storm shelter assemblies.

E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

F. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Hurricane Resistant Exterior Openings (State of Florida including the High Velocity Hurricane Zone (HVHZ)): Provide exterior door hardware as complete and tested assemblies, or component assemblies, including approved doors and frames specified under Section 081113 "Hollow Metal Doors and Frames", to meet the design pressures, debris impact resistance, and glass and glazing requirements as detailed in the current State of Florida building code sections applicable to the Project.

1. Each unit to bear third party permanent label in accordance with the Florida Building Code requirements.

G. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

J. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. 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. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.2 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.

5. Manufacturers:

a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.3 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:.

a. Pemko (PE).

2.4 SLIDING AND FOLDING HARDWARE

A. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should conform with ANSI/BHMA A156.14.

1. Provide sliding door hardware as follows:

a. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.
b. Cascading: Provide a bi-parting or single direction telescoping system as required with a minimum 200 lb. per door capacity.
c. Bi-folding Door Hardware: Rated for door panels weighing up to 125 lb.
d. Pocket Sliding Door Hardware: Rated for doors weighing up to 200 lb.

2. Manufacturers:

a. Pemko (PE).

2.5 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. McKinney (MK) - QC (# wires) Option.

B. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Pemko (PE) - SER-QC (# wires) Option.

C. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Pemko (PE) - EL-CEPT Series.
b. Securitron (SU) - EL-CEPT Series.

D. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

a. McKinney (MK) - QC-C Series.

2.6 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.

3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

    a. Rockwood (RO).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:

    a. Rockwood (RO).

2.7 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Manufacturer’s Standard.

C. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.

2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

D. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

E. Construction Keying: Provide construction master keyed cylinders.

F. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.8 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).
d. No Substitution.

2.9 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

a. ASSA ABLOY ACCENTRA (YA) - 8800FL Series.
b. Corbin Russwin Hardware (RU) - ML2000 Series.
c. Sargent Manufacturing (SA) - 8200 Series.

2.10 DEADLOCKS AND LATCHES

A. Narrow Case Deadlocks and Deadlatches: ANSI/BHMA 156.13 Series 1000 Grade 1 narrow case deadlocks and deadlatches for swinging or sliding door applications. All functions shall be manufactured in a single sized case formed from 12 gauge minimum, corrosion resistant steel

(option for fully stainless steel case and components). Provide minimum 2 7/8" throw laminated stainless steel bolt. Bottom rail deadlocks to have 3/8” diameter bolts.

1. Manufacturers:

    a. Adams Rite Manufacturing (AD) - MS1850S / MS1950 Series.
    b. Adams Rite Manufacturing (AD) - 4900 Series.

2.11 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.12 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
12. Hurricane and Storm Shelter Compliance: Devices to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or storm shelter products that have been independently third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.

B. Security Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed rim panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be constructed of high grade, heat treated, corrosion resistant nickel steel alloy, and have a full 3/4" throw projection with slide action positive deadlocking.

    1. Static Load Force Resistance: Minimum 3000 lbs. certified independent tested.

    2. Manufacturers:

        a. ASSA ABLOY ACCENTRA (YA) - 7050 Series.
        b. Corbin Russwin Hardware (RU) - ED4000S / ED5000S Series.

2.13 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

    1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
    2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
    3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
    4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.

2. Manufacturers:

a. ASSA ABLOY ACCENTRA (YA) - 4400 Series.
b. Corbin Russwin Hardware (RU) - DC6000 Series.
c. Norton Rixson (NO) - 7500 Series.
d. Sargent Manufacturing (SA) - 351 Series.

C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.

1. Manufacturers:

a. ASSA ABLOY ACCENTRA (YA) - Unitrol Series.
b. Corbin Russwin Hardware (RU) - Unitrol Series.
c. Norton Rixson (NO) - Unitrol Series.

2.14 ARCHITECTURAL TRIM AND ACCESSORIES

A. Door, Frame and Wall Protective Trim: ANSI/BHMA A156.6, protective products as specified in the hardware sets. Door protection plates shall be not more than 2" less than door width on stop side and 1” less door width on the pull side or on stop side of pairs of doors. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide protective trim with functions and features as follows:

a. Meets ADA requirements for smooth bottom door surfaces.
b. UL Classified options for use on fire-rated doors up to 3 hours.
c. Fabricated from stainless steel, brass, bronze, aluminum, or high-impact plastic.
d. Available in a variety of sizes, finishes, and profiles to suit aesthetic and functional requirements.

e. Designed to protect doors, frames, and adjacent walls from damage due to impact, abrasion, or traffic.
f. Fasteners included; adhesive-backed options available for select models.
g. Ten-year limited warranty.

2. Manufacturers:

a. Hager Companies (HA).
b. Rockwood (RO).
c. Trimco (TC).

2.15 DOOR STOPS AND HOLDERS

A. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

a. Hager Companies (HA).
b. Hiawatha, Inc. (HI).
c. Rockwood (RO).

B. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

a. Norton Rixson (NO).
b. Rockwood (RO).
c. Sargent Manufacturing (SA).

2.16 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 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 UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).
2. Reese Enterprises, Inc. (RE).
3. Zero (ZE).

2.17 ELECTRONIC ACCESSORIES

A. Networked Proximity Card Readers: Card readers to support HID 125 kHz proximity technology and interface with the access control reader modules and door control hardware devices as specified. Card readers to meet the following, minimum, design and performance specifications.

1. Reader to operate on 12VDC or 5VDC power from the reader I/O modules at a maximum current rating of 150 mA per reader.
2. Reader to be weatherproof type when installed in exterior or other wet environments.
3. Reader to communicate with the reader I/O modules using industry standard Wiegand protocol interface.
4. Reader to have multi-color LED display and audible status indications.
5. Reader type and model to meet the design and mounting applications needs of each entry point as indicated on the drawings.
6. Manufacturers (125 kHz Proximity):

a. Corbin Russwin Hardware (RU) - 752F909/751F929 Series.
b. HID Global (HG) - MiniProx 5365/ProxPro ll 5455 Series.
c. Sargent Manufacturing (SA) - 4302/4304 Series.

B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Alarm Controls (AK) - CP1-1026 Series.
b. Securitron (SU) - DPS Series.

C. Intelligent Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Power supplies shall meet all functions and features as specified herein.

a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.
b. Dedicated fast charger to prolong battery life with low battery cutoff to protect batteries from deep discharge.
c. Enhanced surge immunity for input/output protection
d. Separate, dedicated battery charging circuit to keep locks cooler.
e. Dual-color LED visual notification to prevent applying incorrect voltages to the power supply.
f. Instant auto-switch to battery on AC loss.
g. Expandable up to 16 outputs in the standard enclosure
h. Integrated fire alarm interface to allow main output shutdown or disconnect on a per output basis when using an R8 output module.
i. Network ready and remotely manage locks and connected devices when using an M8 managed output module on network models.
j. Lifetime replacement, no-fault, no questions asked warranty.

2. Manufacturers:

a. Securitron (SU) - AQL Series.

2.18 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.19 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Paint prime coated mullions to match frames.

C. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

D. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

E. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

F. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

G. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.5 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.6 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.7 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SU - Securitron
4. RO - Rockwood
5. YA - ASSA ABLOY ACCENTRA
6. BU - Burns Manufacturing Inc
7. AD - Adams Rite
8. EM - Emtek
9. SA - SARGENT
10. NO - Norton Rixson
11. OT - Other

Hardware Sets

Set: 1.0

Doors: 101A, 127A
Description: EXT - AL - ENTRY - EAC

1	Electric Power Transfer	EL-CEPT	630	SU	
1	Rim Exit Device, Nightlatch	7150WS B MELR 121NL	630	YA	
1	Door Stop	463-RKW	US32D	RO	
1	All other hadware	by door / frame mfg			
1	ElectroLynx Harness	QC-C1500P [PS to Hinge]		MK	
1	Wiring Diagram	WD-SYSPK		SA	
1	ElectroLynx Harness	QC-C3XXP [To power transfer or center elect. pivot]		MK	
1	Card Reader	By security vendor		OT	
1	Position Switch	By Security Vendor		SU	
1	Power Supply	By Security Vendor		SU	

Notes: Hardware is basis of design. Provide hardware that meets local windstorm codes

Door is normally closed and secure. Access by valid credential or key override.

The door will remain locked in a power loss.
Free egress at all times

Set: 2.0

Doors: 106B, 120A, 138E, 138F
Description: EXT - HM - ENTRY - EAC

1	Continuous Hinge [Elec]	CFMXXHD1 SER		PE	
1	Rim Exit Device, Nightlatch	7150WS B MELR 121NL	630	YA	
1	Door Pull [Offset}	RM3310-24	US32D	RO	
1	Surface Closer	UNI4400	689	YA	
1	Kick Plate	K1050 WS 10" LDW	US32D	RO	
1	Door Stop	463-RKW	US32D	RO	
1	Gasketing	by door / frame mfg			
1	Sweep	3452APK TKSP		PE	
1	Threshold	2005AT MSES25SS		PE	
1	ElectroLynx Harness	QC-C1500P [PS to Hinge]		MK	
1	Wiring Diagram	WD-SYSPK		SA	
1	ElectroLynx Harness	QC-C3XXP [To power transfer or center elect. pivot]		MK	
1	Card Reader	By security vendor		OT	
1	Position Switch	By Security Vendor		SU	
1	Power Supply	By Security Vendor		SU	

Notes: Hardware is basis of design. Provide hardware that meets local windstorm codes

Door is normally closed and secure. Access by valid credential or key override.
The door will remain locked in a power loss.
Free egress at all times

Set: 3.0

Doors: 145A
Description: EXT - EAC

2	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP-HVY 4-1/2" x 4-1/2"	US32D	MK	
1	Hinge, Full Mortise, Hvy Wt	T4A3386 QC 4-1/2" x 4-1/2"	US32D	MK	
1	Fail Secure Lock	PBR 8897FL REX	626	YA	
1	Surface Closer	UNI4400	689	YA	

1	Kick Plate	K1050 WS 10" LDW	US32D	RO
1	Door Stop	462	US2C	RO
1	Gasketing	S88D x LAR		PE
1	Rain Guard	346A		PE
1	Threshold	2005AT x LAR		PE
1	ElectroLynx Harness	QC-C1500P [PS to Hinge]		MK
1	ElectroLynx Harness	QC-C3XXP [Hinge to lock/exit/reader]		MK
1	Wiring Diagram	WD-SYSPK		SA
1	Card Reader	By security vendor		OT
1	Position Switch	By Security Vendor		SU
1	Power Supply	By Security Vendor		SU

Notes: Hardware is basis of design. Provide hardware that meets local windstorm codes

Door is normally closed and secure. Access by valid credential or key override.
The door will remain locked in a power loss.
Free egress at all times

Set: 4.0

Doors: 110A
Description: EXT - STOR

3	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP-HVY 4-1/2" x 4-1/2"	US32D	MK
1	Storeroom Lock	PBR 8840FL	626	YA
1	Surface Closer	UNI4400	689	YA
1	Kick Plate	K1050 WS 10" LDW	US32D	RO
1	Door Stop	462	US2C	RO
1	Gasketing	S88D x LAR		PE
1	Rain Guard	346A		PE
1	Threshold	2005AT x LAR		PE
1	Position Switch	By Security Vendor		SU

Notes: Hardware is basis of design. Provide hardware that meets local windstorm codes

Set: 5.0

Doors: 203B
Description: RATED - PR - MECH - OHS

6	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Flush Bolt [Self latching]	2805 [Top bolt only]	US26D	RO
1	Passage Latch	PBR 8801FL	626	YA
2	Surface Closer	UNI4400	689	YA
2	Kick Plate	K1050 10" LDW	US32D	RO
1	Astragal	303AS TKSP		PE
1	Gasketing	S88D x LAR		PE

Set: 6.0

Doors: 139A, 145B
Description: RATED - DECON / SCBA

3	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Passage Latch	PBR 8801FL	626	YA
1	Surface Closer	4400	689	YA
1	Kick Plate	K1050 10" LDW	US32D	RO
1	Wall Stop	409 / 446	US26D	RO
1	Gasketing	S88D x LAR		PE
1	Sweep	57AV		PE
1	Threshold	171A		PE

Set: 7.0

Doors: 136AA, 203A, 204A
Description: RATED - STOR

3	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	PBR 8805FL	626	YA
1	Surface Closer	4400	689	YA
1	Kick Plate	K1050 10" LDW	US32D	RO
1	Wall Stop	409 / 446	US26D	RO
1	Gasketing	S88D x LAR		PE

Set: 8.0

Doors: 106A, 136A
Description: PANIC - EAC

1	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
2	Hinge [Elec]	T4A3786 QCXX 4-1/2" x 4-1/2"	US26D	MK
1	Rim Exit Device, Nightlatch	7150WS B MELR 121NL	630	YA
1	Door Pull [Offset}	RM3310-24	US32D	RO

1	Surface Closer	UNI4400	689	YA	
1	Kick Plate	K1050 10" LDW	US32D	RO	
1	Wall Stop	409 / 446	US26D	RO	
3	Silencer	608-RKW		RO	
1	ElectroLynx Harness	QC-C3XXP [Hinge to lock/exit/reader]		MK	⚡
1	Wiring Diagram	WD-SYSPK		SA	
1	ElectroLynx Harness	QC-C3XXP [To power transfer or center elect. pivot]		MK	⚡
1	Card Reader	By security vendor		OT	
1	Position Switch	By Security Vendor		SU	⚡
1	Power Supply	By Security Vendor		SU	⚡

Notes: Door is normally closed and secure. Access by valid credential or key override.

The door will remain locked in a power loss.
Free egress at all times

Set: 9.0

Doors: 102A
Description: EAC

1	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK	
2	Hinge [Elec]	T4A3786 QCXX 4-1/2" x 4-1/2"	US26D	MK	⚡
1	Fail Secure Lock	PBR 8891FL REX	626	YA	⚡
1	Surface Closer	4400	689	YA	
1	Kick Plate	K1050 10" LDW	US32D	RO	
1	Wall Stop	409 / 446	US26D	RO	
3	Silencer	608-RKW		RO	
1	ElectroLynx Harness	QC-C3XXP [Hinge to lock/exit/reader]		MK	⚡
1	Wiring Diagram	WD-SYSPK		SA	
1	ElectroLynx Harness	QC-C3XXP [To power transfer or center elect. pivot]		MK	⚡
1	Card Reader	By security vendor		OT	
1	Position Switch	By Security Vendor		SU	⚡
1	Power Supply	By Security Vendor		SU	⚡

Notes: Door is normally closed and secure. Access by valid credential or key override.

The door will remain locked in a power loss.

Free egress at all times

Set: 10.0

Doors: 131B, 138A
Description: RATED - PANIC - EAC - BAY

2	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP-HVY 4-1/2" x 4-1/2"	US32D	MK	
1	Hinge, Full Mortise, Hvy Wt	T4A3386 QC 4-1/2" x 4-1/2"	US32D	MK	⚡
1	Rim Exit Device, Nightlatch	7150WS B MELR 121NL	630	YA	⚡
1	Door Pull [Offset]	RM3310-24	US32D	RO	
1	Surface Closer	UNI4400	689	YA	
1	Kick Plate	K1050 10" LDW	US32D	RO	
1	Wall Stop	409 / 446	US26D	RO	
1	Gasketing	S88D x LAR		PE	
1	Sweep	57AV		PE	
1	Threshold	171A		PE	
1	ElectroLynx Harness	QC-C1500P [PS to Hinge]		MK	⚡
1	ElectroLynx Harness	QC-C3XXP [Hinge to lock/exit/reader]		MK	⚡
1	Card Reader	By Others			⚡
1	Wiring Diagram	WD-SYSPK		SA	
1	Card Reader	By security vendor		OT	
1	Position Switch	By Security Vendor		SU	⚡
1	Power Supply	By Security Vendor		SU	⚡
1	Power Supply	AQL4-R8E1		SU	⚡

Notes: Door is normally closed and secure. Access by valid credential or key override.
The door will remain locked in a power loss.
Free egress at all times

Set: 11.0

Doors: 103A, 111A, 113A, 115A, 117A, 142A
Description: TOILET

3	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Privacy Lock	PBR 8802FL V21	626	YA
1	Surface Closer	UNI4400	689	YA
1	Kick Plate	K1050 10" LDW	US32D	RO
1	Kick Plate	K1050 4" LDW	US32D	RO

3	Silencer	608-RKW		RO
1	Coat Hook	RM801	US26D	RO

Set: 12.0

Doors: 108A, 109A, 112A, 114A, 116A, 118A, 119A, 121A
Description: DORM ROOM

3	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Privacy Lock	PBR 8802FL V21	626	YA
1	Gasketing	S88D x LAR		PE
1	Door Bottom	STC411APK		PE
3	Silencer	608-RKW		RO
1	Coat Hook	RM801	US26D	RO

Set: 13.0

Doors: 132A, 134A, 205A
Description: IT / STOR / ELEC

3	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	PBR 8805FL	626	YA
1	Wall Stop	409 / 446	US26D	RO
3	Silencer	608-RKW		RO

Set: 14.0

Doors: 103AA
Description: PR - STOR - OHS

6	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
2	Dust Proof Strike	570	US26D	RO
2	Flush Bolt (Selt-latching)	2845 / 2945 (as required)	US26D	RO
1	Storeroom Lock	PBR 8805FL	626	YA
1	Roller Latch	555 [Top]	US26D	BU
2	Surface Overhead Stop	9-336	630	NO
2	Silencer	608-RKW		RO

Set: 15.0

Doors: 104A, 105A, 107A, 137A
Description: OFFICE

3	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK

1	Entry Lock	PBR 8807FL	626	YA
1	Wall Stop	409 / 446	US26D	RO
3	Silencer	608-RKW		RO
1	Coat Hook	RM801	US26D	RO

Set: 16.0

Doors: 133A
Description: JAN

3	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Passage Latch	PBR 8801FL	626	YA
1	Kick Plate	K1050 4" LDW	US32D	RO
1	Wall Stop	409 / 446	US26D	RO
3	Silencer	608-RKW		RO

Set: 17.0

Doors: 143A
Description: ICE

3	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Passage Latch	PBR 8801FL	626	YA
1	Surface Overhead Holder	9-326	630	NO
3	Silencer	608-RKW		RO

Set: 18.0

Doors: 122A, 131A, 135A
Description: LAUNDRY/WELLNESS / XCORR

3	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Pull Plate	BF 110 x 70C	US32D	RO
1	Push Plate	70C	US32D	RO
1	Surface Closer	4400	689	YA
1	Kick Plate	K1050 10" LDW	US32D	RO
1	Wall Stop	409 / 446	US26D	RO
1	Gasketing	S88D x LAR		PE
1	Door Bottom	STC411APK		PE

Set: 19.0

Doors: 128A, 129A, 130A
Description: PKT LK

1	Sliding Door Hdwe	PF28200A		PE
1	Mortise Deadlock	MS1847	630	AD

Set: 20.0

Doors: 123A, 138B, 138C, 138D, 138G, 138H, 138J, 144A
Description: OH / SLIDER

1	Hardware	by door / frame mfg		OT

END OF SECTION 087100

SECTION 088000 - GLAZING

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. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Doors.
   2. Storefront framing.
   3. Interior borrowed lites.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) 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. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:

   1. Design Wind Pressures: As indicated on Structural Drawings.

   2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

   1. Temperature Change: 180 deg F (100 deg C), material surfaces.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing will not be 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 sufficient 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.

1.6 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of the following products; 12 inches (300 mm) square.

1. Tinted glass.
2. Wired glass.
3. Fire-resistive glazing products.
4. Insulating glass.

C. Glazing Accessory Samples: For gaskets and sealants, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Qualification Data: For glass testing agency.

G. Product Certificates: For glass and glazing products, from manufacturer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for tinted glass, insulating glass, and glazing gaskets.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

I. Preconstruction adhesion and compatibility test report.

J. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. 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.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

E. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.8 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT 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 (4.4 deg C).

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from

normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick of thickness indicated.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).

C. Polished Wired Glass: ASTM C 1036, Type II, Class 1 (clear), Form 1, Quality-Q6, complying with ANSI Z97.1, Class C.

1. Mesh: M1 (diamond).

2.3 INSULATING GLASS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. PPG Industries.

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.

2. Spacer: Manufacturer's standard spacer material and construction.

3. Desiccant: Molecular sieve or silica gel, or blend of both.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

1. Neoprene complying with ASTM C 864.
2. EPDM complying with ASTM C 864.
3. Silicone complying with ASTM C 1115.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.5 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will 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.

3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide the following:

a. Dow Corning Corporation; 790.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining 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. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 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 for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of 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. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.9 MONOLITHIC-GLASS TYPES

A. Glass Type: Clear float glass.

1. Thickness: 6.0 mm.

2. Provide safety glazing labeling.

B. Glass Type: Ultraclear heat-strengthened float glass.

1. Thickness: 6.0 mm.

2. Provide safety glazing labeling.

C. Glass Type: Polished wired glass.

1. Thickness: 6.0 mm.

2.10 INSULATING-GLASS TYPES

A. Glass Type: Large Missile Impact Resistant Low E insulating glass.

1. Overall Unit Thickness: 1 9/16 inch (25 mm).
2. Outdoor Lite: Low E Clear Glazing.

3. Indoor Lite: Clear float glass.

4. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch (3-mm) 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.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. 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.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings 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.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage 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. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing 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 buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 089000 - LOUVERS AND VENTS

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. Section Includes:

1. Fixed, extruded-aluminum louvers.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for building wall vents (brick vents) into masonry.
2. Division 08 Section "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.
3. Division 08 Section "Flush Wood Doors" for louvers in flush wood doors.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

C. Vertical Louver: Louver with vertical blades; i.e., the axes of the blades are vertical.

D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

E. Storm-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.

B. 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 normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; material surfaces.

D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
2. Show mullion profiles and locations.
3. Wiring Diagrams: For power, signal, and control wiring for motorized adjustable louvers.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of metal finish required.

E. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

D. UL and NEMA Compliance: Provide motors and related components for motor-operated louvers that are listed and labeled by UL and comply with applicable NEMA standards.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.

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. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
4. For fastening stainless steel, use 300 series stainless-steel fasteners.
5. For color-finished louvers, use fasteners with heads that match color of louvers.

E. Postinstalled 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.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

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.

1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.

2. Horizontal Mullions: Provide horizontal mullions at joints where indicated.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. 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.

1. Frame Type: Channel unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. 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.

1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.

2. Semirecessed Mullions: Where indicated, provide mullions partly recessed behind louver blades so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.
3. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

4. Exterior Corners: Prefabricated corner units with mitered and welded blades and with fully recessed mullions at corners.

G. Provide subsills made of same material as louvers for recessed louvers.

H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Storm-Resistant Louver:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Air Balance Inc.; a Mestek company.
b. Air Flow Company, Inc.
c. Airolite Company, LLC (The).
d. All-Lite Architectural Products.
e. American Warming and Ventilating, Inc.; a Mestek company.
f. Arrow United Industries; a division of Mestek, Inc.
g. Construction Specialties, Inc.
h. Greenheck Fan Corporation.
i. Industrial Louvers, Inc.
j. NCA Manufacturing, Inc.
k. Nystrom Building Products.
l. Reliable Products, Inc.
m. Ruskin Company; Tomkins PLC.
n. United Enertech Corp.

2. Louver Depth: 7 inches (175 mm).

3. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm)
4. Louver Performance Ratings:

a. Free Area: Not less than 5.0 sq. ft. (0.46 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
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. 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).

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2604] and containing not less than 50 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 Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, 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. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. 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.

F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.

B. 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 during construction period.

C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

D. 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.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089000

SECTION 092900 - GYPSUM BOARD

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. Section Includes:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backing panels.

B. Related Requirements:

1. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
2. Division 09 Section "Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:
   a. Each level of gypsum board finish indicated for use in exposed locations.
2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.

3. Simulate finished lighting conditions for review of mockups.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. 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.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, 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, those that are moisture damaged, and those that are 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.

PART 2 - PRODUCTS

2.1 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.

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 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. Lafarge North America Inc.

5. National Gypsum Company.
6. PABCO Gypsum.
7. Temple-Inland.
8. USG Corporation.

B. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch (12.7 mm).
2. Long Edges: Tapered.

C. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch (12.7 mm).
2. Long Edges: Tapered.

E. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Fry Reglet Corp.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.

3. Basis of Design Products: See drawings for location
   a. Manufacturer: Fry Reglet
      Product: DRM-625-50
      Size: 1/2" W x 5/8" D
      Finish: Prime paint: Factory spray and bake-on primer to serve for field painting
   b. Manufacturer: Fry Reglet
      Product: DRM-snap-in-625 with retainer DRM-625-75
      Size: 5/8" W x 5/8" D
      Finish: Clear anodized

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. 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: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use sandable topping compound.
4. Finish Coat: For third coat, use sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use sandable topping compound

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. 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.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. 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.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. 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. (0.7 sq. m) 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- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) 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.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
1. Type X: Where required for fire-resistance-rated assembly.
2. Ceiling Type: Ceiling surfaces.
3. Moisture- and Mold-Resistant Type: 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-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.

4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

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 recommendations 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- (300-mm-) 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 (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 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.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 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: Panels that are substrate for tile.

3. Level 3: Not used

4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated .

    a. Primer and its application to surfaces are specified in other Division 09 Sections.

5. Level 5: Not Used

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 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 092900

SECTION 093000 - TILING

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. Section Includes:

1. Ceramic tile.

2. Waterproof membrane.
3. Crack isolation membrane.
4. Tile backing panels.
5. Metal edge strips.

B. Related Sections:

1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum >0.7.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

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 Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory for each color and finish required.

D. Qualification Data: For qualified Installer.

E. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

F. Product Certificates: For each type of product, signed by product manufacturer.

G. Material Test Reports: For each tile-setting and -grouting product and special purpose tile.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
1. Waterproof membrane.
2. Crack isolation membrane.
3. Joint sealants.
4. Cementitious backer units.
5. Metal edge strips.

1.7 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.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. 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.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.2 TILE PRODUCTS

1. As indicated in drawings.

2.3 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

2.4 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

2.5 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated below:
   a. For floor applications: Laticrete #272 mortar (or equal)

   b. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.

2.6 GROUT MATERIALS

A. Standard Cement Grout: ANSI A118.6.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated below:
   a. Laticrete Permacolor

2.7 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."

1. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

2.8 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

2.9 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.

b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. 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.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:

a. Tile floors in wet areas.
b. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
c. Tile floors composed of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for

straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Paver Tile: 1/4 inch (6.35 mm).
2. Quarry Tile: 3/8" nominal.

F. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

G. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.5 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect

metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 093000

SECTION 095123 - ACOUSTICAL TILE CEILINGS

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. Section Includes:

1. Acoustical tiles for ceilings.
2. Concealed suspension systems.

B. Related Requirements:

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6-inches- (150-mm-) in size.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
2. Concealed Suspension-System Members: 6-inch- (150-mm-) long Sample of each type.
3. Exposed Moldings and Trim: Set of 6-inch- (150-mm-) long Samples of each type and color.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: For each acoustical tile ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Evaluation Reports: For each acoustical tile ceiling suspension system and anchor and fastener type, from ICC-ES.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes 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. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to the National Voluntary Laboratory Accreditation Program (NVLAP) for testing indicated.

1.8 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. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ACOUSTICAL TILES, GENERAL

A. Source Limitations:

1. Acoustical Ceiling Tile: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

B. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system from single source from single manufacturer.

C. 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. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.

D. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.

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.

2.3 ACOUSTICAL TILES: As indicated in drawing schedule.

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong World Industries, Inc.

B. Color: As indicated in drawings.

C. Modular Size: As indicated in drawing schedule.

D. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard 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 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. 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.

B. 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 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 to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.

    c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.

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.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

2. Size: Select wire diameter so 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 provide not less than 0.106-inch- (2.69-mm-) diameter wire.

D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

2.5 METAL SUSPENSION SYSTEM As indicated in drawing schedule

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong World Industries, Inc.

B. Direct-Hung, Double-Web**,** Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation.

1. Structural Classification: Intermediate-duty system.

2.6 METAL EDGE MOLDINGS AND TRIM As indicated in drawing schedule

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong World Industries, Inc.

B. 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 exposed flanges of suspension-system runners.

1. 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.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips and complying with seismic design requirements and the following:

1. Aluminum Alloy: 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 aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.

2. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
3. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

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. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

B. 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.

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. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

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 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 either to structures 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, postinstalled 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. Space hangers not more than 48 inches (1200 mm) 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.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. 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 postinstalled anchors.

D. 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 (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.

3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical tiles as follows:

1. As indicated on reflected ceiling plans.

G. 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.

2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.

3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.
4. direction parallel to short axis of space.
5. Install tiles in a basket-weave pattern.

3.4 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 postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) 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.

3.5 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095123

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

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. Section Includes:

1. Resilient base.
2. Resilient stair accessories.
3. Resilient molding accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

C. Product Schedule: For resilient products. Use same designations indicated on Drawings.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 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 (10 deg C) or more than 90 deg F (32 deg C).

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), 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. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m)] for every 500 linear feet (150 linear m or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Resilient Base:

1. Manufacturers: Subject to compliance with requirements, provide product as indicated in drawings:
   a. Johnsonite.
   b. Roppe

B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TS (rubber, vulcanized thermoset.
2. Manufacturing Method: Group I solid, homogeneous.
3. Style: Cove (base with toe)

C. Minimum Thickness: 0.125 inch (3.2 mm).

D. Height: As indicated on Drawings.

E. Lengths: Coils in manufacturer's standard length

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Colors and Patterns: as indicated in drawings.

2.2 RESILIENT STAIR ACCESSORIES RS-1

A. Resilient Stair Treads and Risers:

1. Manufacturers: Subject to compliance with requirements provide products as indicated in drawings
   a. Johnsonite.
   b. Roppe Corporation, USA.

B. Colors and Patterns: As indicated in drawings.

2.3 RESILIENT MOLDING ACCESSORY as indicated in drawings

A. Resilient Molding Accessory:

1. Manufacturers: Subject to compliance with requirements, provide product as indicated in drawings.
   a. Johnsonite.
   b. Roppe

B. Description: Transition strips and stair nosings

C. Material: Vinyl or rubber.

D. Profile and Dimensions: As indicated in drawings

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

   a. Cove Base Adhesives: Not more than 50 g/L.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

D. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.

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.

B. 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.

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

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: 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 manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer[and as follows]. Proceed with installation only after substrates pass testing.

    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

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 practicable 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. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet, resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.

2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

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.

D. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 09 91 00 – CONCRETE COATINGS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. This Specification shall be read as a whole by all parties concerned. Each Section may contain more or less the complete Work of any trade. The Contractor is solely responsible to make clear to the Subcontractors the extent of their Work and coordinate overlapping Work.

1.2 SYSTEM DESCRIPTION

A. This specification describes the coating of interior, horizontal floors and containment areas.

1.3 REFERENCES

A. American Society of Testing and Materials (ASTM) as cited herein.

1.4 QUALITY ASSURANCE

A. Manufacturing qualifications:
   1. The manufacturer of the specified product shall be ISO 9001 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.

B. Contractor qualifications:
   1. Contractor shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.

C. Store and apply materials in accordance with all safety requirements, taking into consideration weather conditions, as specified by manufacturer or as modified by applicable rules and regulations of authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. All materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material or unsealed pails must be removed from the site immediately.

B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.

C. Store and handle the specified product as recommended by the manufacturer.

1.6 JOB CONDITIONS

A. Environmental Conditions: Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature 50ºF (10ºC) and rising.

B. Protection: Precautions should be taken to avoid damage to packaging

1.7 SUBMITTALS

A. Submit two copies of manufacturer's actual literature including: Product Data Sheets and appropriate Material Safety Data Sheets (MSDS).

1.8 WARRANTY

A. Provide a written warranty from the manufacturer against defects of materials for a period of one (1) year, beginning with date of substantial completion of the project.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Sikagard® maintenance coatings, as proposed by Sika Corporation, are considered to conform to the requirements of this specification.

2.2 MATERIAL

A. Coating shall be either Sikagard 616 or Sikagard 664, two-component, high solids, epoxy coating/topping.

B. The material shall be a two component, epoxy manufactured by Sika Corporation

2.3 PERFORMANCE CRITERIA

A. Typical Properties of Sikagard 616:
   1. Aspect: Epoxy
   2. Colour: Clear
   3. Mixing Ratio: 1.5:1
   4. Comply with the following test methods:
      a. Compressive Strength (ASTM C579): 7,500 psi @ 28 days
      b. Flexural Strength (ASTM C580): 2,900 psi @ 28 days
      c. Pull-Off Strength (ASTM D4541): >400 psi (100% concrete failure)
      d. Viscosity : 250-350 (SP1/100)
      e. Shore D Hardness (ASTM D2240): 78-82
      f. VOC Content (ASTM D2369): <50 g/l

B. Typical Properties of Sikagard 664:
   1. Aspect: Epoxy
   2. Colour: Grey/Red/Beige

3. Mixing Ratio: 2:1
4. Comply with the following test methods:
   a. Compressive Strength (ASTM C579): 7,250 psi @ 28 days
   b. Flexural Strength (ASTM C580): 2,900 psi @ 28 days
   c. Pull-Off Strength (ASTM D4541): >400 psi (100% concrete failure)
   d. Shore D Hardness (ASTM D2240): 76
   e. VOC Content (ASTM D2369): <30 g/l

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Prepare surface to receive flooring systems in accordance with manufacturer's written instructions.

B. Remove dirt, oil, grease, wax, laitance, curing compounds, water-soluble concrete hardeners, and other surface contaminants. Remove sealers, finishes, and paints. Remove unsound concrete by appropriate mechanical means.

C. Concrete: Shall be cleaned and prepared to achieve laitance-free and contaminant-free, open textured surface by shot blasting or equivalent mechanical means (CSP level as per ICRI guidelines and manufacturer’s written recommendation).

D. Chemical Surface Preparation: Chemical surface preparation (acid etching) is unacceptable and will void Manufacturer’s warranty.

E. Control joints and cracks: Provide repair and treatment of control joints and surface cracks utilizing manufacturer’s standard materials and installation details.

3.2 MIXING AND APPLICATION

A. Mixing:
   1. Thoroughly pre-mix each component separately to ensure that all solids are distributed throughout and components are consistent within themselves.
   2. Empty the complete contents of Component B into the partially filled Component A container. When mixing a partial unit, ensure that the components are proportioned in the correct ratio and empty both into a suitably sized, clean mixing vessel.
   3. Mix the combined components for at least 3 minutes, using a low-speed drill (300-450 rpm) to minimize entrapping air. Use an Exomixer type or Jiffy mixing paddle (recommended model) suited to the volume of the mixing container. During the mixing operation, scrape down the sides and bottom of the container with a flat or straight edge trowel at least once, to ensure complete mixing. When completely mixed, Sikagard Maintenance Coatings should be uniform in color and consistency. Mix only that quantity which can be used within its pot life.

B. Application
   1. Primer Coat:

a. Apply primer by squeegee at the rate of 160 - 200 ft2/US gal (3.4 – 4.9 m2/L) at 8 – 10 mils (0.20 – 0.25 mm) wet film thickness (w.f.t.) and back roll with pressure after 15 minutes. Coverage will vary depending on the porosity of the prepared floor. Product has a limited Pot Life, see Typical Data. Do not apply by dipping roller into mixing container. Pour a bead of product in the form of a ribbon on the surface to be coated, then spread with squeegee and back roll. Ensure that the coating is pore-free and pinhole-free and provides uniform and complete coverage over the entire concrete substrate. If necessary, apply an additional coat to ensure the coating is pore-free and pinhole-free and provides uniform and complete coverage over the entire concrete substrate.

2. Wear or Sealer Coat
   a. Sikagard maintenance coatings are applied with a 40 mil (1 mm) notched squeegee over a smooth surface and a flat squeegee over a rough or broadcast quartz surface. Back rolling is typically done with an 18 inch (455 mm) wide 3/8 inch (10 mm) short nap, solvent-resistant roller cover. Back roll the Sikagard Maintenance Coating only to level the squeegee applied material. Over-rolling and late back rolling may cause bubbling and leave roller marks.

3.3 CLEANING

A. The uncured material can be cleaned from tools with solvent. The cured epoxy can only be removed mechanically.

B. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

END OF SECTION

SECTION 099123 - INTERIOR PAINTING

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. Section includes surface preparation and the application of paint systems on interior substrates:

1. Concrete.
2. Concrete masonry units (CMU).
3. Steel.
4. Wood.
5. Gypsum board.

B. Related Requirements:

1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
3. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
4. Division 09 painting Sections for high-performance and special-use coatings.
5. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
6. Division 09 Section "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.3 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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. (3.8 L) of each material and color applied.

1.6 QUALITY ASSURANCE

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.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 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 (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Benjamin Moore & Co.
2. Sherwin-Williams Company (The).

B. Products: Subject to compliance with requirements, provide product as indicated in drawings.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of

colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

D. Colors: As indicated in a color schedule.

2.3 BLOCK FILLERS

A. Block Filler, Latex, Interior/Exterior: MPI #4.

2.4 PRIMERS/SEALERS

A. Primer Sealer, Latex, Interior: MPI #50.

B. Primer, Alkali Resistant, Water Based: MPI #3.

C. Primer, Latex, for Interior Wood: MPI #39.

D. Primer Sealer, Alkyd, Interior: MPI #45.

E. Primer, Bonding, Water Based: MPI #17.

F. Primer, Bonding, Solvent Based: MPI #69.

G. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.5 METAL PRIMERS

A. Primer, Rust-Inhibitive, Water Based: MPI #107.

B. Primer, Alkyd, Anti-Corrosive, for Metal: MPI #79.

C. Primer, Alkyd, Quick Dry, for Metal: MPI #76.

D. Primer, Galvanized, Water Based: MPI #134.

E. Primer, Vinyl Wash: MPI #80.

F. Primer, Quick Dry, for Aluminum: MPI #95.

2.6 WATER-BASED PAINTS

A. Latex, Interior, Flat, (Gloss Level 1): MPI #53.

B. Latex, Interior, (Gloss Level 2): MPI #44.

C. Latex, Interior, (Gloss Level 3): MPI #52.

D. Latex, Interior, (Gloss Level 4): MPI #43.

E. Latex, Interior, Semi-Gloss, (Gloss Level 5): MPI #54.

F. Latex, Interior, Gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees): MPI #114.

2.7 SOLVENT-BASED PAINTS

A. Alkyd, Interior, Semi-Gloss (Gloss Level 5): MPI #47.

2.8 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

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:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.

4. Gypsum Board: 12 percent.
5. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

G. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates 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.

1. 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.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. 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.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. 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.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. 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.

E. 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 panelboards and switch gear.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Tanks that do not have factory-applied final finishes.
    h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

    a. Equipment, including panelboards.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    h. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:

1. Latex System:

a. Block Filler: Block filler, latex, interior/exterior, MPI #4.

b. Intermediate Coat: Latex, interior, matching topcoat.

c. Topcoat: Pro Industrial Pre-Catalyzed water based epoxy.

B. Steel Substrates:

1. Latex over Alkyd Primer System:

a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.

b. Intermediate Coat: Latex, interior, matching topcoat.

c. Topcoat: Pro Industrial Pre-Catalyzed water based epoxy.

C. Wood Substrates: Including wood trim.

1. Latex System:

a. Prime Coat: Primer, latex, for interior wood, MPI #39.

b. Intermediate Coat: Latex, interior, matching topcoat.

c. Topcoat: Pro Industrial Pre-Catalyzed water based epoxy.

D. Gypsum Board Substrates:

1. Latex System:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.

b. Intermediate Coat: Latex, interior, matching topcoat.

c. Topcoat: Pro Industrial Pre-Catalyzed water based epoxy.

END OF SECTION 099123

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

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. Section Includes:

1. Public-use washroom accessories.
2. Private-use bathroom accessories.
3. Healthcare accessories.
4. Childcare accessories.
5. Underlavatory guards.
6. Custodial accessories.

B. Related Sections:

1. Division 08 Section "Mirrors" for frameless mirrors.
2. Division 09 Section "Tiling" for ceramic toilet and bath accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.

2. Identify products using designations indicated.

C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.5 COORDINATION

A. 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.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) 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. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Basis-of-Design Products: As indicated in drawings.

2.3 CHILDCARE ACCESSORIES

A. Diaper-Changing Station:

1. Basis-of-Design Product: As indicated in drawings.

2.4 UNDERLAVATORY GUARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Plumberex Specialty Products, Inc.
2. Truebro by IPS Corporation.

B. Underlavatory Guard (at all exposed supply and drain pipes)
1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.

2.5 CUSTODIAL ACCESSORIES

A. Basis-of-Design Product: As indicated in drawings:

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104413 - FIRE EXTINGUISHER CABINETS

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. Section Includes:

1. Fire protection cabinets for the following:

a. Portable fire extinguishers.

B. Related Sections:

1. Division 10 Section "Fire Extinguishers."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. 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.

2. Show location of knockouts for hose valves.

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

C. Samples for Initial Selection: For each type of fire protection cabinet indicated.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Size: 6 by 6 inches (150 by 150 mm) square.

E. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function.

F. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. 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.

1.5 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.

C. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

1. Sheet: ASTM B 209 (ASTM B 209M).
2. Extruded Shapes: ASTM B 221 (ASTM B 221M).

C. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, [3] [6] mm thick.

D. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FIRE PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fire End & Croker Corporation; .
b. J. L. Industries, Inc., a division of Activar Construction Products Group.
c. Larsen's Manufacturing Company.
d. Potter Roemer LLC.

B. Cabinet Construction: Nonrated and 1-hour fire rated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Aluminum sheet.

1. Shelf: Same metal and finish as cabinet.

D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
1. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.

E. Cabinet Trim Material: Aluminum sheet.

F. Door Material: Aluminum sheet.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch

2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Accessories:

1. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.

a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet glazing.
2) Application Process: Silk-screened.
3) Lettering Color: Red.
4) Orientation: Vertical.

K. Finishes:

1. Aluminum: Clear anodic.

2.3 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 locks.

4. Install door locks at factory.

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 (13 mm) thick.

2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 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.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for hose valves and cabinets to verify actual locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for semirecessed 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: 54 inches (1372 mm) above finished floor to top of cabinet.

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 manufacturer's 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 104413

SECTION 104416 - FIRE EXTINGUISHERS

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. Section includes portable, fire extinguishers.

B. Related Sections:

1. Division 10 Section "Fire Extinguisher Cabinets."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function.

C. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers 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: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amerex Corporation.
b. Ansul Incorporated; Tyco International Ltd.
c. Badger Fire Protection; a Kidde company.
d. Buckeye Fire Equipment Company.
e. Fire End & Croker Corporation.
f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
h. Larsen's Manufacturing Company.
i. Moon-American.
j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
k. Potter Roemer LLC.
l. Pyro-Chem; Tyco Safety Products.

2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. 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: UL-rated largest capacity fitting fire extinguisher cabinet, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

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

3.2 INSTALLATION

A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 133419 - METAL BUILDING SYSTEMS

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. Section Includes:

1. Structural-steel framing.
2. Metal roof panels.
3. Metal wall panels.
4. Thermal insulation.
5. Accessories.

1.3 DEFINITIONS

A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

1.4 SUBMITTALS

A. Product Data: For each type of metal building system component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

1. Structural-steel-framing system.
2. Metal roof panels.
3. Metal wall panels.
4. Insulation and vapor retarder facings.
5. Flashing and trim.
6. Accessories.

B. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other work.

1. Anchor-Bolt Plans: Submit anchor-bolt plans and templates before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.

3. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

    a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
    b. Show wall-mounted items including doors, windows, louvers, and lighting fixtures.
    c. Show translucent panels.

4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:8)

    a. Flashing and trim.
    b. Gutters.
    c. Downspouts.
    d. Louvers.

C. Samples for Initial Selection: For units with factory-applied color finish.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of sizes indicated below:

1. Metal Panels: Nominal 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
2. Flashing and Trim: Nominal 12 inches (300 mm) long. Include fasteners and other exposed accessories.
3. Vapor-Retarder Facings: Nominal 6-inch- (150-mm-) square Samples.
4. Accessories: Nominal 12-inch- (300-mm-) long Samples for each type of accessory.

E. Qualification Data: For qualified erector and manufacturer.

F. Welding certificates.

G. Metal Building System Certificates: For each type of metal building system, from manufacturer.

1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

    a. Name and location of Project.
    b. Order number.
    c. Name of manufacturer.
    d. Name of Contractor.
    e. Building dimensions including width, length, height, and roof slope.
    f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
    g. Governing building code and year of edition.

h. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
j. Building-Use Category: Indicate category of building use and its effect on load importance factors.
k. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.

H. Erector Certificates: For each product, from manufacturer.

I. Manufacturer Certificates: For each product, from manufacturer.

J. Material Test Reports: For each of the following products:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

K. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor-retarder facings. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.

L. Source quality-control reports.

M. Field quality-control reports.

N. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.

O. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.

1. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

D. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

F. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.

G. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to metal building systems including, but not limited to, the following:

   a. Condition of foundations and other preparatory work performed by other trades.
   b. Structural load limitations.
   c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
   d. Required tests, inspections, and certifications.
   e. Unfavorable weather and forecasted weather conditions.

2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:

   a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
   b. Structural limitations of purlins and rafters during and after roofing.
   c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
   d. Temporary protection requirements for metal roof panel assembly during and after installation.
   e. Roof observation and repair after metal roof panel installation.

3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:

   a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
   b. Structural limitations of girts and columns during and after wall panel installation.
   c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
   d. Temporary protection requirements for metal wall panel assembly during and after installation.
   e. Wall observation and repair after metal wall panel installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect foam-plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements:

1. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
2. Established Dimensions for Metal Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal panels without field measurements, or allow for field trimming metal panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A&S Building Systems, Inc.; Division of NCI Building Systems, L.P.
2. Alliance Steel, Inc.
3. American Buildings Company; Division of Magnatrax Corp.
4. American Steel Building Co., Inc.
5. BC Steel Buildings, Inc.
6. Behlen Mfg. Co.
7. Bigbee Steel Buildings, Inc.
8. Butler Manufacturing Company; a BlueScope Steel company.
9. CBC Steel Buildings; Division of Magnatrax Corp.
10. Ceco Building Systems; Division of NCI Building Systems, L.P.
11. Chief Buildings; Division of Chief Industries, Inc.
12. Elite Structures, Inc.
13. Garco Building Systems; Division of NCI Building Systems, L.P.
14. Gulf States Manufacturers, Inc.; Division of Magnatrax Corp.
15. Inland Buildings; Subsidiary of Behlen Mfg. Co.
16. Kirby Building Systems; Division of Magnatrax Corp.
17. Mesco Building Solutions; Division of NCI Building Systems, L.P.
18. Metallic Building Company; Division of NCI Building Systems, L.P.
19. Metco Metal Supply.
20. Mid-West Steel Building Company; Division of NCI Building Systems, L.P.
21. Nucor Building Systems.
22. Oakland Metal Buildings, Inc.
23. Olympia Steel Building Systems.

24. Package Industries, Inc.
25. Pinnacle Structures, Inc.
26. Robertson Building Systems; an NCI company.
27. Ruffin Building Systems, Inc.
28. Schulte Building Systems, LLP.
29. Spirco Manufacturing.
30. Star Building Systems; an NCI company.
31. Tyler Building Systems, L.P.
32. USA, Inc.
33. VP Buildings; a United Dominion company.
34. Vulcan Steel Structures, Inc.
35. Whirlwind Building Systems.

2.2 METAL BUILDING SYSTEMS

A. Description: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

1. Provide metal building system of size and with bay spacings, roof slopes, and spans indicated.

B. Primary-Frame Type:

1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

C. End-Wall Framing: Engineer end walls to be expandable. Provide primary frame, capable of supporting full-bay design loads, and end-wall columns.

D. Secondary-Frame Type: Manufacturer's standard purlins and joists and girts.

E. Roof System: Manufacturer's standard standing-seam metal roof panels with field-installed insulation.

F. Exterior Wall System: Manufacturer's standard reverse-rib, exposed-fastener with field-installed insulation.

2.3 METAL BUILDING SYSTEM PERFORMANCE

A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for local wind speed.

C. Thermal Performance: Provide insulated metal panel assemblies with the following maximum U-factors and minimum R-values for opaque elements when tested according to ASTM C 1363 or ASTM C 518:

1. Metal Roof Panel Assemblies:
   a. R-Value: 30.

2. Metal Wall Panel Assemblies:
   a. R-Value: 19.

2.4 STRUCTURAL-STEEL FRAMING

A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

   a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.

2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
3. Rigid Modular Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.
4. Truss-Frame, Clear-Span Frames: Rafter frames fabricated from joist girders, and I-shaped column sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
5. Truss-Frame Modular Frames: Rafter frames fabricated from joist girders, and I-shaped column sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.

6. Long-Bay Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.

B. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:

1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

C. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:

1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch- (64-mm-) wide flanges.

2. Purlins: Steel joists of depths indicated.
3. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch- (64-mm-) wide flanges.

4. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
5. Flange Bracing: Minimum 2-by-2-by-1/8-inch (51-by-51-by-3-mm) structural-steel angles or 1-inch (- (25-mm-) diameter, cold-formed structural tubing to stiffen primary-frame flanges.
6. Sag Bracing: Minimum 1-by-1-by-1/8-inch (25-by-25-by-3-mm) structural-steel angles.

7. Base or Sill Angles: Minimum 3-by-2-inch (76-by-51-mm) zinc-coated (galvanized) steel sheet.
8. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
9. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

D. Bolts: Provide plain-finish bolts for structural-framing components that are primed or finish painted. Provide hot-dip galvanized bolts for structural-framing components that are galvanized.

E. Materials:

1. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55 (345 or 380); or ASTM A 529/A 529M, Grade 50 or 55 (345 or 380).
2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55 (345 or 380); or ASTM A 529/A 529M, Grade 50 or 55 (345 or 380).
3. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55 (345 or 380); or ASTM A 529/A 529M, Grade 50 or 55 (345 or 380).

4. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
5. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.
6. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011M, Structural Steel (SS), Grades 30 through 55 (205 through 380), or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70 (310 through 480); or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80 (170 through 550), or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70 (310 through 480).
7. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 (230 through 550), or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80 (340 through 550); with G60 (Z180) coating designation; mill phosphatized.

8. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

    a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 (230 through 550), or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80 (340 through 550); with G90 (Z275) coating designation.
    b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Structural Steel (SS), Grade 50 or 80 (340 or 550); with Class AZ50 (AZM150) coating.

9. Joist Girders: Manufactured according to "Standard Specifications for Joist Girders," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated and required for primary framing.

10. Steel Joists: Manufactured according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated and required for secondary framing.

F. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

1. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil (0.025 mm).

    a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil (0.013 mm) on each side.

2. Prime galvanized members with specified primer after phosphoric acid pretreatment.

3. Primer: SSPC-Paint 15, Type I, gray.

2.5 METAL ROOF PANELS

A. Standing-Seam Metal Roof Panels: Formed with raised ribs at panel edges and between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.

1. Material: galvanized steel sheet, 0.028-inch (0.71-mm) nominal thickness.

    a. Exterior Finish: Kynar

2.6 METAL WALL PANELS

A. Reverse-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with recessed, trapezoidal major valleys and between major valleys; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

1. Material: galvanized steel sheet, 0.028-inch (0.71-mm) nominal thickness.

a. Exterior Finish: Kynar

2.7 THERMAL INSULATION

A. Faced Metal Building Insulation: ASTM C 991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (51-mm-) wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.

a. by Architect from manufacturer's full range.

2.8 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.

2. Clips: Manufacturer's standard, formed from steel sheet, designed to withstand negative-load requirements.
3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from steel sheet.
4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

6. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch (25-mm) standoff; fabricated from extruded polystyrene.

C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.

2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

D. Flashing and Trim: Formed from 0.022-inch (0.56-mm) nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.

1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.

2. Opening Trim: Formed from [0.022-inch (0.56-mm)] [0.034-inch (0.86-mm)] nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

E. Gutters: Formed from 0.022-inch (0.56-mm) nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2438-mm-) long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."

1. Gutter Supports: Fabricated from same material and finish as gutters.
2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.

F. Downspouts: Formed from 0.022-inch (0.56-mm) nominal-thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- (3-m-) long sections, complete with formed elbows and offsets.

1. Mounting Straps: Fabricated from same material and finish as gutters.

G. Louvers: Size and design indicated; self-framing and self-flashing. Fabricate welded frames from minimum 0.052-inch (1.32-mm) nominal-thickness, metallic-coated steel sheet; finished to match metal wall panels. Form blades from 0.040-inch (1.02-mm) nominal-thickness, metallic-coated steel sheet; folded or beaded at edges, set at an angle that excludes driving rains, and secured to frames by riveting or welding. Fabricate louvers with equal blade spacing to produce uniform appearance.

1. Blades: Fixed.
2. Blades: Adjustable type, with weather-stripped edges, and manually operated by hand crank or pull chain.

3. Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire; with rewirable frames, removable and secured with clips; fabricated of same kind and form of metal and with same finish as louvers.

    a. Mounting: [Interior] [Exterior] face of louvers.

4. Vertical Mullions: Provide mullions at spacings recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate product.

B. Testing: Test and inspect shop connections for metal buildings according to the following:

1. Bolted Connections: Shop-bolted connections shall be[tested and] inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:

    a. Liquid Penetrant Inspection: ASTM E 165.
    b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    c. Ultrasonic Inspection: ASTM E 164.
    d. Radiographic Inspection: ASTM E 94.

C. Product will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

2.10 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.

2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.

4. Weld clips to frames for attaching secondary framing.
5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

1. Make shop connections by welding or by using non-high-strength bolts.
2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.

1. Engage land surveyor to perform surveying.

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

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.

1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.

   a. Joint Type: Snug tightened or pretensioned.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
2. Locate and space wall girts to suit openings such as doors and windows.

3. Locate canopy framing as indicated.
4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.

I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

A. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.

1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.

B. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.

2. Install metal panels perpendicular to structural supports unless otherwise indicated.
3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

C. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.

2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

1. Install ridge[and hip] caps as metal roof panel work proceeds.
2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.

1. Install clips to supports with self-drilling or self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.

3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.
6. Provide metal closures at peaks, rake edges andeach side of ridge and hip caps.

C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

D. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. When two rows of metal panels are required, lap panels 4 inches (102 mm) minimum.
4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
7. Install screw fasteners in predrilled holes.
8. Install flashing and trim as metal wall panel work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and on location lines as indicated, and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.7 THERMAL INSULATION INSTALLATION

A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.

1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.

3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.

4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.

B. Blanket Roof Insulation: Comply with the following installation method:

1. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.

a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.

2. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.8 CLEANING AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, and accessories.

1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

D. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

E. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

F. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

1. Restore louvers damaged during installation and construction period 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.

a. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 133419

SECTION 210000 – FIRE PROTECTION GENERAL

PART 1 - GENERAL

1.1 The work covered by this division consists of providing all labor, equipment and materials and performing all operations necessary for the installation of the fire protection work as herein called for and shown on the drawings. The work shall include but shall not be limited to the following:

Provide all fire protection sprinkler system piping and associated fittings, valves, control devices, and accessories for the project. Fully coordinate all fire protection requirements with work by other divisions under this construction contract. All systems shall be complete and fully functional.

1.2 Related Documents:

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

B. Provisions of this section apply to work of all Division 21 sections.

C. Review all other contract documents to be aware of conditions affecting work herein.

1.3 Definitions:

A. Provide: Furnish and install, complete and ready for intended use.

B. Furnish: Supply and deliver to the project site, ready for subsequent requirements.

C. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.

1.4 Permits and Fees: Contractor shall obtain all necessary permits and inspections required for Division 21 work and pay all fees and charges incidental thereto.

1.5 Verification of Owner's Survey Data: Prior to commencing any work, the Contractor shall verify the accuracy of all survey data as indicated in these plans and specifications and/or as provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, such items shall immediately be notified to the Architect/Engineer so that proper adjustments can be anticipated and ordered. Commencement by the Contractor of work shall be held as an acceptance of the data after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions or inaccuracies of the said data.

1.6 Delivery and Storage of Materials: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. All material shall be stored to provide protection from the weather and accidental damage.

1.7 Extent of work is indicated by the drawings, schedules, and the requirements of the specifications. Singular references shall not be construed as requiring only one device if multiple devices are shown on the drawings or are required for proper system operation.

1.8 Field Measurements and Coordination:

A. The intent of the drawings and specifications is to obtain a complete and satisfactory installation. Separate divisional drawings and specifications shall not relieve the Contractor or subcontractors from full compliance of work of his trade indicated on any of the drawings or in any section of the specifications. Report conflicts prior to start of work.

B. Verify all field dimensions and locations of equipment to ensure close, neat fit with other trades' work. Make use of all contract documents and approved shop drawings to verify exact dimension and locations.

C. Coordinate work in this division with all other trades in proper sequence to ensure that the total work is completed within contract time schedule and with minimum cutting and patching.

D. Locate all equipment, piping, and apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on fire protection drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others. Provide all required work clearances as defined by code and manufacturer’s recommendations.

E. Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval from Engineer or Architect.

F. Carefully examine any existing conditions, piping, and premises. Compare drawings with existing conditions. Report any observed discrepancies. It shall be the Contractor’s responsibility to properly coordinate the work and to identify problems in a timely manner. Written instructions will be issued by the Engineer to resolve discrepancies.

G. Because of the small scale of the drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members, wall and partition locations, trusses, and room dimensions and take actual measurements on the job. Locate piping, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and for coordination with all trades. Contractor shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the drawings. If field measurements show that equipment or material cannot be fitted, the Engineer shall be consulted. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

1.9 Guarantee and Service:

A. The Contractor shall guarantee labor, materials and equipment for a period of one (1) year from Substantial Completion, or from Owner's occupancy, whichever is earlier. Contractor shall make good any defects and shall include all necessary adjustments to and replacement of defective items without expense to the Owner. Manufacturer warranties do not relieve the Contractor of this responsibility.

B. Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond or relieving Contractor of his responsibilities during guarantee period.

C. Contractor shall provide service of all new equipment during the guarantee period without additional expense to the Owner.

1.10 Approval Submittals:

A. Shop drawings, product literature, and other approved submittals will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions and Division 1 Specification sections and the following:

1. Submittals shall include all applicable items referenced in each specification section, and not include items from more than one specification section in the same submittal.

2. Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control numbers, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approved stamps. A sample cover sheet is included at the end of this section.

3. Submittals shall have been reviewed and approved by the General Contractor (or Prime Contractor). Evidence of this review and approval shall be an “Approved” stamp with a signature and date on the cover sheet.

4. Submittals shall be combined into a single submittal package with a table of contents. Submittals shall not be issued as multiple individual submittal packages.

5. The electrical design shown on the drawings supports the fire protection equipment basis of design specifications at the time of design. If fire protection equipment is submitted with different electrical requirements, it is the responsibility of the fire protection contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the fire protection submittal with a written statement that this change will be provided at no additional cost. Fire protection submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost.

B. Before ordering any materials or equipment, and within 30 days after the award of the contract, the Contractor shall submit to the Architect/Engineer one complete schedule showing the make, type, manufacturer's name and trade designation of all equipment.

1. This schedule shall be accompanied by the required number of copies of the manufacturer's printed specifications and shop drawings for each piece of equipment or specialty and shall give dimensions, diagrams, descriptive literature, capacity or rating, kind of material, finish, guarantee, etc., and such other detailed information as the Architect/Engineer may require.
2. When approved, such schedule shall be an addition to these specifications, and shall be of equal force in that no deviation will be permitted except with the approval of the Architect/Engineer.

C. If the shop drawings show variation from the requirements of the contract documents, the Contractor shall make specific mention of such variation in his letter of transmittal. If acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the contract.

D. Review of shop drawings, descriptive literature, catalog data, or schedules shall not relieve the Contractor from responsibility for deviations from contract drawings or specifications, unless he has in writing called to the attention of the Architect/Engineer such deviation at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings, descriptive literature, catalog data, or schedules. Any feature or function specified but not mentioned in the submittal shall be assumed to be included per the specification.

E. Submit shop drawings and any other drawings called for in other sections. Shop drawings shall consist of plans, sections, elevations and details to scale (not smaller than 1/4" per foot), with dimensions clearly showing the installation. Direct copies of small-scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other sections and shall show space allotted for it. Include construction details and materials.

F. Submit product data after award of the contract and before any equipment or materials are purchased. Product data are defined as manufacturer's printed literature specifically marked to indicate size and model and accompanied by rating sheets listing values showing that equipment meets scheduled or specified values. Properly coded stamp from the Engineer on returned submittal is required before ordering equipment.

G. Coordinate with other divisions supplying equipment prior to submitting shop drawings.

H. Shop drawings shall be submitted in one package unless approved otherwise by the Engineer. Provide an index of sections listing manufacturers and “as-specified” or not. Each specification section shall be tabbed with equipment inserted.

1.11 Test Reports and Verification Submittals: Submit test reports, certifications and verification letters as called for in other sections. Contractor shall coordinate the required testing and documentation of system performance such that sufficient time exists to prepare the reports, review the reports, and take corrective action within the scheduled contract time.

1.12 O&M Data Submittals: Submit Operations and Maintenance data as called for in other sections when a copy of approved submittals is included in the O&M Manual, only the final “Furnish as Submitted” or “Furnish as Corrected” copy shall be used. Contractor shall organize these later in the O&M Manuals tabbed by specification number. Prepare O&M Manuals as required by Division 1 and as described herein. Submit manuals at the Substantial Completion inspection.

PART 2 - PRODUCTS

2.1 All materials shall be new or Owner-supplied reused as shown on the drawings, the best of their respective kinds, suitable for the conditions and duties imposed on them. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following sections.

2.2 Equipment and Materials:

A. Equipment and materials furnished under this division shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of three years. Where practical, all of the components shall be products of a single manufacturer in order to provide proper coordination and responsibility. Where required, Contractor shall furnish proof of installation of similar equipment or materials.

B. Each item of equipment shall bear a nameplate showing the manufacturer's name, trade name, model number, serial number, ratings and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated or painted.

C. The label of the approving agency, such as UL, ASME, or FM, by which a standard has been established for each particular item, shall be in full view.

D. The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be a product of the manufacturer’s latest design.

E. A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

F. Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.

G. Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material and type of construction desired. Manufacturer's products shown on the drawings have been used as basis for design; it shall be the Contractor's responsibility to ascertain that alternate manufacturer's products meet detailed specifications and that size and arrangement of the equipment are suitable for installation.

H. Model Numbers: Catalog numbers and model numbers indicated in the drawings and specifications are used as a guide in the selection of the equipment and are only listed for the Contractor's convenience. The Contractor shall determine the actual model numbers for ordering equipment and materials in accordance with the written description of each item and with the intent of the drawings and specifications.

2.3 Requests for Substitution:

A. Where a particular system, product or material is specified by name, consider it as standard basis for bidding, and base proposal on the particular system, product or material specified.

Other systems, products, equipment or materials may be accepted only if in the opinion of the Engineer, that they are equivalent in quality and workmanship and will perform satisfactorily its intended purpose. The Engineer shall approve all such substitutions in materials or equipment in writing. This shall occur prior to bidding.

B. In making requests for substitutions, the Contractor shall list the particular system, product, equipment or material he wishes to substitute and, at bid time, the Contractor shall state the amount he will add or deduct from his base bid if the substitution is approved by the Engineer. If the Contractor allows no deduction or addition to the base bid for such substitution, it shall be stated on the request.

C. Requests by the Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

1. Required product cannot be supplied in time for compliance with Contract time requirements.
2. Required product is not acceptable to governing authority, or determined to be non-compatible, or cannot be properly coordinated, warranted or insured, or has other recognized disabilities as certified by the Contractor.
3. Substantial cost advantage is offered to the Owner after deducting offsetting disadvantages including delays, additional compensation for redesign, investigation, evaluation and other necessary services and similar considerations.

D. All requests for substitution shall contain a "Comparison Schedule" and clearly and specifically indicate any and all differences and omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include, but not limited to, data as follows for both the specified and substituted products:

1. Principle of operation.
2. Materials of construction or finishes.
3. Thickness or gauge of materials.
4. Weight of item.
5. Deleted features or items.
6. Added features or items.
7. Changes in other work caused by the substitution.
8. Performance and rating data.

E. If the approved substitution contains differences or omissions not specifically called to the attention of the Engineer, the Owner reserves the right to require equal or similar features to be added to the substituted products at the Contractor's expense.

2.4 Prior Approval: Prior Approval shall be required for any manufacturer other than those listed for all specified items in the drawings and specifications. Submit all requests for approval of the alternate manufacturer's products two weeks prior to bid opening. Approval will be in the form of an Addendum to the drawings and specifications. Clearly indicate all differences between the specified and proposed product following the guidelines for substitution herein. This requirement may be waived if, in the opinion of the Engineer, it is in the best interest of the Owner. Submittals received after award of the bid for equipment that has not been Prior Approved shall be subject to immediate rejection.

PART 3 - EXECUTION

3.1 Workmanship: All materials and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat and/or workmanlike appearance, or do not allow adequate space for maintenance, shall be removed and replaced when so directed by the Architect/Engineer.

3.2 Coordination:

A. The Contractor shall be responsible for full coordination of the fire protection systems with shop drawings of the building construction so the proper openings and sleeves or supports are provided for piping or other equipment passing through slabs or walls.

B. Any additional steel supports required for the installation of any fire protection equipment or piping shall be furnished and installed under the section of the specifications requiring the additional supports.

C. It shall be the Contractor's responsibility to verify all equipment such as valves and such other apparatus or equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the drawings.

D. All connections to fixtures and equipment shown on the drawings shall be considered diagrammatic unless otherwise indicated by detail. The actual connections shall be made to fully suit the requirements of each case and adequately provide for expansion and servicing.

E. The Contractor shall protect equipment, material, and accessories at all times during storage and construction. The Contractor shall replace all equipment, material, and accessories which are damaged as a result of inadequate protection.

F. Prior to starting and during progress of work, examine work and materials installed by others as they apply to work in this division. Report conditions which will prevent satisfactory installation.

G. Start of work will be construed as acceptance of suitability of work of others.

3.3 Interruption of Service: Before any equipment is shut down for disconnection or tie-ins, arrangements shall be made with the Architect/Engineer and this work shall be done at the time best suited to the Owner. This will typically be on weekends and/or holidays and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this work shall be included in the base bid.

3.4 Phasing: Provide all required temporary valves, piping, equipment and devices as required. Maintain temporary services to areas as required. Remove all temporary material and equipment on completion of work unless Engineer concurs that such material and equipment

would be beneficial to the Owner on a permanent basis.

3.5 Cutting and Patching: Contractor shall be responsible for cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under these Specifications. Utilize experienced trades for cutting and patching. Obtain permission from Architect/Engineer before cutting any structural items.

3.6 Equipment Setting: Bolt equipment directly to concrete pads or vibration isolators as required, using hot-dipped galvanized anchor bolts, nuts and washers. Level equipment.

3.7 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 21. Obtain matched color coatings from the manufacturer and apply as directed. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint as required. If corrosion is found to be extensive by the Engineer, the equipment shall be removed and replaced with factory new at the expense of the Contractor.

3.8 Cleanup: Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials and remove all oil and grease spots. Repaint or touch up as required to look like new. During progress of work, Contractor is to carefully clean up and leave premises and all portions of building free from debris and in a clean and safe condition.

3.9 Startup and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, startup shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety, and operating control shall be included in startup check.

3.10 Record Drawings:

A. During the progress of the work, the Contractor shall record on his field set of drawings the exact location, as installed, of all piping, equipment, and other systems which are not installed exactly as shown on the contract drawings.

B. Upon completion of the work, record drawings shall be prepared as described in the General Conditions, Supplementary Conditions, and Division 1 sections.

3.11 Acceptance:

A. Request inspections as required under the Supplementary or General Conditions. Conceal no work until inspected.

B. Punch List: Submit written confirmation that all punch lists have been checked and the required work completed. The Contractor shall pay, at the Engineer’s current billing rate, for additional field time required by the Engineer to report or check on previous punch list deficiencies.

C. Instructions: At completion of the work, provide a competent and experienced person who is

thoroughly familiar with project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems.

D. Operation and Maintenance Manuals: Furnish complete manuals electronically and organized by system or section. Manuals shall contain:

1. Detailed operating instructions and instructions for making minor adjustments.
2. Routine maintenance operations.
3. Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.
4. Copies of approved submittals.
5. Copies of all manufacturers' warranties.
6. Copies of test reports and verification submittals.

E. Warranties: Submit copies of all manufacturers' warranties.

F. Record Drawings: Submit record drawings.

This is a sample cover sheet. Use one for each shop drawing.

PROJECT NAME
PROJECT NUMBER

SAMPLE

ARCHITECT/ENGINEER: Dell Consulting, LLC

CONTRACTOR: XYZ Construction

SUBCONTRACTOR: ABC Fire Protection Contractor

SUPPLIER: Supply Company

MANUFACTURER: Manufacturer

DATE: MM/DD/YYYY

SECTION: 21 XX XX / Section Name

Any standard heading is acceptable

1. Description: Manufacturer, Model
2. Description: Manufacturer, Model
3. Description: Manufacturer, Model
4. Description: Manufacturer, Model
5. Description: Manufacturer, Model

List each item separately; include manufacturer name and model number

General Contractor's APPROVAL stamp must be on this sheet.

END OF SECTION

SECTION 210010 – CODES AND STANDARDS

PART 1 - GENERAL

1.1 All work under Division 21 shall be constructed in accordance with the codes and standards listed herein. The design has been based on the requirements of these codes and standards. While it is not the responsibility of the Contractor to verify that all work called for complies with these codes and standards, the Contractor shall be responsible for calling to the Architect/Engineer's attention any details on the drawings or specifications that are not in conformance with these or other codes and standards.

1.2 Comply with regulations and codes of utility suppliers.

1.3 Where no specific method or form of construction is called for in the contract documents, the Contractor shall comply with code requirements when carrying out such work.

1.4 Where code conflict exists, the most stringent requirement applies. Comply with current code edition, unless noted.

PART 2 - CODES

2.1 The following codes shall govern all work:

1. Florida Building Code – Eighth Edition (2023) – Building
2. Florida Building Code – Eighth Edition (2023) – Mechanical
3. Installation of Sprinkler Systems (NFPA 13) – 2019
4. National Electric Code (NFPA 70) – 2020
5. Fire Alarm and Signaling Code (NFPA 72) – 2019
6. Fire Code (NFPA 1) – 2021
7. Life Safety Code (NFPA 101) – 2021

PART 3 - STANDARDS

3.1 All fire protection materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments, to the extent referenced:

1. Underwriters' Laboratories (UL)
2. Factory Mutual Global (FM)
3. American National Standards Institute (ANSI)
4. American Society of Testing Materials (ASTM)
5. National Fire Protection Association (NFPA)
6. National Electrical Manufacturers Association (NEMA)

END OF SECTION

SECTION 210553 – FIRE PROTECTION IDENTIFICATION

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. Extent of fire protection identification work required by this section is indicated on drawings and/or specified in other Division 21 sections.

1.2 Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

PART 2 - PRODUCTS

2.1 General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 21 sections. Where more than a single type is specified for application, selection is the Contractor’s option, but provide single selection for each product category.

2.2 Plastic Pipe Markers:

A. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers.

B. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with name as shown or specified.

C. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.3 Engraved Plastic-Laminate Signs:

A. General: Provide engraving stock melamine plastic laminate, in the sizes and thicknesses indicated, engraved with engraver's standard letter style a minimum of 3/4” tall and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 square inches or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.4 Stamped Nameplates: Provide equipment manufacturer's standard stamped nameplates for motors, pumps, etc.

PART 3 - EXECUTION

3.1 Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 Piping System Identification:

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:

1. Plastic pipe markers.

B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces and exterior non-concealed locations.

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for equipment and sprinkler heads. Mark each pipe at branch where there could be question of flow pattern.
3. Near locations where pipes pass through walls or floors/ ceilings or enter non-accessible enclosures.
4. At access doors, manholes, and similar access points which permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

C. The following piping shall be color-coded where exposed outdoors, in mechanical and electrical rooms, and stairwells by completely painting the piping with the indicated color. Use standard colors where exposed in finished spaces. Use standard identification methods in concealed areas.

1. Fire protection piping – Red

3.3 Fire Protection Equipment Identification:

A. General: Install engraved plastic laminate sign on or near each major item of fire protection equipment and each operational device. Label shall indicate type of system and area served. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices.

2. Air compressors.

3.4 Stamped Nameplates: Equipment manufacturers to provide standard stamped nameplates on all major equipment items such as motors, pumps, etc. Where motors are hidden from view (within equipment casing, or otherwise not easily accessible, etc.), the equipment supplier shall furnish a duplicate motor data nameplate to be affixed to the equipment casing in an easily visible location, unless data is already included on the equipment nameplate.

3.5 Adjusting and Cleaning:

A. Relocate any identification device which has become visually blocked by work of this division or other divisions.

B. Clean face of each identification device.

END OF SECTION

SECTION 211300 – FIRE PROTECTION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 Scope of Work: Design and provide a new automatic wet and dry pipe fire extinguishing sprinkler systems for complete fire protection coverage throughout the building and exterior covered areas as indicated.

1.2 References:

A. NFPA 13 – Installation of Sprinkler Systems

B. FM – Factory Mutual Approval Guide

C. UL – Fire Resistance Directory

1.3 System Design: Contractor shall design automatic fire extinguishing sprinkler systems, in strict accordance with the required and advisory provisions of NFPA 13 for uniform distribution of water over the design areas. The systems shall include materials, accessories, and equipment inside and outside the building to provide systems complete and ready for use. Contractor shall design and provide the systems to give full consideration to blind spaces, piping, electrical equipment, ducts, and other obstructions. Contractor shall locate the sprinkler heads in a consistent pattern with ceiling grid, lights, and air supply diffusers. Devices and equipment for fire protection service shall be UL listed or FM approved for use in wet or dry pipe sprinkler systems as applicable. The systems shall be hydraulically designed in accordance with the guidelines of NFPA 13 for the proper hazard classifications as indicated. The proper outside hose stream allowances shall be included in the calculations.

1.4 Fire Protection Engineer: Fire extinguishing sprinkler systems shall be designed by, or under the direct supervision of, a professional engineer registered in the state of Florida. The Contractor shall be the Engineer of Record for the systems design.

1.5 Basis for Calculations: The sprinkler contractor shall obtain independent water flow and pressure data to verify any data provided in the drawings. The design of the sprinkler systems shall be based upon water flow and pressure data obtained by the sprinkler contractor and witnessed by the “Authority Having Jurisdiction”. Water supply shall be presumed available at the point of connection of the underground fire main to city water supply.

1.6 Submittals:

A. Submit computer generated hydraulic calculations in accordance with the guidelines of NFPA 13.

B. Submit working plans as required by NFPA 13. Drawings shall be prepared on minimum 24”x36” paper with a drawing scale of not less than 1/8” = 1’-0”. Drawings shall show all data essential for the proper installation of the systems. Drawings shall show plan view, elevations, sections, and details of the system’s supply piping, devices, valves, accessories, and fittings.

C. Submit qualifications of the installer. Prior to installation, submit data showing that the contractor has successfully installed systems of the same type and design as specified herein. Data shall include names and locations of at least three installations, the type of system installed, a short description of the work performed, and the approximate contract value. The contractor shall certify that each system has performed satisfactorily in the manner intended for not less than 18 months.

D. Submit the name and documentation of certification of the proposed Fire Protection Engineer.

E. Submit the following product data. Annotate manufacturer’s descriptive data to show specific model, type, and size of each item.

1. Pipe, fittings, and mechanical couplings
2. Valves, including gate, check, and globe
3. Water motor alarm bell
4. Sprinkler heads
5. Pipe hangers and supports
6. Pressure or water flow switch
7. Fire department connection
8. Low air pressure supervisory switch
9. Dry pipe valve
10. Air compressor

1.7 Submittals at Project Closeout:

A. Submit “as-built” drawings that record the actual locations of sprinklers and deviations in pipe routing from submitted shop drawings. Indicate locations of all drains and Inspector’s tests.

B. Submit manufacturer’s test certificates that certify the sprinkler systems have been tested, and meet or exceed all applicable codes. Use forms located in NFPA 13.

C. Submit three copies of operation and maintenance data for all sprinkler system components requiring servicing, in 3-ring binders.

D. Submit documentation of a 1-year warranty covering all parts and labor.

1.8 Quality Assurance:

A. Manufacturer shall be a company specializing in manufacturing the products specified in this section with a minimum of (3) years documented experience.

B. Installer shall be a company specializing in performing the work of this section with a minimum of (5) years documented experience.

1.9 Regulatory Requirements:

A. All work shall conform to UL and FM and be performed in accordance with NFPA 13 and all applicable coded. Equipment and components shall bear a UL or FM label or marking.

B. Products requiring electrical connection shall be listed and classified by Underwriters Laboratories as suitable for the purpose specified and indicated.

1.10 Extra Materials: Provide extra sprinklers and suitable wrenches for each sprinkler type under the provisions of NFPA 13. Provide a metal storage cabinet at the riser to house them.

PART 2 - PRODUCTS

2.1 Underground Piping Components:

A. Piping and fittings from a point of 1'-0" above finished floor to 5'-0" outside of building shall be ductile iron. Ductile iron pipe and fittings shall be outside-coated, cement-mortar-lined, Class 150, conforming to NFPA 24 for piping under the building and outside of building walls. Contractor shall provide a concrete thrust block at the elbow where the pipe turns up toward the floor and restrain the pipe riser with steel rods from the elbow to the flange above the floor. Piping beyond 5 feet outside of the building walls shall be provided under the "Civil" sections of this specification.

B. Fittings shall be mechanical joint type. Gaskets shall be suitable in design and size for the pipe with which they are to be used.

C. Provide valves as required by NFPA 13 and NFPA 24. Gate valves shall conform to UL 262 and shall open by counter-clockwise rotation.

D. Provide post indicator valve with operating nut located approximately 3 feet above finished grade. Gate valves for use with indicator post shall conform to UL 262. Indicator posts shall conform to UL 789. Provide each indicator post with one coat of primer and two coats of red enamel paint.

2.2 Aboveground Piping Components:

A. Pipe shall be black or galvanized steel as permitted by NFPA 13. Pipe, in which threads or grooves are cut, shall be Schedule 40 or shall be listed by Underwriters Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut.

B. Fittings for non-grooved pipe shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Galvanized fittings shall be used for piping systems or portions of piping systems utilizing galvanized piping. Fittings, into which sprinklers, drop nipples, or riser nipples (sprigs) are screwed, shall be threaded type. Plain-end fittings with mechanical couplings, which utilize steel gripping devices to "bite" into the pipe, will not be permitted.

C. Grooved fittings shall be designed for not less than 175 psi service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47M, ASTM A 47, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12.

D. Manually operated sprinkler control valve shall be of the OS&Y type or the Butterfly type with supervisory switches installed. Provide supervision of each control valve against closure and tempering in accordance with NFPA 13.

E. Check valves shall be UL listed and FM approved for their particular use.

2.3 Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC.

2.4 Sprinkler Heads:

A. Sprinkler heads installed in suspended or hard ceilings shall be chrome plated, semi-recessed type with matching escutcheon plate. Temperature rating of head shall be contingent on the hazard area in which it is installed.

B. Sprinkler heads installed in exposed piping/construction shall be brass plated, upright type with temperature rated for specific hazard area.

C. Sprinkler heads for dry pipe systems shall be nominal 0.5 inch orifice quick response. No o-rings will be permitted. Temperature rating of the release element of each head shall be contingent on the hazard area in which it is installed. Provide corrosion resistant sprinkler heads and sprinkler head guards as required by NFPA 13. Automatic sprinklers installed in the pendant position shall be of the dry-pendant type.

2.5 Inspector's Test Connection: Provide a test connection approximately 6 feet above the finished floor for each sprinkler system or portion of each sprinkler system equipped with an alarm device. Locate at the hydraulically most remote part of each system or portion of system. Provide test connection piping to a location where the discharge will be readily visible and where water may be discharged without property damage.

2.6 Main Drain: Provide separate drain piping to discharge at a safe point outside the building or to a sight cone attached to a drain of adequate size to readily receive the full flow from the drain piping under maximum system pressure. Provide auxiliary drains as required by NFPA 13.

2.7 Fire Department Connection: Provide fire department connection approximately 3 feet above finished grade. Connection shall be of the approved two-way type with 2.5 inch National Standard female hose threads with plug, chain, and identifying fire department connection escutcheon plate.

2.8 Identification Signs: Attach properly lettered, approved metal identification signs, conforming to NFPA 13 to each valve and alarm device. Permanently affix Hydraulic Data Plates to the riser of each system for each area calculated.

2.9 Pipe Sleeves:

A. Provide pipe sleeves wherever piping passes entirely through walls, floors, and roofs. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, and roofs. Provide 1 inch minimum clearance between exterior of piping and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of the sleeve or core-drilled hole with plastic waterproof cement, which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with UL listed fill, void, or cavity material.

B. For masonry and concrete walls and floors, provide hot-dip galvanized steel, ductile-iron, or cast-iron sleeves. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

C. For other than masonry and concrete walls, provide 26-gauge galvanized steel sheet pipe sleeve.

2.10 Escutcheon Plates: Provide one piece or split hinge type metal plates for piping passing through walls, floors, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

2.11 Dry Pipe Sprinkler System Components:

A. Dry Pipe Valve: Provide valve complete with all accessories and appurtenances for the proper operation of the system.

B. Pressure Switch: Provide switch with circuit opener or closer for the automatic transmittal of an alarm over the facility fire alarm system. Connection of switch shall be by the Fire Alarm Contractor in compliance with the Fire Alarm specification. Do not install a shutoff valve in the piping between the dry pipe valve and any pressure switch.

C. Low Air Pressure Supervisory Switch: Provide switch for each dry pipe sprinkler system and connect to the building fire alarm system to activate the system supervisory alarm when the air pressure in the dry pipe system drops halfway from the normal pressure to the tripping point. Connection of this switch shall be by the Fire Alarm Contractor in compliance with the Fire Alarm specification. Provide a bleeder valve in the air line ahead of the switch for testing operation of the switch. The valve shall be normally open. Closing the valve shall shut off the air supply to the switch and exhaust the pressure between the switch and the valve.

D. Riser Mounted Air Compressor: Provide an approved, automatic type, electric motor-driven air compressor including pressure switch, and air piping, sized for the application. Compressor shall have a minimum capacity capable of charging the complete dry pipe sprinkler system to

normal system air pressure within 30 minutes. Provide an approved automatic air maintenance device for each dry pipe system.

PART 3 - EXECUTION

3.1 Installation:

A. Installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall all be in strict accordance with NFPA 13.

B. Contractor shall install piping straight and true to bear evenly on hangers and supports. Piping shall not be hung from plaster or gypsum ceilings. Contractor shall keep the interior and ends of new piping and existing piping affected by the contractor's operations thoroughly cleaned of water and foreign matter. Contractor shall keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of piping shall be securely closed to prevent entry of water and foreign matter. Contractor shall inspect all piping before placing into position. Piping shall be installed above ceilings where applicable. All piping routing and installation shall be coordinated with other trades.

C. All equipment shall be installed in accordance with manufacturer’s instructions.

D. Contractor shall locate the fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connections to allow full swing of fire department wrench handle. Fire department connection shall be located within 100’ of a fire hydrant per NFPA requirements.

E. Water motor alarm bell shall be installed on an outside wall.

3.2 Preliminary Tests: Hydrostatically test system at 200 psi for a period of at least 2 hours. Flush piping in accordance with NFPA 13. Piping above ceilings shall be tested, inspected, and approved before the installation of ceilings. Test the alarms and other devices. Test water flow alarms by flowing water through the inspector’s test connection. When tests have been completed and corrections made, submit a signed and dated test certificate, with a request for a formal inspection and test.

3.3 Formal Inspection and Test: Do not submit a request for a formal test until the preliminary test and corrections are completed and approved. The “Authority Having Jurisdiction” and a representative of the owner will witness the formal tests and approve the system before acceptance. Submit the request for formal inspection, at least 14 days prior to the date the tests are to take place. An experienced technician, regularly employed by the fire sprinkler contractor, shall be present during the inspection.

END OF SECTION

SECTION 220000 – PLUMBING GENERAL

PART 1 - GENERAL

1.1 The work covered by this division consists of providing all labor, equipment and materials and performing all operations necessary for the installation of the plumbing work as herein called for and shown on the drawings. The work shall include but shall not be limited to the following:

Provide all plumbing and associated fittings, valves, and accessories for the project. Fully coordinate all plumbing requirements with work by other divisions under this construction contract. All systems shall be complete and fully functional.

1.2 Related Documents:

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

B. Provisions of this section apply to work of all Division 22 sections.

C. Review all other contract documents to be aware of conditions affecting work herein.

1.3 Definitions:

A. Provide: Furnish and install, complete and ready for intended use.

B. Furnish: Supply and deliver to the project site, ready for subsequent requirements.

C. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.

1.4 Permits and Fees: Contractor shall obtain all necessary permits, meters, and inspections required for Division 22 work and pay all fees and charges incidental thereto.

1.5 Verification of Owner's Survey Data: Prior to commencing any work, the Contractor shall verify the accuracy of all survey data as indicated in these plans and specifications and/or as provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, such items shall immediately be notified to the Architect/Engineer so that proper adjustments can be anticipated and ordered. Commencement by the Contractor of work shall be held as an acceptance of the data after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions or inaccuracies of the said data.

1.6 Delivery and Storage of Materials: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. All material shall be stored to provide

protection from the weather and accidental damage.

1.7 Extent of work is indicated by the drawings, schedules, and the requirements of the specifications. Singular references shall not be construed as requiring only one device if multiple devices are shown on the drawings or are required for proper system operation.

1.8 Field Measurements and Coordination:

A. The intent of the drawings and specifications is to obtain a complete and satisfactory installation. Separate divisional drawings and specifications shall not relieve the Contractor or subcontractors from full compliance of work of his trade indicated on any of the drawings or in any section of the specifications. Report conflicts prior to start of work.

B. Verify all field dimensions and locations of equipment to ensure close, neat fit with other trades' work. Make use of all contract documents and approved shop drawings to verify exact dimension and locations.

C. Coordinate work in this division with all other trades in proper sequence to ensure that the total work is completed within contract time schedule and with minimum cutting and patching.

D. Locate all equipment, piping, and apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on plumbing drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others. Provide all required work clearances as defined by code and manufacturer’s recommendations.

E. Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval from Engineer or Architect.

F. Carefully examine any existing conditions, piping, and premises. Compare drawings with existing conditions. Report any observed discrepancies. It shall be the Contractor’s responsibility to properly coordinate the work and to identify problems in a timely manner. Written instructions will be issued by the Engineer to resolve discrepancies.

G. Because of the small scale of the drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members, wall and partition locations, trusses, and room dimensions and take actual measurements on the job. Locate piping, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and for coordination with all trades. Contractor shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the drawings. If field measurements show that equipment or material cannot be fitted, the Engineer shall be consulted. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

1.9 Guarantee and Service:

A. The Contractor shall guarantee labor, materials and equipment for a period of one (1) year from Substantial Completion, or from Owner's occupancy, whichever is earlier. Contractor shall make good any defects and shall include all necessary adjustments to and replacement of defective items without expense to the Owner. Manufacturer warranties do not relieve the Contractor of this responsibility.

B. Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond or relieving Contractor of his responsibilities during guarantee period.

C. Contractor shall provide service of all new equipment during the guarantee period without additional expense to the Owner.

1.10 Approval Submittals:

A. Shop drawings, product literature, and other approved submittals will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions and Division 1 Specification sections and the following:

1. Submittals shall include all applicable items referenced in each specification section, and not include items from more than one specification section in the same submittal.

2. Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control numbers, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approved stamps. A sample cover sheet is included at the end of this section.

3. Submittals shall have been reviewed and approved by the General Contractor (or Prime Contractor). Evidence of this review and approval shall be an “Approved” stamp with a signature and date on the cover sheet.

4. Submittals shall be combined into a single submittal package with a table of contents. Submittals shall not be issued as multiple individual submittal packages.

5. The electrical design shown on the drawings supports the plumbing equipment basis of design specifications at the time of design. If plumbing equipment is submitted with different electrical requirements, it is the responsibility of the plumbing contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the plumbing submittal with a written statement that this change will be provided at no additional cost. Plumbing submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost.

B. Before ordering any materials or equipment, and within 30 days after the award of the contract, the Contractor shall submit to the Architect/Engineer one complete schedule showing the make, type, manufacturer's name and trade designation of all equipment.

1. This schedule shall be accompanied by the required number of copies of the manufacturer's printed specifications and shop drawings for each piece of equipment or specialty and shall give dimensions, diagrams, descriptive literature, capacity or rating, kind of material, finish, guarantee, etc., and such other detailed information as the Architect/Engineer may require.
2. When approved, such schedule shall be an addition to these specifications, and shall be of equal force in that no deviation will be permitted except with the approval of the Architect/Engineer.

C. If the shop drawings show variation from the requirements of the contract documents, the Contractor shall make specific mention of such variation in his letter of transmittal. If acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the contract.

D. Review of shop drawings, descriptive literature, catalog data, or schedules shall not relieve the Contractor from responsibility for deviations from contract drawings or specifications, unless he has in writing called to the attention of the Architect/Engineer such deviation at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings, descriptive literature, catalog data, or schedules. Any feature or function specified but not mentioned in the submittal shall be assumed to be included per the specification.

E. Submit shop drawings and any other drawings called for in other sections. Shop drawings shall consist of plans, sections, elevations and details to scale (not smaller than 1/4" per foot), with dimensions clearly showing the installation. Direct copies of small-scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other sections and shall show space allotted for it. Include construction details and materials.

F. Submit product data after award of the contract and before any equipment or materials are purchased. Product data are defined as manufacturer's printed literature specifically marked to indicate size and model and accompanied by rating sheets listing values showing that equipment meets scheduled or specified values. Properly coded stamp from the Engineer on returned submittal is required before ordering equipment.

G. Coordinate with other divisions supplying equipment prior to submitting shop drawings.

H. Shop drawings shall be submitted in one package unless approved otherwise by the Engineer. Provide an index of sections listing manufacturers and “as-specified” or not. Each specification section shall be tabbed with equipment inserted.

1.11 Test Reports and Verification Submittals: Submit test reports, certifications and verification letters as called for in other sections. Contractor shall coordinate the required testing and documentation of system performance such that sufficient time exists to prepare the reports, review the reports, and take corrective action within the scheduled contract time.

1.12 O&M Data Submittals: Submit Operations and Maintenance data as called for in other sections when a copy of approved submittals is included in the O&M Manual, only the final “Furnish as Submitted” or “Furnish as Corrected” copy shall be used. Contractor shall organize these later in the O&M Manuals tabbed by specification number. Prepare O&M Manuals as required by Division 1 and as described herein. Submit manuals at the Substantial Completion inspection.

PART 2 - PRODUCTS

2.1 All materials shall be new or Owner-supplied reused as shown on the drawings, the best of their respective kinds, suitable for the conditions and duties imposed on them. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following sections.

2.2 Equipment and Materials:

A. Any material or equipment used in any potable water system intended for human consumption, including inline devices (i.e. valves, fittings, pumps, meters) and end point devices (ie. drinking water fountains, faucets, ice makers, supply stops, control valves for dispensing), shall be certified “lead-free” in accordance with NSF/ANSI 61.

B. Equipment and materials furnished under this division shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of three years. Where practical, all of the components shall be products of a single manufacturer in order to provide proper coordination and responsibility. Where required, Contractor shall furnish proof of installation of similar equipment or materials.

C. Each item of equipment shall bear a nameplate showing the manufacturer's name, trade name, model number, serial number, ratings and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated or painted.

D. The label of the approving agency, such as UL, ASME, or FM, by which a standard has been established for each particular item, shall be in full view.

E. The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be a product of the manufacturer’s latest design.

F. A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

G. Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.

H. Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material and type of construction desired. Manufacturer's products shown on the drawings have been used as basis for design; it shall be the Contractor's responsibility to ascertain that alternate manufacturer's products meet detailed specifications and that size and arrangement of the equipment are suitable for installation.

I. Model Numbers: Catalog numbers and model numbers indicated in the drawings and specifications are used as a guide in the selection of the equipment and are only listed for the Contractor's convenience. The Contractor shall determine the actual model numbers for ordering equipment and materials in accordance with the written description of each item and with the intent of the drawings and specifications.

2.3 Requests for Substitution:

A. Where a particular system, product or material is specified by name, consider it as standard basis for bidding, and base proposal on the particular system, product or material specified. Other systems, products, equipment or materials may be accepted only if in the opinion of the Engineer, that they are equivalent in quality and workmanship and will perform satisfactorily its intended purpose. The Engineer shall approve all such substitutions in materials or equipment in writing. This shall occur prior to bidding.

B. In making requests for substitutions, the Contractor shall list the particular system, product, equipment or material he wishes to substitute and, at bid time, the Contractor shall state the amount he will add or deduct from his base bid if the substitution is approved by the Engineer. If the Contractor allows no deduction or addition to the base bid for such substitution, it shall be stated on the request.

C. Requests by the Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

1. Required product cannot be supplied in time for compliance with Contract time requirements.
2. Required product is not acceptable to governing authority, or determined to be non-compatible, or cannot be properly coordinated, warranted or insured, or has other recognized disabilities as certified by the Contractor.
3. Substantial cost advantage is offered to the Owner after deducting offsetting disadvantages including delays, additional compensation for redesign, investigation, evaluation and other necessary services and similar considerations.

D. All requests for substitution shall contain a “Comparison Schedule” and clearly and specifically indicate any and all differences and omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include, but not limited to, data as follows for both the specified and substituted products:

1. Principle of operation.
2. Materials of construction or finishes.
3. Thickness or gauge of materials.
4. Weight of item.
5. Deleted features or items.
6. Added features or items.
7. Changes in other work caused by the substitution.
8. Performance and rating data.

E. If the approved substitution contains differences or omissions not specifically called to the attention of the Engineer, the Owner reserves the right to require equal or similar features to be added to the substituted products at the Contractor’s expense.

2.4 Prior Approval: Prior Approval shall be required for any manufacturer other than those listed for all specified items in the drawings and specifications. Submit all requests for approval of the alternate manufacturer’s products two weeks prior to bid opening. Approval will be in the form of an Addendum to the drawings and specifications. Clearly indicate all differences between the specified and proposed product following the guidelines for substitution herein.

This requirement may be waived if, in the opinion of the Engineer, it is in the best interest of the Owner. Submittals received after award of the bid for equipment that has not been Prior Approved shall be subject to immediate rejection.

PART 3 - EXECUTION

3.1 Workmanship: All materials and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat and/or workmanlike appearance, or do not allow adequate space for maintenance, shall be removed and replaced when so directed by the Architect/Engineer.

3.2 Coordination:

A. The Contractor shall be responsible for full coordination of the plumbing systems with shop drawings of the building construction so the proper openings and sleeves or supports are provided for piping or other equipment passing through slabs or walls.

B. Any additional steel supports required for the installation of any plumbing equipment or piping shall be furnished and installed under the section of the specifications requiring the additional supports.

C. It shall be the Contractor's responsibility to verify all equipment such as valves and such other apparatus or equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the drawings.

D. All connections to fixtures and equipment shown on the drawings shall be considered diagrammatic unless otherwise indicated by detail. The actual connections shall be made to fully suit the requirements of each case and adequately provide for expansion and servicing.

E. The Contractor shall protect equipment, material, and fixtures at all times during storage and construction. The Contractor shall replace all equipment, material, and fixtures which are damaged as a result of inadequate protection.

F. Prior to starting and during progress of work, examine work and materials installed by others as they apply to work in this division. Report conditions which will prevent satisfactory installation.

G. Start of work will be construed as acceptance of suitability of work of others.

3.3 Interruption of Service: Before any equipment is shut down for disconnection or tie-ins, arrangements shall be made with the Architect/Engineer and this work shall be done at the time best suited to the Owner. This will typically be on weekends and/or holidays and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this work shall be included in the base bid.

3.4 Phasing: Provide all required temporary valves, piping, equipment and devices as required. Maintain temporary services to areas as required. Remove all temporary material and equipment on completion of work unless Engineer concurs that such material and equipment would be beneficial to the Owner on a permanent basis.

3.5 Cutting and Patching: Contractor shall be responsible for cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under these Specifications. Utilize experienced trades for cutting and patching. Obtain permission from Architect/Engineer before cutting any structural items.

3.6 Equipment Setting: Bolt equipment directly to concrete pads or vibration isolators as required, using hot-dipped galvanized anchor bolts, nuts and washers. Level equipment.

3.7 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 22. Obtain matched color coatings from the manufacturer and apply as directed. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint as required. If corrosion is found to be extensive by the Engineer, the equipment shall be removed and replaced with factory new at the expense of the Contractor.

3.8 Cleanup: Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials and remove all oil and grease spots. Repaint or touch up as required to look like new. During progress of work, Contractor is to carefully clean up and leave premises and all portions of building free from debris and in a clean and safe condition.

3.9 Startup and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, startup shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety, and operating control shall be included in startup check.

3.10 Record Drawings:

A. During the progress of the work, the Contractor shall record on his field set of drawings the exact location, as installed, of all piping, equipment, and other systems which are not installed exactly as shown on the contract drawings.

B. Upon completion of the work, record drawings shall be prepared as described in the General Conditions, Supplementary Conditions, and Division 1 sections.

3.11 Acceptance:

A. Request inspections as required under the Supplementary or General Conditions. Conceal no work until inspected.

B. Punch List: Submit written confirmation that all punch lists have been checked and the required work completed. The Contractor shall pay, at the Engineer’s current billing rate, for additional

field time required by the Engineer to report or check on previous punch list deficiencies.

C. Instructions: At completion of the work, provide a competent and experienced person who is thoroughly familiar with project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems.

D. Operation and Maintenance Manuals: Furnish complete manuals electronically and organized by system or section. Manuals shall contain:

1. Detailed operating instructions and instructions for making minor adjustments.
2. Routine maintenance operations.
3. Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.
4. Copies of approved submittals.
5. Copies of all manufacturers' warranties.
6. Copies of test reports and verification submittals.

E. Warranties: Submit copies of all manufacturers' warranties.

F. Record Drawings: Submit record drawings.

This is a sample cover sheet. Use one for each shop drawing.

PROJECT NAME
PROJECT NUMBER

SAMPLE

ARCHITECT/ENGINEER: Dell Consulting, LLC

CONTRACTOR: XYZ Construction

SUBCONTRACTOR: ABC Plumbing Contractor

SUPPLIER: Supply Company

MANUFACTURER: Manufacturer

DATE: MM/DD/YYYY

Any standard heading is acceptable

SECTION: 22 XX XX / Section Name

1. Description: Manufacturer, Model

2. Description: Manufacturer, Model

3. Description: Manufacturer, Model

4. Description: Manufacturer, Model

5. Description: Manufacturer, Model

List each item separately; include manufacturer name and model number

General Contractor's APPROVAL stamp must be on this sheet.

END OF SECTION

SECTION 220010 – CODES AND STANDARDS

PART 1 - GENERAL

1.1 All work under Division 22 shall be constructed in accordance with the codes and standards listed herein. The design has been based on the requirements of these codes and standards. While it is not the responsibility of the Contractor to verify that all work called for complies with these codes and standards, the Contractor shall be responsible for calling to the Architect/Engineer's attention any details on the drawings or specifications that are not in conformance with these or other codes and standards.

1.2 Comply with regulations and codes of utility suppliers.

1.3 Where no specific method or form of construction is called for in the contract documents, the Contractor shall comply with code requirements when carrying out such work.

1.4 Where code conflict exists, the most stringent requirement applies. Comply with current code edition, unless noted.

PART 2 - CODES

2.1 The following codes shall govern all work:

1. Florida Building Code – Eighth Edition (2023) – Building
2. Florida Building Code – Eighth Edition (2023) – Energy Conservation
3. Florida Building Code – Eighth Edition (2023) – Mechanical
4. Florida Building Code – Eighth Edition (2023) – Plumbing
5. Florida Building Code – Eighth Edition (2023) – Fuel Gas
6. Florida Building Code – Eighth Edition (2023) – Accessibility
7. National Electric Code (NFPA 70) – 2020
8. Fire Alarm and Signaling Code (NFPA 72) – 2019
9. Florida Fire Prevention Code Fifth Edition
    a. Fire Code (NFPA 1) – 2021
    b. Life Safety Code (NFPA 101) – 2021

PART 3 - STANDARDS

3.1 All plumbing materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments, to the extent referenced:

1. Underwriters' Laboratories (UL)
2. Factory Mutual Global (FM)
3. American National Standards Institute (ANSI)
4. American Society of Testing Materials (ASTM)
5. National Fire Protection Association (NFPA)
6. National Electrical Manufacturers Association (NEMA)

END OF SECTION

SECTION 220020 – PLUMBING RELATED WORK

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. This is a Common Work Results for Plumbing section. Provisions of this section apply to work of all Division 22 sections.

C. Coordinate with the General Contractor for all cutting and patching. Contractors performing Division 22 work shall inform the General Contractor of all cutting and patching required prior to bidding and shall coordinate installation.

PART 2 - DIVISION 2 – SITE WORK

2.1 Specific requirements for excavation and backfill for underground piping are contained in Section 220550.

2.2 Refer to Division 2 – Site Work for:

A. All water, sewer, and storm water piping greater than five feet from the building.

B. Manholes and catch-basins.

C. Underground tanks and enclosures.

2.3 The following work is part of Division 22:

A. All site piping within five feet of building footprint.

B. Underground tanks and enclosures within five feet of building footprint.

C. Grease trap.

PART 3 - DIVISION 3 – CONCRETE

3.1 Refer to Division 3 – Concrete for:

A. Rough grouting in and around plumbing work.

B. Cutting and patching concrete to accommodate plumbing work.

3.2 The following work is part of Division 22, complying with the requirements of Division 3:

A. Curbs, foundations and pads for plumbing equipment.

B. Basins, sumps, and vaults for plumbing work.

C. Underground structural concrete to accommodate plumbing work.

PART 4 - DIVISION 4 – MASONRY

4.1 Refer to Division 4 – Masonry for:

A. Installation of access doors in walls.

PART 5 - DIVISION 5 – METALS

5.1 Refer to Division 5 – Metals for:

A. Framing openings for plumbing equipment.

5.2 The following work is part of Division 22:

A. Supports for plumbing work.

PART 6 - DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

6.1 Refer to Division 6 – Wood, Plastics, and Composites for:

A. Framing openings for plumbing equipment.

PART 7 - DIVISION 7 – THERMAL AND MOISTURE PROTECTION

7.1 Refer to Division 7 – Thermal and Moisture Protection for:

A. Installation of all roof curbs and roof supports for plumbing work.

B. Caulking and waterproofing of all wall- and roof-mounted plumbing work.

C. Flashing of all roof curbs and roof vents.

7.2 The following work is part of Division 22, complying with the requirements of Division 7:

A. Fire barrier penetration seals.

PART 8 - DIVISION 9 – FINISHES

8.1 Refer to Division 9 – Finishes for:

A. Painting exposed piping and equipment.

B. Painting structural metal and concrete for plumbing work.

C. Painting access panels.

D. Painting color-coded plumbing work indicated for continuous painting. See color schedule in Division 22 Section, "Plumbing Identification".

E. Installation of access doors in gypsum drywall.

8.2 Colors shall be selected by the Architect for all painting of exposed plumbing work in occupied spaces, unless specified herein. Do not paint insulated or jacketed surfaces.

8.3 The following work is part of Division 22:

A. Touch-up painting of factory finishes.

B. Painting of all hangers.

PART 9 - DIVISION 11 – EQUIPMENT

9.1 Refer to Division 11 – Equipment for:

A. All food service equipment including ranges, ovens, dishwashers, and related food preparation equipment and accessories.

9.2 The following work is part of Division 22:

A. All trim including faucets, waste connections, drain traps, vents, valves, piping, flashing, fittings, strainers, and other materials necessary to make equipment operational. Provide rough-in for all equipment. Provide final connections for all equipment.

B. All automatic gas valves for shutoff to cooking appliances when fire suppression system activates. Coordinate type of valve with fire suppression system supplier.

PART 10 - DIVISION 26 – ELECTRICAL

10.1 Plumbing contractor shall coordinate the exact electrical requirements of all plumbing equipment being provided with the electrical contractor. Where approval submittals are required, this coordination shall be accomplished prior to making the submittals. The electrical design shown on the drawings supports the plumbing equipment basis of design. If plumbing equipment is submitted with different electrical requirements, it is the responsibility of the plumbing contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the plumbing submittal with a written statement that this design will be provided at no additional cost. Plumbing submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost.

10.2 Electrical contractor shall provide disconnect switches, starters, and contactors for plumbing equipment unless specifically noted as being furnished as part of the plumbing equipment.

10.3 Electrical contractor shall provide all power wiring, raceway and devices, and make final electrical connections to all plumbing equipment, switches, starters, contactors, controllers, and similar equipment.

END OF SECTION

SECTION 220517 – SLEEVES AND SLEEVE SEALS

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. This section is a Division 22 Common Work Results for Plumbing section, and is part of each Division 22 section making reference to or requiring sleeves and sleeve seals specified herein.

PART 2 - PRODUCTS

2.1 General: Provide factory-fabricated sleeves and sleeve seals recommended by manufacturer for use in service indicated. Provide sleeves and sleeve seals of type indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

2.2 Escutcheons:

A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

2.3 Fire Barrier Penetration Seals:

A. Provide seals for any opening through fire-rated walls, floors, or ceilings used as passage for plumbing components such as piping in accordance with the requirements of Division 7.

2.4 Fabricated Piping Specialties:

A. Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2". Reinforce top, either by structural angles or by rolling top over 1/4" steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1"

drain line connection.

B. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet-Metal: Fabricate from galvanized sheet metal, round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3" and smaller, 20 gauge; 4" to 6" 16 gauge; over 6", 14 gauge.

2. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.

3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.

C. Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:

1. Caulking and Sealant: Provide foam or caulking and sealant compatible with piping materials used.

PART 3 - EXECUTION

3.1 Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

3.2 Fire Barrier Penetration Seals: Provide pipe sleeve as required. Fill entire opening with sealing compound. Adhere to manufacturer's installation instructions. Refer to Division 7.

3.3 Drip Pans: Locate drip pans under piping passing over or within 3' horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

3.4 Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 2" above finished floor. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

A. Install sleeves in fire-rated assemblies in accordance with the listing of the assembly and the fire

barrier sealant.

B. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings. Fill annular space with caulking or fire barrier sealant as required.

C. Install steel-pipe sleeves at floor penetrations. Fill annular space with caulking or fire barrier sealant as required.

D. Install iron-pipe sleeves at all foundation wall penetrations and at exterior penetrations, both above and below grade. Fill annular space with caulking or mechanical sleeve seals.

END OF SECTION

SECTION 220519 – METERS AND GAUGES

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. This section is a Division 22 Common Work Results for Plumbing section, and is part of each Division 22 section making reference to or requiring meters and gauges specified herein.

C. Extent of meters and gauges required by this section is indicated on drawings and/or specified in other Division 22 sections.

1.2 Codes and Standards:

A. UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.

B. ANSI and ISA Compliance: Comply with applicable portions of ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

C. Any material or equipment used in any potable water system intended for human consumption shall be certified “lead-free” in accordance with NSF/ANSI 61.

1.3 Approval Submittals:

A. Product Data: When required by other Division 22 sections, submit manufacturer's technical product data for each type of meter and gauge. Submit with Division 22 section using meters and gauges, not as a separate submittal. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit for:
1. Thermometers
2. Pressure gauges
3. Gauge connector plugs

1.4 O&M Data Submittals: Submit a copy of approval submittals. Submit calibration curves and operating instructions for each type of meter or gauge. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide thermometers and pressure gauges by: Ashcroft, Ernst Gauge Company, Weksler, Marshalltown Instruments, Trerice, Weiss Instruments, Wheatley, Fluidyne, or approved equal.

2.2 Dial Type Insertion Thermometers:

A. General: Provide dial type insertion thermometers of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

B. Type: Bi-metal, stainless steel case and stem, 3-1/2" diameter dial, dust and leak proof, 1/8" diameter stem with nominal length of 5".

C. Accuracy: 0.5% of dial range.

D. Range: Conform to the following:

1. Hot Water: 0° – 220°F.

2.3 Thermometer Wells: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2" extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well. Same manufacturer as thermometers.

2.4 Pressure Gauges:

A. General: Provide liquid-filled pressure gauges of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

B. Type: General use, 1% accuracy, ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection.

C. Case: Drawn steel or brass, glass lens, 4-1/2" diameter.

D. Connector: Brass with 1/4" male NPT.

E. Scale: White coated aluminum with black scale.

F. Range: Select so that highest possible pressure does not exceed 75% of full scale.

2.5 Pressure Gauge Cocks:

A. General: Provide 1/4" ball valves for use as pressure gauge cocks.

B. Snubber: 1/4" brass bushing with corrosion resistance porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

2.6 Gauge Connector Plugs:

A. Provide temperature gauge connector plugs pressure rated for 500 psi and 200°F. Construct of brass and finish in nickel-plate, equip with 1/2" NPT fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion thermometer. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping. Pete's Plug or approved equal.

B. Provide pressure gauge connector plugs pressure rated for 500 psi and 200°F. Construct of

brass and finish in nickel-plate, equip with 1/2" NPT fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion pressure gauge. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping. Pete's Plug or approved equal.

C. Provide master test kit with one 2-1/2" test gauge of suitable range, one gauge adapter probe, and one stem pocket testing thermometer (0°F – 220°F).

PART 3 - EXECUTION

3.1 Installation of Temperature Gauges:

A. General: Install temperature gauges in vertical upright position, and tilt so as to be easily read by observer standing on floor.

B. Locations: Install in the following locations, and elsewhere as indicated:

1. At inlet and outlet of each water heater.

C. Thermometer Wells: Install in piping tee where indicated, in vertical upright position. Thermometers shall have at least 75% of stem in moving fluid.

D. Temperature Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.2 Installation of Pressure Gauges:

A. General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position.

B. Locations: Install in the following locations, and elsewhere as indicated:
1. At suction and discharge of each pump.
2. At outlet of air compressor.
3. At water service outlet.

C. Pressure Gauge Cocks: Install in piping tee with snubber.

3.3 Pressure Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.4 Adjusting and Cleaning:

A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

B. Cleaning: Clean windows of meters and gauges and factory-finished surfaces. Replace cracked or broken windows. Repair any scratched or marred surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 220523 – VALVES

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. This section is a Division 22 Common Work Results for Plumbing section, and is part of each Division 22 section making reference to or requiring valves specified herein.

C. Extent of valves required by this section is indicated on drawings and/or specified in other Division 22 sections.

1.2 Codes and Standards:

A. UL Compliance: Comply with applicable UL standards pertaining to valves.

B. Any material or equipment used in any potable water system intended for human consumption shall be certified “lead-free” in accordance with NSF/ANSI 61.

1.3 Quality Assurance:

A. Valve Types: Provide valves of same type by same manufacturer.

1.4 Approval Submittals: When required by other Division 22 sections, submit product data, catalog cuts, specifications, and dimensioned drawings for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valves with Division 22 section using the valves, not as a separate submittal. Submit valve comparison chart with applicable valves clearly marked if valves other than basis-of-design are to be used. For each valve, identify systems where the valve is intended for use.

A. Check Valves: Type CK.

B. Ball Valves: Type BA.

C. Butterfly Valves: Type BF.

1.5 O&M Data Submittals: Submit a copy of approval submittals. Submit installation instructions, maintenance data, and spare parts lists for each type of valve. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with specifications and installation requirements. Provide sizes as indicated, and connections which properly mate with pipe, tube, and equipment connections.

2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide valves of one of the producers listed for each valve type. The model numbers are listed for Contractor's convenience only. In the case of a model number discrepancy, the written description shall govern.

2.3 Check Valves:

A. Construction: Construct valves of castings free of any impregnating materials. Construct valves with a bronze regrinding disc with a seating angle of 40º to 45º, unless a composition disc is specified. Provide stop plug as renewable stop for disc hanger, unless otherwise specified. Disc and hanger shall be separate parts with disc free to rotate. Support hanger pins on both ends by removable side plugs.

B. Comply with the following standards:

1. Cast Iron Valves: MSS SP-71. Cast Iron Swing Check Valves, Flanged and Threaded Ends.

2. Bronze Valves: MSS SP-80. Bronze Gate, Globe, Angle, and Check Valves.

3. Steel Valves: ANSI B16.34. Steel Standard Class Valve Ratings.

C. Types of Check (CK) Valves:

1. Threaded Ends 2" and Smaller (CK1): Class 125, bronze body, screwed cap, horizontal swing, bronze disc. Apollo Valves, a division of Aalberts-IPS 161T. Stockham B-319. Nibco T-413-BY. Crane 1707. Milwaukee 509. Jomar T-511G.

2. Soldered Ends 2" and Smaller (CK2): Class 125, bronze body, screwed cap, horizontal swing, bronze disc. Apollo Valves, a division of Aalberts-IPS 161S. Stockham B-309. Nibco S-413-B. Crane 1707S. Milwaukee 1509. Jomar S-511G.

3. Flanged Ends 2-1/2" and Larger (CK3): Class 125, iron body, bronze-mounted, bolted cap, horizontal swing, cast-iron or composition disc. Apollo Valves, a division of Aalberts-IPS 910F / 910FLFA. Stockham G-931 or G-932 as applicable. Nibco F918-B. Crane 373. Milwaukee F2974 as applicable.

4. Threaded Ends 2" and Smaller (CK4): Class 200, bronze body, screwed cap, Y-pattern swing, regrinding bronze disc. Stockham B-345. Nibco T-453-B. Crane 36. Milwaukee 518/508.

5. Flanged Ends 2-1/2" and Larger (CK5): Class 250, iron body, bronze mounted, bolted cap, cast-iron disc. Apollo Valves, a division of Aalberts-IPS 920F. Stockham F-947.

Nibco F-968-B. Crane 39E. Milwaukee F2970.

6. Threaded Ends 2" and Smaller (CK6): Class 300, bronze body, screwed cap, Y-pattern swing, regrinding bronze disc. Apollo Valves, a division of Aalberts-IPS 168T. Stockham B-375. Nibco T-473-B. Crane 76E. Milwaukee 517/507.

7. Flanged Ends 2-1/2" and Larger (CK7): Class 300, cast steel body, bolted cap, horizontal swing, seal welded seat rings, chromium stainless disc. Stockham 30-SF. Crane 159.

2.4 Ball Valves:

A. General: Select with port area equal to or greater than connecting pipe area, include seat ring designed to hold sealing material.

B. Construction: Ball valves shall be rated for 150 psi saturated steam and 600 psi non-shock cold water. Pressure containing parts shall be constructed of ASTM B-584 alloy 844, or ASTM B-124 alloy 377. Valves shall be furnished with blow-out proof bottom loaded stem constructed of ASTM B-371 alloy 694 or other approved low zinc material. Provide TFE packing, TFE thrust washer, chrome-plated ball and reinforced PTFE seats. Valves shall be full port design unless otherwise noted. Valves 1-1/4" and larger in air and gas applications shall be conventional port design. Stem extensions shall be furnished for use in insulated piping where insulation exceeds 1/2” thickness.

C. Comply with the following standards:
1. MSS SP-72. Ball Valves with Flanged or Butt Welding Ends for General Service.
2. MSS SP-110. Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

D. Types of Ball (BA) Valves:

1. Threaded Ends 2" and Smaller (BA1): Bronze two-piece full port body with adjustable stem packing. Nibco T-585-70. Stockham S216-BR-R-T. Milwaukee BA150. Apollo Valves, a division of Aalberts-IPS 77-100. Jomar T-200CSSG.

2. Soldered Ends 2" and Smaller (BA2): Bronze three-piece full port body with adjustable stem packing. Nibco S-595-Y-66. Milwaukee BA350. Apollo Valves, a division of Aalberts-IPS 82-200.

3. Threaded Ends 1" and Smaller (BA3): Bronze two-piece full port body, UL listed (UL 842) for use with flammable liquids and LP gas. Apollo Valves, a division of Aalberts-IPS 77G. Nibco T-585-70-UL.

4. Flanged Ends 2-1/2” and Larger (BA4): Class 150, stainless steel full port two-piece body with adjustable stem packing. Apollo Valves, a division of Aalberts-IPS 87A-200.

2.5 Butterfly Valves:

A. General: Comply with MSS SP-67, Butterfly Valves. Provide butterfly valves designed for tight shutoff. Where used for terminal or equipment removal or repair, select lug type valves.

Select wafer type valves for other applications. Provide gear operators on all butterfly valves 6" and larger.

B. Types of Butterfly (BF) Valves:

1. Wafer Type 3" and Larger (BF1): 200 CWP, cast-iron body, lever-operated, cadmium-plated ductile iron or stainless steel disc, Type 410 stainless steel stem, EPT seat. Stockham LG-512. Nibco WD 2110-3. Crane 42-FXB-TL. Jomar BFV-Wafer. Milwaukee MW222E-8416.

2. Lug Type 3" and Larger (BF2): 200 CWP, cast-iron body, lever-operated, cadmium-plated ductile iron or stainless steel disc, Type 410 stainless steel stem, EPT seat. Stockham LG-712. Nibco LD 2110-3. Crane 44-FXB-TL. Jomar BFV-Lug. Milwaukee ML132B-8416.

3. Wafer Type 3" and Larger (BF3): 150/200 CWP, cast-iron body, gear-operated, cadmium-plated ductile iron or stainless steel disc, Type 410 stainless steel stem, EPT seat. Stockham LG-522 and LG-521. Nibco WD 2110-5. Crane 42-FXB-G. Jomar BFV-Wafer. Milwaukee MW 122B-8115.

4. Lug Type 3" and Larger (BF4): 150/200 CWP, cast-iron body, gear-operated, cadmium-plated ductile iron or stainless steel disc, Type 410 stainless steel stem, EPT seat. Stockham LG-722 and LG-721. Nibco LD 2110-5. Crane 44-FXB-G. Jomar BFV-Lug. Milwaukee ML 132B-8115.

5. Wafer Type 4" and Larger (BF5): 175 WWP, cast-iron body, gear-operated, nickel-plated ductile iron disc, Type 410 stainless steel stem, EPT seat, UL listed. Stockham LG-52U. Nibco WD 3510-8.

6. Lug Type 4" and Larger (BF6): 175 WWP, cast-iron body, gear-operated, nickel-plated ductile iron or aluminum bronze disc, Type 410 stainless steel stem, EPT seat, UL listed. Stockham LG-72U. Nibco LD 3510-8.

7. Grooved Type 4" and Larger (BF7): 175 WWP, cast-iron body, gear-operated, nickel-plated ductile iron or aluminum bronze disc, Type 410 stainless steel stem, EPT seat, UL listed. Stockham LG-82U. Nibco GD 1765-2.

2.6 Valve Features:

A. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ANSI B31.1.

B. Valve features specified or required shall comply with the following:

1. Flanged: Provide valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

2. Threaded: Provide valve ends complying with ANSI B2.1.

3. Solder-Joint: Provide valve ends complying with ANSI B16.18.

4. Trim: Fabricate pressure-containing components of valve, including stems (shafts) and seats from brass or bronze materials, of standard alloy recognized in valve manufacturing industry unless otherwise specified.

5. Non-Metallic Disc: Provide non-metallic material selected for service indicated in accordance with manufacturer's published literature.

6. Renewable Seat: Design seat of valve with removable disc, and assemble valve so disc can be replaced when worn.

7. Extended Stem: Increase stem length by 2" minimum, to accommodate insulation applied over valve.

PART 3 - EXECUTION

3.1 Installation:

A. General: Install valves where required for proper operation of piping and equipment, including valves in branch lines to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward below horizontal plane. No valve shall be installed more than 2'-0" above finished ceiling.

B. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

C. Applications Subject to Corrosion: Do not install bronze valves and valve components in direct contact with steel, unless bronze and steel are separated by dielectric insulator.

D. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections:
1. Tube Size 3" and Smaller: Threaded valves. Soldered-joint valves may also be used.
2. Pipe Size 2" and Smaller: Threaded valves.
3. Pipe Size 2-1/2" and Larger: Flanged valves.

E. Non-Metallic Disc: Limit selection and installation of valves with non-metallic disc to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.

F. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

G. Installation of Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction flow.

H. Valve Tags and Valve Charts: Provide identification complying with Division 22 Common Work Results for Plumbing section “Plumbing Identification”.

END OF SECTION

SECTION 220526 – ACCESS DOORS

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. This section is a Division 22 Common Work Results for Plumbing section, and is part of each Division 22 section making reference to or requiring access doors specified herein.

1.2 Approval Submittals:

A. Product Data: When required by other Division 22 sections, submit product data for access doors. Submit with Division 22 section using access doors, not as a separate submittal. Include rating data.

1.3 O&M Data Submittals: Submit a copy of approval submittals. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 General: Where floors, walls and ceilings must be penetrated for access to plumbing work, provide types of access doors indicated. Furnish sizes indicated or, where not otherwise indicated, furnish adequate size for intended and necessary access. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.

2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide access doors by Acudor, Milcor, Jay R. Smith, Zurn, Elmdor, or approved equal.

2.3 Standard Access Door Construction: Except as otherwise indicated, fabricate wall/ceiling door units of welded steel construction with welds ground smooth, 16-gauge frames and 14-gauge flush panel doors, 175° swing with concealed spring hinges, flush screw-driver-operated cam locks, factory-applied rust-inhibitive prime-coat paint finish.

2.4 Locks: Where indicated, provide flat pass key, individually keyed unless otherwise indicated, 2 keys.

2.5 Fire Rated Access Doors: Where required furnish with 20-gauge insulated sandwich panel, automatic closing mechanism, cylinder type lock (self-latching with inside release mechanism),

and continuous concealed steel hinge pin. Access doors shall carry the UL 1-1/2 hour "B" label.

PART 3 - EXECUTION

3.1 Access doors shall be installed to operate and service all plumbing equipment including valves and other items requiring maintenance that are concealed above or behind finished construction. Access doors shall be installed in walls, chase and floors as necessary, but are not required in accessible suspended ceiling systems. Access doors shall have factory applied protective phosphate coating and baked enamel primer suitable for field painting.

3.2 Access doors shall be installed by the Division installing the substrate construction. However, responsibility for furnishing and determining location of access doors is part of this Division's work. The style of access door shall be suitable for construction into which installed.

3.3 Access doors shall be sized and located as required to provide proper maintenance and service access in accordance with the manufacturer's recommendations and code authority requirements for all devices and equipment.

END OF SECTION

SECTION 220529 – HANGERS AND SUPPORTS

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. This section is a Division 22 Common Work Results for Plumbing section, and is part of each Division 22 section making reference to or requiring hangers and supports specified herein.

C. Extent of hangers and supports required by this section is indicated on drawings and/or specified in other Division 22 sections.

1.2 Codes and Standards:

A. Code Compliance: Comply with applicable codes pertaining to product materials and installation of hangers and supports.

B. MSS Standard Compliance:

1. Provide pipe hangers and supports of which materials, design, and manufacture comply with ANSI/MSS SP-58.

2. Select and apply pipe hangers and supports, complying with MSS SP-69.

3. Terminology used in this section is defined in MSS SP-90.

C. UL Compliance: Provide products which are UL listed.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide supports and hangers by Grinnell, MAPA Products, B-Line Systems, or approved equal.

2.2 Horizontal-Piping Hangers and Supports: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.

A. Adjustable Steel Clevises: MSS Type 1.

B. Steel Double Bolt Pipe Clamps: MSS Type 3.

C. Adjustable Steel Band Hangers: MSS Type 7.

D. Steel Pipe Clamps: MSS Type 4.

2.3 Vertical-Piping Clamps: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

A. Two-Bolt Riser Clamps: MSS Type 8.

2.4 Hanger-Rod Attachments: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

A. Steel Turnbuckles: MSS Type 13.

B. Malleable Iron Sockets: MSS Type 16.

2.5 Building Attachments: Except as otherwise indicated, provide factory-fabricated building attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods.

A. Center Beam Clamps: MSS Type 21.

B. C-Clamps: MSS Type 23.

C. Malleable Beam Clamps: MSS Type 30.

D. Side Beam Brackets: MSS Type 34.

E. Concrete Inserts: MSS Type 18.

2.6 Saddles and Shields: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

A. Protection Shields: MSS Type 40, of length recommended by manufacturer to prevent crushing of insulation.

B. Protection Saddles: MSS Type 39, use with rollers; fill interior voids with segments of

insulation matching adjoining insulation.

2.7 Miscellaneous Materials:

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ANSI/ASTM A 36.

C. Cement Grout: Portland cement (ANSI/ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ANSI/ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes or continuous channel struts selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

3.1 Preparation:

A. Proceed with installation of hangers, supports, and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including, but not limited to, proper placement of inserts, anchors and other building structural attachments.

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, and installers of other work requiring coordination with work of this section for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.2 Installation of Building Attachments:

A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

B. In areas of work requiring attachments to existing concrete, use self drilling rod inserts, Phillips Drill Co., "Red-Head" or equal.

3.3 Installation of Hangers and Supports:

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal

piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacing complying with MSS SP-69 or as listed herein, whichever is most limiting. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

1. Horizontal steel pipe and copper tube 1-1/2" diameter and smaller: support on 6-foot centers.

2. Horizontal steel pipe and copper tube over 1-1/2" diameter: support on 10-foot centers.

3. Vertical steel pipe and copper tube: support at each floor and on 10-foot centers.

4. Horizontal PVC pipe: support on 4-foot centers.

5. Vertical PVC pipe: support at each floor and on 10-foot centers.

6. Non-PVC plastic pipe: support in accordance with manufacturer's recommendations.

7. Horizontal cast iron pipe inside building: support on 5-foot centers.

8. Vertical cast iron pipe: support at each floor and on 15-foot centers.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

C. Paint all black steel hangers with black enamel. Galvanized steel and copper clad hangers do not require paint.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

E. Provision for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

3. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.

F. Insulated Piping: Comply with the following installation requirements:

1. Shields: Where low-compressive-strength insulation or vapor barriers are indicated, install coated protective shields.

2. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

3.4 Installation of Anchors:

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchors by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

C. Anchor Spacing: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and elbows. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

D. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

3.5 Equipment Bases:

A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division 22. Size bases to extend minimum of 4" beyond equipment base in any direction, and 4" above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands. Prime and paint with black enamel.

END OF SECTION

SECTION 220539 – TESTING, CLEANING, AND STERILIZATION FOR PLUMBING 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. This section is a Division 22 Common Work Results for Plumbing section, and is part of each Division 22 section making reference to or requiring the testing and other procedures specified herein.

C. Notify the Architect/Engineer when system tests are ready to be witnessed at least 24 hours prior to the test.

D. All materials, test equipment, and devices required for cleaning, testing, sterilizing or purging shall be provided by the Contractor.

PART 2 - PRESSURE TESTS

2.1 General: Provide temporary equipment for testing, including pump and gauges. Test piping systems before insulation is installed wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with indicated medium and pressurize for indicated pressure and time.

2.2 Required test period is four hours.

2.3 No piping, fixtures, or equipment shall be concealed or covered until they have been tested. The contractor shall apply each test and ensure that it is satisfactory for the period specified before calling the Architect/Engineer to observe the test. Test shall be repeated upon request to the satisfaction of those making the inspection.

2.4 Observe each test section for leakage at the end of the test period. Test fails if leakage is observed or if pressure drop exceeds 5% of the test pressure.

2.5 Check of systems during application of test pressures should include visual check for water leakage and soap bubble or similar check for air and nitrogen leakage.

2.6 Repair piping systems sections which fail required piping test. Disassemble and re-install using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

2.7 Pressure Test Requirements:

A. Soil, Waste and Vent: Test all piping within the building with a 10 foot head of water. Test piping in sections so that all joints are tested. Provide test tees as required.

B. Domestic Water: Perform hydrostatic test on all piping within the building at twice the normal static pressure at service point, but not less than 100 psig. Once tested, flush out piping and leave under pressure of the supply main or 40 psig for the balance of the construction period.

C. Gas: Test with air or nitrogen at 150% of normal working pressure, but not less than 25 psig. The test and check for leaks shall be in accordance with NFPA 54.

D. Compressed Air Test with air or nitrogen at 150% of the normal operating pressure, but not less than 50 psig.

PART 3 - CLEANING AND STERILIZATION

3.1 General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water or blowdown with air before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

3.2 Flush and drain all water systems at least three times. Reverse flush systems from smallest piping to largest piping. Replace startup strainers with operating strainers.

3.3 Blowdown all gas, and air systems with air or nitrogen (at a rate of flow exceeding design) at least three times or until no residue shows at each outlet. Reverse blowdown systems from smallest piping to largest piping.

3.4 Sterilization of Domestic Water Systems:

A. Prerequisites: All new hot and cold water piping installed (complete), all fixtures connected, system flushed out, and system filled with water.

B. The shut off valve at the water main shall be closed, all fixture outlets opened slightly, and a sterilizing solution shall be introduced at a manifold connection installed by the Contractor at the meter.

C. The solution shall contain 50 parts per million of available chlorine. The chlorinating material shall be either liquid chlorine or calcium hypochlorite. The solution shall be allowed to stand in the system for at least eight hours after which the entire system shall be flushed.

D. After final flushing, all aerators shall be removed, cleaned, and reinstalled. After final flush the residual chlorine shall not exceed 0.2 parts per million.

E. The Architect/Engineer shall be notified 24 hours prior to the procedure so that it can be

witnessed.

F. Provide sampling and certified report by an independent testing lab. Provide written Health Department approval of disinfection samples.

END OF SECTION

SECTION 220548 – VIBRATION ISOLATION

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. This section is a Division 22 Common Work Results for Plumbing section, and is part of each Division 22 section making reference to or requiring vibration isolation specified herein.

C. Extent of work required by this section is indicated on drawings and/or specified in other Division 22 sections. Types of vibration isolation specified in this section include equipment support isolators and flexible pipe connectors.

1.2 Quality Assurance:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration isolation, of types and sizes required, whose products have been in satisfactorily used in similar service for not less than five years.

B. Comply with ASME B31 – Pressure Piping.

C. All equipment provided under Division 22 shall operate under all conditions of load, free of objectionable sound and vibration. Sound and vibration conditions considered objectionable by the Architect/Engineer shall be corrected in an approved manner.

1.3 Approval Submittals:

A. Product Data: Where required by other Division 22 sections, submit product data sheets for each type of vibration isolation equipment including configuration and rating data. Submit with Division 22 Section using vibration isolation, not as a separate submittal. Submit for:

1. Equipment Mountings. Type EM.
2. Pipe Flexible Connections. Type PF.

1.4 O&M Data Submittals: Submit a copy of approval submittals. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 General: Provide factory-fabricated products recommended by manufacturer for use in service indicated. Provide products of types and deflections indicated; provide proper selection as determined by Installer to comply with specifications and installation requirements. Provide sizes which properly fit with equipment. All metal parts installed outside shall be hot-dipped

galvanized after fabrication.

2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide vibration isolation equipment of: Mason Industries, Keflex, Consolidated Kinetics, Vibration Mountings & Controls, Wheatley, or approved equal. All vibration isolators shall be supplied by a single approved manufacturer.

2.3 Equipment Mountings:

A. Select mountings with the required deflection and fastening means. Provide steel rails or bases as required to compensate for equipment rigidity and overhang.

B. Types of equipment mountings (EM):

1. Pads (EM1): Waffle or ribbed pattern neoprene pads shall be fabricated from 40-50 durometer neoprene. Provide rigid steel plate and mounting angles as required. Basis of design: Mason Industries Super W.

2.4 Pipe Flexible Connections:

A. Select pipe flexible connections suitable for duty indicated with ends to match piping system.

B. Types of pipe flexible connections (PF):

1. Bronze Flexible Hoses (PF1): Provide 300 psi working pressure flexible hoses with corrugated bronze hose body and braided cover. Basis of Design: Mason Industries BBF with sweat ends.

2. Stainless Steel Flexible Hoses (PF2): Provide 300 psi working pressure flexible hoses with corrugated seamless hose body and braided cover. Basis of Design: Mason Industries BSS threaded or RF flanged, as required.

PART 3 - EXECUTION

3.1 General:

A. Install vibration isolation devices for the duty indicated and for ease of inspection, adjustment, and proper operation. Install in accordance with the manufacturer's written instructions and coordinate with shop drawings of supported equipment.

B. All connections to fixtures and equipment shown on the drawings shall be considered diagrammatic unless otherwise indicated by detail. The actual connections shall be made to fully suit the requirements of each case and adequately provide for expansion and servicing.

C. Piping, ductwork, and conduit shall not be suspended from one another or physically contact one another. Vibrating systems shall be kept free from non-vibrating systems.

3.2 Equipment Mountings:

A. Unless otherwise shown or specified, all floor-mounted equipment shall be set on housekeeping equipment bases. Refer to Division 22 section “Hangers and Supports”.

B. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators, and such direct support is approved by the equipment manufacturer. All support frames shall be sufficiently stiff and rigid so as to prevent distortion and misalignment of components installed thereon.

C. Align equipment mountings for a free, plumb installation. Isolators that are binding, offset or fully compressed will not be accepted.

3.3 Pipe Flexible Connections:

A. Piping connected to vibration isolated equipment shall be installed so that it does not strain or force out of alignment the vibration isolators supporting the basic equipment, nor shall pipes restrict such equipment from "floating" freely on its respective vibration isolation system. Flexible connections shall be used to eliminate transferring vibration along piping.

B. Flexible connections and hoses shall not be used to compensate for pipe misalignment. Units shall be aligned so that the flexible connection is not distorted perpendicular to the axis of the piping.

C. Install flexible connections in pump suction and discharge, and where shown on the drawings or required by equipment specifications.

D. Install flexible hoses in all air compressor outlets and where shown on the drawings or required by other equipment specifications. Select end types to match equipment and piping connections. Install on the equipment side of shutoff valves horizontally and parallel to the equipment shafts wherever possible.

E. Drain piping connected to vibrating equipment shall not physically contact any building construction or non-isolated systems or components.

END OF SECTION

SECTION 220550 – EXCAVATION AND BACKFILL

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. This section is a Division 22 Common Work Results for Plumbing section, and is part of each Division 22 section making reference to or requiring excavation and backfill specified herein.

C. Existing Utilities: Underground utilities shown were taken from old drawings. The exact location of these utilities and irrigation branches and abandoned services are unknown. Use extreme caution when excavating.

D. OSHA: Contractor employee worker protection for all trenching and excavation operations shall comply with 29 CFR 1926.650 Subpart P and all current OSHA requirements.

E. Trench Safety Act: Contractor shall comply with all requirements of Florida Statues Chapter 553, including the requirement to provide a separate line item to identify the cost to comply on a per lineal foot of trench and per square foot of shoring.

PART 2 - PRODUCTS

2.1 Sand: Clean, hard, uncoated grains free from organic matter or other deleterious substances. Sand for backfill shall be of a grade equal to mortar sand, with 95% passing a No. 8 sieve, and not more than 8% passing a No. 100 sieve.

2.2 Gravel: Clean, well-graded hard stone or lime rock gravel, free from organic material. Size range to be from No. 4 screen retentions to 1".

2.3 Earth: Must be free of stones, wood, roots or rubbish.

2.4 Identification Tape: Polyethylene 6 inches wide, 0.004 inches thick, continuously printed with “CAUTION” in large letters and type of pipe below.

2.5 Copper Identification Wire: 14-gauge.

PART 3 - EXECUTION

3.1 Ditching and Excavation: Shall be performed by hand wherever the possibility of encountering obstacles or any existing utility lines. The Contractor is responsible to ensure that no utility or service interruptions shall be caused and that no existing utilities or obstructions will prohibit installations of service under this contract at proper grade and location. Where clear and un-obstructed areas are to be excavated, appropriate machine excavation methods may be employed. Avoid use of machine excavations within the limits of the building lines, except when machine weights and operation will not damage sub-surface structural components or piping.

3.2 Bedding: Excavate to bottom grade of pipe to be installed, and shape bed of undisturbed earth to contour of pipe for a width of at least 50% of pipe diameter. If earth conditions necessitate excavation below grade of the pipe, such as due to the presence of clay, much, or roots, sub-cut and bring bed up to proper elevation with clean, dry sand deposited in 6" layers and firmly tamped by mechanical means. If sub-cut exceeds 12", or if bed is of an unstable nature, a 6" minimum layer of rock will be required before sand bedding begins.

3.3 Placing: Pipe shall be carefully handled into place. Avoid knocking loose soil from the banks of the trench into the pipe bed. Rig heavier sections with nylon slings in lieu of wire rope to avoid crushing or chipping. Pipe which is handled with insulation in place, coated pipe, and jacketed pipe shall have special handling slings to prevent damage to the material.

3.4 Backfilling: Deposit sand to 6” above the pipe and tamp. Then deposit sand or earth carefully in 6" layers, maintaining adequate side support on nonferrous piping materials. Compact fill in 6" layers, using mechanical means, up to the top elevation of the pipe, and in 12" layers to rough or finish grade as required. Fine grade and restore surface to original condition.

3.5 Special: Excavations shall be installed and maintained in satisfactory condition during the progress of the work. Subsurface structures are to be constructed in adequately sized excavations. De-watering equipment shall be installed and properly maintained where required. Shoring shall be employed in the event of unstable soil condition, and in all cases where required by OSHA regulations and necessary to protect materials and personnel from injury.

3.6 Identification: Install identification tape directly above all underground piping, one tape for each pipe where multiple pipes are installed. Depth of tape shall be at least 6 inches below finished grade and 24" above buried pipe. Install copper wire above non-metallic pipes.

3.7 Depth of Cover: Minimum cover for underground piping is two feet unless indicated otherwise.

3.8 Existing Pavement: Where new piping passes below existing streets, driveways, parking lots, or other paved areas, the pavement shall be saw cut. Backfill shall be compacted to 95% density and the pavement shall be patched to match existing pavement. Provide compaction tests and reports as required.

END OF SECTION

SECTION 220553 – PLUMBING IDENTIFICATION

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. This section is a Division 22 Common Work Results for Plumbing section, and is part of each Division 22 section making reference to or requiring identification devices specified herein.

C. Extent of plumbing identification work required by this section is indicated on drawings and/or specified in other Division 22 sections.

D. Refer to Division 26 sections for identification requirements of electrical work (not work of this section).

1.2 Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

PART 2 - PRODUCTS

2.1 General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Where more than a single type is specified for application, selection is the Contractor’s option, but provide single selection for each product category.

2.2 Painted Identification Materials:

A. Stencils: Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than 3/4" high letters for access door signs and similar operational instructions.

B. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.

C. Identification Paint: Standard identification enamel.

2.3 Plastic Pipe Markers:

A. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers.

B. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping

system in each instance, as selected by Architect/Engineer in cases of variance with name as shown or specified.

C. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.4 Valve Tags:

A. Brass Valve Tags: Provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and 1/2” high sequenced valve numbers, and with 5/32" hole for fastener. Provide 1-1/2" diameter tags, except as otherwise indicated.

B. Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32" thick engraved plastic laminate valve tags, with piping system abbreviation in 1/4" high letters and 1/2” high sequenced valve numbers, and with 5/32" hole for fastener. Provide 1-1/2" square black tags with white lettering, except as otherwise indicated.

2.5 Engraved Plastic-Laminate Signs:

A. General: Provide engraving stock melamine plastic laminate, in the sizes and thicknesses indicated, engraved with engraver's standard letter style a minimum of 3/4” tall and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 square inches or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.6 Stamped Nameplates: Provide equipment manufacturer's standard stamped nameplates for motors, pumps, etc.

PART 3 - EXECUTION

3.1 Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 Piping System Identification:

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:

1. Plastic pipe markers.

2. Stenciled markers of black or white for best contrast.

B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces and exterior non-concealed locations.

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch where there could be question of flow pattern.
3. Near locations where pipes pass through walls or floors/ ceilings or enter non-accessible enclosures.
4. At access doors, manholes, and similar access points which permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

C. The following piping shall be color-coded where exposed outdoors and in mechanical and electrical rooms by completely painting the piping with the indicated color. Use standard colors where exposed in finished spaces. Use standard identification methods in concealed areas.

1. Gas piping – Yellow

3.3 Valve Identification: Provide coded valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, and similar rough-in connections of end-use fixtures and units.

3.4 Valve Charts: Provide framed, glass-covered valve charts in each mechanical room. Identify coded valve number, valve function, and valve location for each valve.

3.5 Plumbing Equipment Identification: Install engraved plastic laminate sign on or near each major item of plumbing equipment and each operational device. Label shall indicate type of system and area served. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices.
2. Meters, gages, thermometers and similar units.
3. Fuel-burning units including water heaters.
4. Pumps, compressors, and similar equipment.
5. Tanks and pressure vessels.

3.6 Stamped Nameplates: Equipment manufacturers to provide standard stamped nameplates on all

major equipment items such as motors, pumps, water heaters, etc. Where motors are hidden from view (within equipment casing, or otherwise not easily accessible, etc.), the equipment supplier shall furnish a duplicate motor data nameplate to be affixed to the equipment casing in an easily visible location, unless data is already included on the equipment nameplate.

3.7 Adjusting and Cleaning:

A. Relocate any plumbing identification device which has become visually blocked by work of this division or other divisions.

B. Clean face of each identification device and glass frame of each valve chart.

END OF SECTION

SECTION 220719 – PLUMBING PIPING 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. Division 22 Common Work Results for Plumbing sections apply to work of this section.

1.2 Approval Submittals:

A. Product Data: Submit manufacturer's product data sheets and installation instruction on each insulation system including insulation, coverings, adhesives, sealers, protective finishes, and other material recommended by the manufacturer for applications indicated. Submit for:

1. Fiberglass pipe insulation.
2. Flexible unicellular pipe insulation.

1.3 O&M Data Submittals: Submit a copy of all approval submittals. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide insulation products by Knauf, Owens-Corning, Johns Manville, Certainteed, Pittsburgh Corning, U.S. Rubber, or approved equal.

2.2 Flame/Smoke Ratings: Provide composite plumbing insulation (insulation, coverings, sealers, mastic, and adhesive) with a flame spread rating of 25 or less, and a smoke-developed rating of 50 or less as tested by ANSI/ASTM E84.

2.3 Pipe Insulation Materials:

A. Fiberglass Pipe Insulation: ASTM C547, Class 1 unless otherwise indicated (preformed sleeving with white all-service jacket, suitable for temperatures up to 450°F).

B. Flexible Unicellular Pipe Insulation: ASTM C534, Type I (tubular, suitable for use up to 200°F).

C. Staples, Bands, Wires, and Cement: As recommended by the insulation manufacturer for applications indicated.

D. Adhesives, Sealers, Protective Finishes: Products recommended by the insulation manufacturer

for the application indicated.

E. Jackets: ASTM C921, Type I (vapor barrier) for piping below ambient temperature, Type II (vapor permeable) for piping above ambient temperature. Type I may be used for all piping at Installer's option.

PART 3 - EXECUTION

3.1 General:

A. Install thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapor barrier on insulation and protect it to prevent puncture and other damage. Label all insulation "ASBESTOS FREE".

D. Do not apply insulation to surfaces while they are hot or wet.

E. Do not install insulation until systems have been checked and found free of leaks. Surfaces shall be clean and dry before attempting to apply insulation. A professional insulator with adequate experience and ability shall install insulation.

F. Do not install insulation on pipe systems until acceptance tests have been completed except for flexible unicellular insulation. Do not install until the building is "dried-in".

3.2 Installation of Fiberglass Pipe Insulation:

A. Insulate the following piping systems:

1. Domestic hot water: up to 3" pipe = 1-1/2" thick; over 3" pipe = 2" thick.

2. Cold water pipe: 1/2" thick.

B. Apply insulation to pipe with all side and end joints butted tightly. Seal longitudinal lap by pressurizing with plastic sealing tool. Apply 3-inch wide self-sealing butt strips to joints between insulation sections. Insulate all fittings, flanges, valves and strainers with premolded insulation. Apply coat of insulating cement to fittings and wrap with glass cloth overlapping each wrap 1" and adjacent pipe 2". Finish with heavy coat of general purpose mastic. Premolded PVC covers may also be used, but no flexible inserts are allowed.

C. Provide hanger or pipe support shields of 16 gauge (minimum) galvanized steel over the insulation which extends halfway up the pipe insulation cover and at least 6" on each side of the hanger.

D. Omit insulation on unions, flanges, strainer blowoffs, flexible connections, expansion joints, and exposed plumbing fixture run-outs from faces of wall or floor to fixture.

E. Outdoor Locations: Cover straight piping with 0.016" thickness smooth aluminum jacket fastened with aluminum bands on not over 12" centers. Use factory-made 0.014" aluminum covers for fittings and valves. Metal jacketing shall be applied with the longitudinal seam positioned to shed water.

3.3 Installation of Flexible Unicellular Pipe Insulation:

A. Insulate the following piping systems:

1. Horizontal above-grade waste piping receiving condensate from air conditioning units to points of connection receiving waste from four or more fixtures: 1/2” thick.

2. Horizontal above-grade waste piping receiving discharge from ice machines, coolers, freezers or similar units to points of connection receiving waste from four or more fixtures: 1/2” thick.

3. Floor drain bodies located above ceiling or above-grade and receiving condensate from air conditioning units: 1/2” thick.

4. Air compressor after-cooler piping: 3/4” thick.

B. Apply insulation in accordance with the manufacturer's recommendations and instructions. Miter cut insulation to fit pipe fittings. Use approved cement to seal all joints and ends in the insulation.

C. Insulation outside the building shall be protected by a smooth 0.016" thickness aluminum jacket secured with aluminum bands on 12" centers. All joints in metal jacketing (longitudinal and transverse) shall be sealed with silicone sealant.

END OF SECTION

SECTION 221116 – 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. Division 22 Common Work Results for Plumbing sections apply to work of this section.

C. Extent of domestic water piping work is indicated on drawings and schedules, and by requirements of this section.

D. Refer to appropriate Division 2 sections for exterior domestic water piping (not work of this section unless noted).

E. Refer to other Division 22 sections for insulation of domestic water piping (not work of this section).

F. Refer to other Division 22 sections for excavation and backfill required in conjunction with domestic water piping.

1.2 Codes and Standards: Comply with applicable portions of Uniform Plumbing Code pertaining to selection and installation of plumbing materials and products. Comply with local utility requirements.

A. Any material or equipment used in any potable water system intended for human consumption, including inline devices (i.e. valves, fittings, pumps, meters) and end point devices (ie. drinking water fountains, faucets, ice makers, supply stops, control valves for dispensing), shall be certified “lead-free” in accordance with NSF/ANSI 61.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer’s product data for:

1. Valves.
2. Adjustable balancing valves.
3. Thermostatic balancing valves.
4. Dielectric unions.
5. Strainers.
6. Hose bibbs.
7. Wall hydrants.
8. Thermostatic mixing valves.
9. Temperature & Pressure Relief Valves
10. Water hammer arrestors.
11. Access doors.

1.4 Test Reports and Verification Submittals:

A. Backflow Preventer Test Report: Submit Test Report for each backflow preventer.

B. Disinfection: Submit report by Health Department.

1.5 O&M Data Submittals: Submit a copy of all approval submittals. Submit maintenance data and parts list for valves and trap primers. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with Uniform Plumbing Code where applicable. Provide sizes and types matching pipe materials used in potable water systems. Where more than one type of materials or products is indicated, selection is Installer's option.

2.2 Basic Identification: Provide identification complying with Division 22 Common Work Results for Plumbing section “Plumbing Identification”.

2.3 Basic Pipes and Pipe Fittings: Provide pipes and pipe fittings in accordance with the following listing:

A. Interior Water Piping:

1. Above Grade: ASTM B88 copper tube, Type L, hard-drawn temper with ANSI B16.29 wrought-copper fittings and soldered joints.

2. Below Grade: ASTM B88 copper tube, Type L, soft-annealed temper; no joints below floor.

B. Soldered Joints: Tin-Antimony (95-5) solder, ASTM B32, Grade 95TA.

2.4 Sleeves and Sleeve Seals: Provide sleeves and sleeve seals complying with Division 22 Common Work Results for Plumbing section “Sleeves and Sleeve Seals”.

2.5 Basic Hangers and Supports: Provide hangers and supports complying with Division 22 section "Hangers and Supports".

2.6 Interior Valves: Provide valves complying with Division 22 Common Work Results for Plumbing section “Valves” and the following list:

A. Sectional and Shutoff Valves: Type BA1, BA2, BF1, BF2.

B. Drain Valves: Type BA1, BA2.

C. Throttling Valves: Type BA1, BA2, BF1, BF2.

D. Check Valves: Type CK1, CK2, CK3.

2.7 Thermostatic Balancing Valves: Provide thermostatic balancing valves as indicated, of one of the following types:

A. Threaded Ends 1" and Smaller: Class 200, stainless steel or dezincification resistant (DZR) brass body, temperature setpoint with accuracy of ±3°F, wax thermostatic element. Provide thermostatic balancing valve assembly with integral check valve and inlet / outlet shutoff valves.

B. Acceptable Manufacturers: Subject to compliance with requirements, provide thermostatic balancing valves by CircuitSolver (a ThermOmegaTech brand), Jomar TB-120MFG, or approved equal.

2.8 Dielectric Unions: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.

2.9 Low Pressure Y-Type Pipeline Strainers:

A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Provide Type 304 stainless steel screens. Select for 200 psi working pressure (water, oil or gas). Provide 20 mesh screens through 2" size and 1/16" perforations for 2-1/2" size and larger.

B. Select from the following types:

1. Threaded Ends, 2" and Smaller: Cast-bronze body, screwed screen retainer with centered blowdown fitted with pipe plug. Zurn SXL or approved equal.

2.10 Hose Bibbs: Provide exposed, lead-free, anti-siphon, moderate climate hose bibbs external vacuum breaker, 3/4” male threaded hose connection, bronze and stainless steel interior components, vandal-resistant operating stem, and secured wheel-type handle. Provide rough chrome finish or as specified by Architect/Engineer. Vacuum breakers shall conform to ASME A112.21.3 and ASSE 1011. Zurn Z1341XL, or equal model by Acorn or Wade.

2.11 Non-freeze Wall Hydrants: Provide 3/4" anti-syphon, automatic draining wall hydrant with non-freeze integral backflow preventer, bronze casing, all bronze interior parts, straight inlet connection, nickel bronze box, and hinged cover with operating key lock and “WATER” cast on cover. Vacuum breakers shall conform to ASME A112.21.3 and ASSE 1019. Zurn Z1300 or approved equal.

2.12 Thermostatic Mixing Valves: Provide thermostatic mixing valves to maintain and limit mixed hot water to a desired, selectable temperature. Mixing valves shall be ASSE 1017, ASSE 1069, and ASSE 1070 certified. Watts LFMMV, Wilkins ZW1017XL / ZW1070XL, or approved equal.

2.13 Combined Pressure-Temperature Relief Valves: Provide relief valves as indicated, of size and capacity as selected by Installer for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code. Provide bronze body, test lever and thermostat complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210°F, and pressure relief at 150 psi. Apollo Valves, Watts, Cash, Zurn, or approved equal.

2.14 Water Hammer Arrestors: Provide bellows type water hammer arrestors, stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201 and ASSE 1010. Precision Plumbing Products, Josam, Zurn, Amtrol, Wade, Jay R. Smith, or approved equal.

2.15 Access Doors: Provide access doors to service all valves and other devices as required in accordance with Division 22 Common Work Results for Plumbing section “Access Doors”.

PART 3 - EXECUTION

3.1 General: Examine areas and conditions under which potable water systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Install plumbing identification in accordance with Division 22 Common Work Results for Plumbing section "Plumbing Identification.

3.3 Installation of Domestic Water Piping:

A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance or replacement of valves and equipment.

B. Comply with ANSI B31 Code for Pressure Piping.

C. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead

construction, columns and other structural and permanent-enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation.

D. Concealed Piping: Unless specifically noted as “Exposed” on the drawings, conceal piping from view in finished and occupied spaces, by locating in column enclosures, chases, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

E. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical, communications, or data equipment spaces and enclosures unless shown. Install drip pan under piping that must run through electrical spaces.

F. Cut pipe from measurements taken at the site, not from drawings. Keep pipes free of contact with building construction and installed work.

G. Install eccentric reducers where pipe is reduced in size in direction of flow, with tops of both pipes and reducer flush. Do not use bushings.

H. Install piping with 1/32" per foot (1/4%) upward slope in direction of flow, or as indicated on the drawings. The intent is to install piping sloped to drains at low points in the system for a drainable system.

I. Connect branch-feed piping to mains at horizontal center line of mains, connect run-out piping to branches at horizontal center line of branches.

J. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

K. Install piping to allow for expansion and contraction.

L. Isolate all copper tubing from steel and concrete by wrapping the pipe at the contact point, and for one inch on each side, with a continuous plastic sleeve. Isolate all copper tubing installed in block walls with a continuous plastic sleeve.

3.4 Installation of Piping System Joints: Provide joints of the type indicated in each piping system.

A. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply ASTM B13, water-flushable / non-acid type solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint according to ASTM B828 or Copper Tube Handbook by CDA. Wipe excess solder from joint before it hardens.

3.5 Install hangers and supports in accordance with Division 22 Common Work Results for Plumbing section "Hangers and Supports".

3.6 Install valves in accordance with Division 22 Common Work Results for Plumbing section "Valves".

A. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two or more plumbing fixtures or equipment connections, and elsewhere as indicated.

B. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.

C. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain domestic water piping system.

D. Check Valves: Install on discharge side of each pump, and elsewhere as indicated.

3.7 Thermostatic Balancing Valves: Install thermostatic balancing valves in each hot water recirculating loop, and elsewhere as indicated. Provide suitable access panel as required in non-accessible ceilings and walls. Maintain minimum length of straight unrestricted piping equivalent to three pipe diameters upstream of valve.

3.8 Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions. Provide ball valves on each side of dielectric union to facilitate repair of union.

3.9 Y-Type Strainers: Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blowdown connection, full size of connection. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blowdown connection.

Locate Y-type strainers in supply line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment: pumps and temperature or pressure regulating valves.

3.10 Hose Bibbs and Wall Hydrants: Install on concealed piping where indicated with vacuum breaker. Mount 18 inches above grade or finished floor.

3.11 Thermostatic Mixing Valves: Install in accordance with manufacturer’s installation instructions for lavatories, hand sinks, and breakroom sinks to provide tempered hot water at a temperature of 105°F – 110°F.

3.12 Relief Valves: Install on each water heater, and where indicated in accordance with the manufacturer's instructions. Pipe full size outside or to floor drain. Cut the end of the pipe at a 45° angle and terminate 6 inches above the floor or grade.

3.13 Piping Run-outs to Fixtures: Provide hot and cold water piping run-outs to fixtures of sizes indicated, but in no case smaller than required by Uniform Plumbing Code.

3.14 Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated, and comply with equipment manufacturer's installation instructions. Provide shutoff valve and union for each connection; provide drain valve on drain connection.

3.15 Water Hammer Arrestors: Install in upright position, in locations and of sizes indicated in accordance with PDI Standard WH-201.

3.16 Access Doors: Locate and coordinate installation of access doors for all valves and devices in accordance with Division 22 Common Work Results for Plumbing section “Access Doors”.

3.17 Piping Tests: Test, clean, and sterilize domestic water piping in accordance with requirements of Division 22 Common Work Results for Plumbing section "Testing, Cleaning, and Sterilization for Plumbing Piping".

END OF SECTION

SECTION 221123 – DOMESTIC WATER PUMPS

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. Division 22 Common Work Results for Plumbing sections apply to work of this section.

C. Extent of domestic water pumps work required by this section is indicated by drawings and schedules, and requirements of this section.

D. Refer to Division 26 sections for power supply wiring from power source to power connection on pumps. Division 26 work includes starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

1. Interlock wiring between pumps and field-installed control devices.

1.2 Codes and Standards:

A. UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA standards.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer's pump specifications, dimensions, weights, required clearances, installation and startup instructions. Submit pump characteristic performance curves with selection points clearly indicated. Submit product data for:

1. In-Line Recirculation Pumps

1.4 O&M Data Submittals:

A. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to pumps. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

B. O&M Data: Submit a copy of approval submittals and maintenance data and parts lists for each type of pump, control, and accessory; include troubleshooting maintenance guide. Include this data, product data, and wiring diagrams in O&M manual.

PART 2 - PRODUCTS

2.1 General: Provide factory-tested pumps, thoroughly cleaned, and painted with one coat of machinery enamel prior to shipment. Provide high efficiency motors; coordinate with variable frequency drive supplier (if applicable). Type, size, and capacity of each pump listed in pump schedule. Provide pumps of same type by same manufacturer.

2.2 In-Line Recirculation Pumps:

A. General: Provide in-line all-bronze recirculation pumps where indicated, and of capacities as indicated on the drawings.

B. Type: Horizontal, oil-lubricated, designed for 125 psi working pressure, 225°F continuous water temperature, and specifically designed for quiet operation.

C. Body: Bronze construction.

D. Shaft: Steel, ground and polished, integral thrust collar.

E. Bearings: Two horizontal sleeve bearings designed to circulate oil.

F. Seal: Mechanical, with carbon seal face rotating against ceramic seat.

G. Motor: Non-overloading at any point on pump curve, open drip-proof, sleeve bearings, quiet operating, rubber mounted construction, built-in thermal overload protection.

H. Coupling: Self-aligning, flexible coupling.

I. Acceptable Manufacturers: Subject to compliance with requirements, provide pumps by:

2.3 Vibration Isolators: Provide vibration isolators in accordance with Division 22 section "Vibration Isolation" and the following listing:

1. Unit Mounting: Type EM1.

2. Piping: Type PF1.

PART 3 - EXECUTION

3.1 Examine areas and conditions under which domestic water pumps are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 General: Install domestic water pumps where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that pumps comply with requirements and serve intended purposes.

3.3 Access: Provide access space around pumps for service as indicated, but in no case less than that recommended by manufacturer.

3.4 Pump Support:

A. In-Line Pump Support: Install pumps supported from piping system. Provide additional pipe supports to properly support pump weight.

3.5 Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

A. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment startup until wiring installation is acceptable to equipment installer.

3.6 Piping Connections: Refer to Division 22 piping sections. Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated.

A. Install flexible connections at pump suction and discharge piping as specified in Division 22 section “Vibration Isolation”.

B. Install strainer on inlet and shutoff valves on inlet and outlet of recirculation pumps.

3.7 Alignment: Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer.

3.8 Startup: Lubricate pumps before startup. Startup in accordance with manufacturer's instructions.

3.9 Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 221316 – SANITARY 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. Division 22 Common Work Results for Plumbing sections apply to work of this section.

C. Extent of sanitary waste and vent piping work is indicated on drawings and schedules, and by requirements of this section.

D. Refer to appropriate Division 2 sections for exterior sanitary sewer piping (not work of this section unless noted).

E. Refer to other Division 22 sections for insulation of sanitary waste piping (not work of this section).

F. Refer to other Division 22 sections for excavation and backfill required in conjunction with sanitary waste piping.

1.2 Codes and Standards: Comply with applicable portions of Uniform Plumbing Code pertaining to selection and installation of plumbing materials and products. Comply with local utility requirements.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer's product data for:

1. Cleanouts.
2. Floor drains.
3. Floor sinks.
4. Trap seal protection.
5. Trench drains.
6. Oil separators.
7. Grease interceptors.
8. Sand interceptors

1.4 O&M Data Submittals: Submit a copy of all approval submittals. Submit maintenance data and parts list for oil separators. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in sanitary waste systems. Where more than one type of materials or products is indicated, selection is Installer's option.

2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following listed for each item.

2.3 Basic Identification: Provide identification complying with Division 22 Common Work Results for Plumbing section "Plumbing Identification."

2.4 Underground-Type Plastic Line Marker: Manufacturer’s standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service, not less than 6” wide x 4 mils thick. Provide green tape with black printing reading “CAUTION SEWER LINE BURIED BELOW”.

2.5 Basic Pipes and Pipe Fittings: Provide pipes and pipe fittings in accordance with the following listing:

A. Above Ground Sanitary Waste and Vent Piping:

1. ASTM D2665 Schedule 40 polyvinyl chloride plastic pipe (PVC), Type DWV, with PVC plastic type DWV socket-type fittings, solvent cement joints, in applications that will not exceed 140°F. Do not use in fire-rated assemblies or return air plenums.

B. Underground Building Drain Piping (within 5 feet of the building):

1. ASTM D2665 Schedule 40 polyvinyl chloride plastic pipe (PVC), Type DWV, with PVC plastic type DWV socket-type fittings, compression gasket joints, in applications that will not exceed 140°F.

2. ASTM F441 Schedule 40 chlorinated polyvinyl chloride plastic pipe (CPVC), Type DWV, with CPVC plastic type DWV socket-type fittings, solvent cement joints. Do not use in fire-rated assemblies or return air plenums. Provide for the first 25-ft of sanitary waste piping at floor drains where specified on the drawings.

2.6 Pipe Sleeves and Seals: Provide pipe sleeves and seals complying with Division 22 Common Work Results for Plumbing section "Sleeves and Sleeve Seals".

2.7 Basic Hangers and Supports: Provide supports and anchors complying with Division 22 Common Work Results for Plumbing section "Hangers and Supports".

2.8 Cleanouts: Provide factory-fabricated drainage piping products of sizes and type indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and governing regulations. Josam, Jay R. Smith, Sioux Chief, Zurn.

A. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1 countersunk head.

B. Cleanouts for PVC Systems:

1. Floor Cleanouts: Cast-iron body with adjustable head, brass plug, and scoriated nick-brass cover. Furnish with carpet marker or flange style for carpeted floors as recommended by Architect. Furnish with recessed cover for tile floors. Furnish with clamping ring for floors with membrane. Sioux Chief 854 Series hub outlet for push-on.

2. Cleanouts in Piping: PVC cleanout adaptor with threaded PVC plug.

3. Wall Cleanouts: PVC cleanout adaptor with tapped, countersunk, threaded brass plug and round stainless steel access cover with screw. Sioux Chief 873 Series.

4. Grade Cleanouts: PVC cleanout adaptor with countersunk, threaded brass plug. Sioux Chief 853 Series. In sidewalks and other finished concrete, provide access cover frames with a non-tilting tractor cover. Sioux Chief 850 Series.

5. Cleanouts in Paved Areas: Cast iron body, adjustable housing, ferrule with plug and round loose scoriated tractor cover. Sioux Chief 850 Series. Coordinate concrete depth at site with adjustable flange.

C. Cleanouts for CPVC Systems:

1. Floor Cleanouts: Cast-iron body with adjustable head, brass plug, and scoriated nick-brass cover. Furnish with carpet marker or flange style for carpeted floors as recommended by Architect. Furnish with recessed cover for tile floors. Furnish with clamping ring for floors with membrane.

2. Cleanouts in Piping: CPVC cleanout adaptor with threaded CPVC plug.

3. Wall Cleanouts: CPVC cleanout adaptor with tapped, countersunk, threaded brass plug and round stainless steel access cover with screw.

4. Grade Cleanouts: CPVC cleanout adaptor with countersunk, threaded brass plug. In sidewalks and other finished concrete, provide access cover frames with a non-tilting tractor cover.

5. Cleanouts in Paved Areas: Cast iron body, adjustable housing, ferrule with plug and round loose scoriated tractor cover. Sioux Chief 850 Series. Coordinate concrete depth at site with adjustable flange.

2.9 Floor Drains: Provide floor drains of size as indicated on drawings and type, including features, as specified herein. Floor drains shall conform to ASME A112.3.1 or ASME A112.6.3. Josam, Jay R. Smith, Sioux Chief, Zurn.

A. Floor Drains: Provide inside caulk bottom outlet or TY-Seal hub outlet with adaptor for cast iron trap installation and a 4" deep trap seal. Provide clamping rings for floors with membrane.

B. Strainer: Provide 5" satin-nickel bronze strainer.

C. Trap Seals: Provide trap seal protection in accordance with ASSE 1072. TrapShield by Sioux Chief 835 Series.

2.10 Floor Sinks: Provide floor sinks of size and type as indicated on drawings and in compliance with ASME A112.6.7. Josam, Jay R. Smith, Sioux Chief, Zurn.

2.11 Trench Drains: Provide trench drains of modular channels constructed of polymer concrete with cast iron heavy-duty grates. Channels shall be interlocking with a built-in slope in each section of 0.6% and with radiused inside bottom surface. Provide catch basins, channel caps, and other accessories of same material as channels. Trench drains shall comply with ASME A112.6.3. Basis of design: Sioux Chief HydroTec Maxi 150.

2.12 Oil Separators: Provide steel or high density polyethylene (HDPE), horizontal, atmospheric oil-water separator designed for intermittent variable flows of any mixture of water-oil at 40°F-180°F. The separator shall remove all free oil droplets greater than or equal to 20 microns and the effluent free petroleum concentration shall not exceed 10 ppm. The separator shall be designed in accordance with API recommendations and UL-58 "Standard for Safety, Steel Underground Tanks for Flammable and Combustible Liquids" or IAPMO IGC 183 “Oil/Water Separators and Coalescing Plate Separators”. Provide the following features:

A. STIP-3 corrosion resistant coating and sacrificial anodes with 30 year warranty.

B. Oil storage capacity of at least 40% of the total vessel volume and emergency oil spill capacity of al least 80% of the total vessel volume.

C. Inlet and outlet connections, non-clogging flow distributor, flow baffle, solids presettling chamber, sludge baffle, polypropylene coalescer, oil coalescing chamber and effluent downcomer.

D. Access manholes for each chamber.

E. Vent fittings, oil pumpout, sampling and gauging connections.

F. Lifting lugs.

G. Oil level controls and high level alarm in NEMA 3R enclosure.

H. Basis of Design: Striem OS or approved equal.

2.13 Grease Interceptors: Provide horizontal, atmospheric grease interceptors designed for intermittent variable flows of kitchen grease waste. The interceptor shall be suitable for outdoor above-grade or below-grade installations. Interceptor shall be built in accordance with ASME A112.14.3. Provide the following features:

A. Field-cut riser system.

B. Built-in flow control and test / sealing caps.

C. Access covers with water / gas tight seal.

D. Vent fittings, pumpout port.

E. Lifting lugs.

F. Acceptable Manufacturers: Jay R. Smith, Mifab, Schier, or approved equal.

2.14 Sand Interceptors: Provide horizontal, atmospheric sand interceptors designed for intermittent variable flows of any mixture of water-sand at 40°F – 140°F. The interceptor shall be suitable for outdoor above-grade or below-grade installations. Interceptor shall be built in accordance with ASCE/SEI 7 for direct burial. Provide the following features:

A. Field-cut riser system.

B. Built-in flow control and test / sealing caps.

C. Access covers with water / gas tight seal.

D. Vent fittings, pumpout port.

E. Acceptable Manufacturers: Striem model CB, or approved equal.

PART 3 - EXECUTION

3.1 General: Examine substrates and conditions under which sanitary waste and vent systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Install plumbing identification in accordance with Division 22 Common Work Results for Plumbing section "Plumbing Identification".

3.3 Piping Installation:

A. General:

1. Install above-grade sanitary waste and vent piping in accordance with Uniform Plumbing

Code and recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings.

2. Install underground sanitary waste piping as indicated and in accordance with Uniform Plumbing Code. Lay underground piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clean interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

3. Install building sanitary piping below grade pitched to drain at minimum slop of 1/4” per foot (2%).

4. Install building sanitary waste and vent piping above grade pitched to drain at minimum slope of 1/4" per foot (2%) for piping 3" and smaller, and 1/8" per foot (1%) for piping 4" and larger.

5. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation.

B. Underground Piping: Provide plastic tape markers over all underground piping. Provide copper wire over all underground plastic piping. Locate markers 18” above piping.

C. Concealed Piping: Unless specifically noted as “Exposed” on the drawings, conceal piping from view in finished and occupied spaces, by locating in column enclosures, chases, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

D. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical, communications, or data equipment spaces and enclosures unless shown. Install drip pan under piping that must run through electrical spaces.

E. Cut pipe from measurements taken at the site, not from drawings. Keep pipes free of contact with building construction and installed work.

F. Install eccentric reducers where pipe is reduced in size in direction of flow, with tops of both pipes and reducer flush. Do not use bushings.

G. Connect branch-feed piping to mains at horizontal center line of mains, connect run-out piping to branches at horizontal center line of branches.

3.4 Installation of Piping System Joints: Provide joints of the type indicated in each piping system.

A. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply non-acid type solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

B. Plastic Pipe Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards.

1. Solvent-cemented joints shall be made in accordance with ASTM D2235 and ASTM F402.

2. PVC sewer pipe bell/gasket joints shall be installed in accordance with ASTM D2321.

3.5 Install pipe sleeves and seals in accordance with Division 22 Common Work Results for Plumbing section "Sleeves and Sleeve Seals".

3.6 Install hangers and supports in accordance with Division 22 Common Work Results for Plumbing section "Hangers and Supports".

3.7 Installation of Cleanouts: Install in above ground piping and building drain piping as indicated, as required by Uniform Plumbing Code, and at each change in direction of piping greater than 45°, at minimum intervals of 50' for piping 4" and smaller and 100' for larger piping, and at base of each vertical waste stack. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.

A. Size: Cleanouts shall be full size up to 4". Piping over 4" shall have a reducing fitting to accommodate a 4" cleanout unless indicated otherwise on drawings.

B. Install cleanouts to allow adequate clearance for rodding.

C. Protect all finished surfaces of cleanouts with a suitable adhesive covering until construction is completed.

D. Cleanouts to Grade: Provide an 18" x 18" x 8" thick concrete pad around the cleanout. Set the cleanout ferrule, adapter, or access cover frame in the concrete as required. The cleanout shall be extended to the finished grade. The concrete pad shall slope away from the cleanout in all directions approximately one inch. Cover pad with fill to finished grade.

E. Cleanouts in Paved Areas: Provide concrete pad similar to cleanout to grade and coordinate concrete depth at site with adjustable flange. Access cover frames are required.

3.8 Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

3.9 Vent Flashing Sleeves: Install on stack passing through roof, secure to stack flashing in accordance with manufacturer's instructions. For metal roofs, sleeves and flashing are by Division 7.

3.10 Installation of Floor Drains: Install floor drains in accordance with manufacturer's written instructions and in locations indicated.

A. Coordinate flashing work with work of waterproofing and adjoining substrate work.

B. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.

C. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

D. Position drains so that they are accessible and easy to maintain.

3.11 Trap Seal Protection: Install trap seals in accordance with manufacturer’s instructions.

3.12 Installation of Floor Sinks: Install floor sinks in accordance with manufacturer's written instructions and in locations indicated. Coordinate flashing work with work of waterproofing and adjoining substrate work. Position floor sinks so that they are accessible and easy to maintain.

3.13 Installation of Trench Drains: Install trench drains in accordance with manufacturer's written instructions and in locations indicated.

A. Coordinate flashing work with work of waterproofing and adjoining substrate work.

B. Install trench drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.

C. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

D. Position drains so that they are accessible and easy to maintain.

3.14 Piping Runouts to Fixtures: Provide sanitary waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated, but in no case smaller than required by Uniform Plumbing Code.

3.15 Oil Separators: Install oil-water separators and gauging in accordance with the manufacturer's printed instructions.

A. Provide 12 inches of clean compacted sand below the tank for bedding.

B. Handle tank with care when placing.

C. Anchor tank to concrete base as indicated. Tanks shall be surrounded by at least six inches of clean sand tamped into place.

D. Tank Cover: For tanks subject to traffic, provide at least two feet of earth cover plus six inches of reinforced concrete (or eight inches of asphaltic concrete) extending horizontally one foot beyond the tank outline.

E. Tank Cover: Provide at least two feet of earth cover.

F. Tank Cover: Provide at least one foot of earth cover and a four inch thick reinforced concrete slab extending at least one foot horizontally beyond the tank outline.

3.16 Grease Interceptors: Install grease interceptors in accordance with the manufacturer's printed instructions.

A. Provide 12 inches of clean compacted sand below the tank for bedding.

B. Handle tank with care when placing.

C. Anchor tank to concrete base as indicated. Tanks shall be surrounded by at least six inches of clean sand tamped into place.

D. Tank Cover: Provide at least two feet of earth cover.

3.17 Sand Interceptors: Install sand interceptors and gauging in accordance with the manufacturer's printed instructions.

A. Provide 12 inches of clean compacted sand below the tank for bedding.

B. Handle tank with care when placing.

C. Anchor tank to concrete base as indicated. Tanks shall be surrounded by at least six inches of clean sand tamped into place.

D. Tank Cover: For tanks subject to traffic, provide at least two feet of earth cover plus six inches of reinforced concrete (or eight inches of asphaltic concrete) extending horizontally one foot beyond the tank outline.

E. Tank Cover: Provide at least two feet of earth cover.

F. Tank Cover: Provide at least one foot of earth cover and a four inch thick reinforced concrete slab extending at least one foot horizontally beyond the tank outline.

3.18 Piping Tests: Test, clean, and sterilize sanitary waste piping in accordance with requirements of Division 22 Common Work Results for Plumbing section "Testing, Cleaning, and Sterilization for Plumbing Piping".

END OF SECTION

SECTION 221500 – COMPRESSED AIR SYSTEM

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. Division 22 Common Work Results for Plumbing sections apply to work of this section.

C. Extent of compressed air system work is indicated on drawings and schedules, and by requirements of this section.

D. Refer to Division 26 sections for power supply wiring from power source to power connection on air compressors and other devices. Include disconnects and required electrical devices, except where specified as furnished, or factory installed, by manufacturer.

1.2 Codes and Standards: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA standards.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer’s technical product data and installation instructions for:

1. Air compressors.
2. Refrigerated dryers.
3. Filters.
4. Automatic drains.
5. Valves.
6. Relief valves.
7. Pressure regulating valves.
8. Pressure gauges.
9. Vibration isolation.
10. Hose reels.
11. Equipment mountings.
12. Pipe flexible connections.
13. Receivers.
14. Access doors.

1.4 O&M Data Submittals:

A. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to air compressors. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to

be field-installed.

B. Maintenance Data: Submit a copy of approval submittals. Submit maintenance data and parts lists for air compressors, dryers, filters, automatic drains, pressure regulating valves; provide troubleshooting maintenance guide. Include data and wiring diagrams in O&M manual.

PART 2 - PRODUCTS

2.1 General: Provide piping materials and factory-fabricated piping products of types, sizes, pressure ratings, temperature ratings, and capacities indicated. Where not indicated, provide proper selection as determined by Installer to comply with the installation requirements. Provide materials and products complying with ASME B31.9 Code for Building Services Piping where applicable, base pressure rating on piping systems maximum design pressures.

A. Air Piping: Schedule 40 black steel with 150 psi malleable iron fittings unless otherwise noted.

B. Flexible Hoses: Hoses shall be d" ID, flexible, 2 braid rubber, with helical steel wire inner core. Hose shall be rated for 250 psi working pressure. Provide brass body SAE, D Series Dyna Quip quick disconnects or air hose couplings at each end of hose as required.

2.2 Air Compressors:

A. Furnish and install self-contained, air-cooled, two-stage air compressors mounted on an ASME stamped receiver. The unit shall be pressure lubricated. Unit shall be complete with compressors, receiver, electric motors, vee-belt drives, operating pressure regulator, and suitable interconnecting piping between all devices.

B. The motor shall be of adequate size to permit continuous operation at the scheduled pressure. The motor shall be 1750 rpm with ball bearings. Motors shall be high efficiency per Division 23 section “Motors”.

C. The receiver shall be an ASME code tank rated for the scheduled pressure. Provide auto drain trap and manual shutoff valve at outlet from the receiver. Provide ASME rated safety relief valve set as required.

D. Control shall be automatic start and stop type by pressure switch.

E. Acceptable Manufacturers: Subject to compliance with requirements, provide air compressors of one of the following: Champion, Curtis, Gast, Ingersoll-Rand, Quincy, or approved equal.

F. Accessories: Provide the following:

1. Pressure gauges.
2. Belt guard.
3. Air intake cleaner and silencer.
4. Safety valve.
5. Interstage cooler.
6. Operating pressure control.

7. Discharge line filter.
8. Moisture separator.
9. Combination fused disconnect and magnetic starter.
10. Refrigerated dryer.
11. Drain cock.

2.3 Air Compressors: Provide pre-wired, pre-piped, packaged, oil-injected and oil-cooled rotary screw compressors.

A. Motor: Provide TEFC type of adequate size to permit continuous operation at the scheduled pressure. The motor shall be 1750 rpm with ball bearings. Motors shall be high efficiency per Division 23 section “Motors”.

B. Starter: Provide full voltage magnetic with 120 volt control transformer.

C. Drive: Provide multi-V-belt drive with automatic tensioning device.

D. Control Panel: Provide start-stop switches, indicator lights, air pressure and temperature gauges, coolant temperatures gauge, runtime meter, reset. Provide electrical alternation of compressors to operate each compressor for 12 to 24 hours (adjustable). Provide lead-lag function, such that if the lead fails, the other compressor will automatically maintain air pressure. Provide compressor controls for capacity and idling.

E. Safety Devices: Provide high discharge air and oil temperature cutouts, low oil pressure cutout, three phase thermal overload protection, wrong direction cutout, loss of drive cutout, safety valve, and oil level sight glasses.

F. Air/Coolant System: Provide air and oil piping, oil charge, pressure differential system, dry air intake filter, oil/air separation oil filter, oil stop valve, vent valve, oil temperature control, air-cooled oil cooler, air-cooled after-cooler, air circulation fan, and cooling air filters. Oil carryover shall not exceed 10 ppm at design conditions.

G. Maintenance: Provide oil change pressurization valve and drain hose. Provide gasketed and hinged doors for access to all components.

H. Cabinet: Provide insulated cabinets with sound-proofing and vibration isolation to limit noise level to 75 dB (A).

I. Warranty: Provide 24 month warranty on the air end of the compressors.

J. Acceptable Manufacturers: Subject to compliance with requirements, provide products by Kaeser, or approved equal.

2.4 Air Dryer: Provide pre-wired, pre-piped, packaged, cycling, refrigerated air dryers manufactured by Ingersoll-Rand, Zeks, or approved equal.

A. Capacity: Meet or exceed total air compressor capacity at 35°F dew point.

B. Control Panel: Provide on-off switch, thermal overload protection, indicator lights, high temperature light and automatic condensate trap. Provide pressure gauges and high temperature

cutout.

C. Dryer System: Provide precooler, heat exchanger, separator, complete cycling refrigeration system, and all required operating and safety controls. Maximum working pressure: 200 psig.

D. Cabinet: Provide painted steel cabinet.

2.5 Filters: Provide filters rated for total air compressor capacity at working pressure, capable of removing moisture, particulates, and oil. Clean pressure drop shall not exceed 1.5 psi.

A. Prefilter: 3-micron particulate absolute filter with replaceable cartridge. Basis of Design: Zeks Accraflow with two extra replacement cartridges, or approved equal.

B. Final Filter: Coalescing filters for "oil-free" air, 0.3 micron with 99.97% DOP efficiency with replaceable cartridge. Basis of Design: Zeks Accralesor with two extra replacement cartridges, or approved equal.

2.6 Automatic Drains: Provide 120 volt, single phase, direct acting automatic drain valves in NEMA 1 enclosure with cord and grounded plug. Working pressure rating: 175 psig. Provide adjustable drain cycle and drain period with indicating lights. Basis of Design: Sure Drain, or approved equal.

2.7 Basic Valves: Provide valves complying with Division 22 Common Work Results for Plumbing section “Valves”, in accordance with the following listing.

A. Standard Service Valves: BA1, BA2.

B. High Pressure Service: Provide with port area equal to or greater than connecting pipe area, include blow-out proof stem, adjustable stem gland, Teflon seats, nickel-plated brass body, chrome plated brass ball, stainless steel handle with yellow grips, and female thread ends. Working pressure 500 psi or greater. Legris 433 (4912), or approved equal.

2.8 Relief Valves: Provide ASME Standard N.B. Certified valves set as required. Valves shall be all brass construction with steel ball stem and manual lift ring. Kingston, or approved equal.

2.9 Pressure Regulating Valves: Provide automatic, adjustable, pressure regulating valves capable of maintaining pressure at the specified working pressure. Working pressure rating: 150 psig. Basis of Design: Watts, or approved equal.

2.10 Pressure Gauges: Provide pressure gauges complying with Division 22 Common Work Results for Plumbing section "Meters and Gauges".

2.11 Vibration Isolation: Provide vibration isolation complying with Division 22 Common Work Results for Plumbing section “Vibration Isolation”, and in accordance with the following listing:

A. Air Compressor Mounting: EM1.

B. Compressed Air Discharge Piping: PF1 or PF2 to match piping.

2.12 Receivers: Provide vertical steel receivers of capacity shown on the drawings. The receiver shall be ASME code stamped, National Board registered with tappings for pressure relief valve, drain, pressure gauge, inlet, and outlet. Provide welded steel support stand.

2.13 Drain Piping: Copper tubing with soldered joints.

2.14 Hose Reels: Provide retractable hose reels where shown on the drawings.

2.15 Quick Connects: Provide male and female ends, size as shown on the drawings.

2.16 Access Doors: Provide access doors to service all valves and other devices as required in accordance with Division 22 Common Work Results for Plumbing section “Access Doors”.

2.17 Basic Identification: Provide identification complying with Division 22 Common Work Results for Plumbing section "Plumbing Identification."

2.18 Sleeves and Sleeve Seals: Provide sleeves and sleeve seals complying with Division 22 Common Work Results for Plumbing section "Sleeves and Sleeve Seals".

2.19 Basic Hangers and Supports: Provide hangers and supports complying with Division 22 Common Work Results for Plumbing section "Hangers and Supports".

PART 3 - EXECUTION

3.1 General: Examine areas and conditions under which compressed air system materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Install plumbing identification in accordance with Division 22 Common Work Results for Plumbing section "Plumbing Identification".

3.3 Install air compressors on a reinforced concrete pad. Install dryers as shown on the drawings. Set and level units on vibration isolation pads. Install flexible connector in discharge piping. Start units in accordance with manufacturer's printed instructions.

3.4 Install filters, automatic drains, and air separators where shown on the drawings. Pipe to drains.

3.5 Installation of Compressed Air Piping:

A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure.

B. Locate piping runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building.

C. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical, communications, or data equipment spaces and enclosures unless shown.

D. Cut pipe from measurements taken at the site, not from drawings. Keep pipes free of contact with building construction and installed work.

E. Install compressed air piping with 1/32” per foot (1/4%) downward slope in the direction of flow.

F. Install air compressor intake a minimum of 10 feet from all plumbing vents, exhaust fans, vents or stacks.

G. Locate groups of pipes parallel to each other, spaced to permit servicing of valves. All branches and outlets shall be taken from the top of the main.

3.6 Installation of Valves:

A. Provide 1/2" air riser blow off and shut off valve at location shown on the plans. Blow off shall be turned down and terminated 4" above finished floor.

3.7 Quick disconnects shall be mounted 42" above the floor unless otherwise noted and shall be installed with a tee in the branch line or drop. Provide 6-inch drip leg with d" blow off valve at all quick disconnects.

3.8 Install sleeves and sleeve seals in accordance with Division 22 Common Work Results for Plumbing section "Sleeves and Sleeve Seals".

3.9 Install hangers and supports in accordance with Division 22 Common Work Results for Plumbing section "Hangers and Supports".

3.10 Access Doors: Locate and coordinate installation of access doors for all valves and devices in accordance with Division 22 Common Work Results for Plumbing section “Access Doors”.

3.11 Piping Tests: Inspect, test, and clean compressed air piping systems in accordance with Division 22 Common Work Results for Plumbing section "Testing, Cleaning, and Sterilization for Plumbing Piping".

3.12 Check entire assembly for correctness of installation, alignment and control sequencing. Start all component parts in proper sequence. Make all adjustments required to ensure proper smooth quiet operation.

END OF SECTION

SECTION 221700 – GAS SYSTEM

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. Division 22 Common Work Results for Plumbing sections apply to work of this section.

C. Extent of gas systems work is indicated on drawings and schedules, and by requirements of this section.

D. Refer to other Division 22 sections for excavation and backfill required in conjunction with gas piping.

1.2 Codes and Standards:

A. NFPA Compliance: Fabricate and install gas systems in accordance with NFPA 54 "National Fuel Gas Code".

B. Utility Compliance: Fabricate and install gas systems in accordance with local gas utility company requirements and standards.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer’s technical product data and installation instructions for:

1. Gas cocks and/or ball valves.
2. Gas vents.
3. Gas regulators.
4. Kitchen gas appliance connectors.
5. Gas appliance connectors.
6. Access doors.

1.4 O&M Data Submittals: Submit a copy of all approval submittals. Submit maintenance data and parts list for gas cocks, ball valves, control valves, appliance connectors, gas vents, regulators. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and

products complying with NFPA 54 where applicable. Base pressure rating on gas piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in gas systems. Where more than one type of materials or products is indicated, selection is Installer's option.

2.2 Basic Identification: Provide identification complying with Division 22 Common Work Results for Plumbing section "Plumbing Identification."

2.3 Basic Pipes and Pipe Fittings: Provide pipes and pipe fittings in accordance with the following listing:

A. Building Distribution Piping:

1. Pipe Size 2" and Smaller: Schedule 40 black steel pipe with malleable-iron threaded fittings.

2. Pipe Size 2½" and Larger: Schedule 40 black steel pipe with wrought-steel buttwelding fittings.

2.4 Sleeves and Sleeve Seals: Provide sleeves and sleeve seals complying with Division 22 Common Work Results for Plumbing section "Sleeves and Sleeve Seals".

2.5 Sealants: Provide UL-listed or AGA approved sealants for gas piping.

2.6 Basic Hangers and Supports: Provide hangers and supports complying with Division 22 Common Work Results for Plumbing section "Hangers and Supports".

2.7 Valves: Provide valves complying with Division 22 Common Work Results for Plumbing section “Valves” and the following listing:

A. Gas Cocks 2" and Smaller: UL-listed, AGA approved, 150 psi non-shock WOG, full port, bronze straightway cock, flat or square head, threaded ends.

B. Gas Cocks 2-1/2" and Larger: UL-listed, CGA approved, MSS SP-78; 175 psi, lubricated plug type, full port, semi-steel body, single gland, wrench operated, flanged ends.

C. Acceptable Manufacturers for Gas Cocks: Subject to compliance with requirements, provide products of Resun R1430 and R1431, Milliken 200M and 201M, or approved equal.

2.8 Kitchen Gas Appliance Connectors: Provide kitchen gas appliance connectors of annealed 304 stainless steel tubing with Type 304 stainless steel braiding to protect tubing from elongation and a PVC coating surrounding steel braiding with suitable ends for appliance connection. Provide NSF & (AGA or CGA) approvals. Where kitchen equipment gas appliance connectors

serve movable appliance (on castors), provide swivel fittings and quick connects that close upon disconnecting. Hose length for movable appliances shall be 1.25 times the depth of the appliance. Appliance restraining device shall prevent over extension of connecting tube.

2.9 Gas Appliance Tube Connectors: Provide commercial grade appliance connectors with a 2 year manufacturer's warranty. Tubing shall be Type 304 stainless steel tubing with type 304 stainless steel braiding to protect tubing from elongation. Tubing shall be complete with factory installed end connectors. Provide products that are AGA or CGA approved. Indicate maximum BTU input for each length and size used on submittal.

2.10 Gas Vents:

A. Single Wall Construction: Provide UL-1738 single wall, factory-built vent system designed for use with Category II or IV condensing gas-fired appliances. The vent system shall be constructed from flame-resistant polypropylene and be continuous from the equipment flue outlet to the vent termination located outside. All vent system components (vent supports, roof or wall penetrations, terminations, equipment connectors, drain fittings) required to install the vent system shall be UL listed and provide by the manufacturer. Vent layout shall be designed and installed in compliance with the manufacturer's installation instructions. Acceptable Manufacturer: Subject to compliance with requirements, provide single wall vent system by Centrotherm, IPEX, or approved equal.

B. Double Wall Construction: Provide Type B double wall gas vent system for gas-fired appliances, except where noted otherwise on the drawings. Metalbestos Style RV(3"-8") or QC(10"-24"). The system shall include pipe, top, flashing cone, storm collar, joist shield, support plates, firestops, and fittings as required by the manufacturer for a complete installation. Acceptable Manufacturer: Subject to compliance with requirements, provide products of one of the following: Metalbestos, Hart and Cooley, or approved equal.

2.11 Gas Regulators:

A. First Stage Regulators: Provide UL listed first stage (high pressure) regulators set for 15 psi.

B. Second Stage Regulators: Provide UL listed second stage (1-5 psi) adjustable regulators with integral relief valves.

C. Acceptable Manufacturers: Subject to compliance with requirements, provide regulators by Rego, or approved equal.

2.12 Gas Meter and Regulator: Provided by local utility company. Coordinate with manufacturer's requirements for regulators at individual gas trains to gas-fired appliances and equipment.

2.13 Access Doors: Provide access doors to service all valves and other devices as required in accordance with Division 22 Common Work Results for Plumbing section "Access Doors".

PART 3 - EXECUTION

3.1 General: Examine areas and conditions under which gas systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer. Coordinate with gas supplier prior to starting work.

3.2 Install plumbing identification in accordance with Division 22 Common Work Results for Plumbing section "Plumbing Identification".

3.3 Installation of Gas Piping:

A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance or replacement of valves and equipment.

B. Comply with ANSI B31 Code for Pressure Piping.

C. Locate piping runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping.

D. Concealed Piping: Unless specifically noted as “Exposed” on the drawings, conceal piping from view in finished and occupied spaces, by locating in column enclosures, chases, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

E. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical, communications, or data equipment spaces and enclosures unless shown.

F. Cut pipe from measurements taken at the site, not from drawings. Keep pipes free of contact with building construction and installed work.

G. Connect branch-feed piping to mains at horizontal center line of mains, connect run-out piping to branches at horizontal center line of branches.

H. Locate groups of pipes parallel to each other, spaced to permit servicing of valves.

I. Isolate all copper tubing from steel and concrete by wrapping the pipe at the contact point, and for one inch on each side, with a continuous plastic sleeve. Isolate all copper tubing installed in block walls with a continuous plastic sleeve.

J. Use sealants on metal gas piping threads which are chemically resistant to gas. Use sealants sparingly, and apply to only male threads of metal joints.

K. Remove cutting and threading burrs before assembling piping.

L. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped or damaged. Do not use bushings in the gas system.

M. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connections are completed.

N. Ground gas piping electrically and continuously within project, and bond tightly to grounding connection.

O. Install drip-legs in gas piping where indicated, and where required by code or gas company requirements. Install drip legs at every turn up to equipment, and at the bottom of every drop to equipment. Install drip leg on the main gas line to the building.

P. Install "Tee" fitting with bottom outlet plugged or capped, at bottom of pipe risers.

Q. Use dielectric unions where dissimilar metals are joined together.

R. Install piping with 1/64" per foot (1/8%) downward slope in direction of flow.

S. Install piping parallel to other piping, but maintain minimum of 12" clearance between gas piping and steam or hydronic piping above 200°F.

3.4 Installation of Piping System Joints: Provide joints of the type indicated in each piping system.

A. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply non-acid type solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

B. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed. Paint exposed threads to retard rusting.

C. Weld pipe joints in accordance with recognized industry practice and as follows. Be guided by ANSI B.31.

1. Weld pipe joints only when ambient temperature is above 0°F.

2. Bevel pipe ends at a 37.5° angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.

3. Use pipe clamps or tack-weld joints; 4 welds for pipe sizes to 10". All welds shall be open-butt.

4. Build up welds with root pass, followed by filler pass and then a cover pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.

5. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.

6. At Installer's option, install forged branch-connection fittings wherever branch pipe is less than 3" and at least two pipe sizes smaller than main pipe indicated; or install regular "T" fitting. Weld-O-Let or equal.

7. All field welding and cutting using oxygen-acetylene methods within the building shall be performed in accordance with NFPA-51B (2014).

3.5 Install sleeves and sleeve seals in accordance with Division 22 Common Work Results for Plumbing section "Sleeves and Sleeve Seals".

3.6 Install hangers and supports in accordance with Division 22 Common Work Results for Plumbing section "Hangers and Supports".

3.7 Installation of Valves:

A. Gas Cocks: Provide at connection to gas train for each gas-fired equipment item; and on risers and branches where indicated.

B. Locate gas cocks where easily accessible, and where they will be protected from possible injury.

3.8 Equipment Connections: Connect gas piping to each gas-fired equipment item, with union, drip leg, and shutoff gas cock. Comply with equipment manufacturer's instructions.

3.9 Appliance Connectors: Install tubing, valves, connectors, fittings in accordance with their listing. Hose, fittings, and valves shall not restrict gas flow and shall be rated for the capacity of the appliance they serve. Hoses shall not be crimped. Hoses behind movable appliances shall not be crimped when appliance is extended from wall or when appliance is set in working position. Appliance restraining device shall set to engage just prior to the connector being fully extended. Check all tubing, piping, fittings & valves for leakage at less than 50 parts per million.

3.10 Access Doors: Locate and coordinate installation of access doors for all valves and devices in

accordance with Division 22 Common Work Results for Plumbing section “Access Doors”.

3.11 Gas Vent Installation:

A. Install gas vents for all gas-fired appliances in accordance with NFPA 54 and the manufacturer's instructions. Provide all flashing and related materials.

B. Gas vents shall terminate at least 3 feet above the roof and 2 feet higher than any portion of a building within a horizontal distance of 10 feet.

C. Minimum vertical gas vent length is 5 feet.

D. Slope horizontal gas vent connectors upward at least 1/4” per foot.

3.12 Piping Tests: Inspect, test, and purge gas systems in accordance with NFPA 54, local utility requirements, and Division 22 Common Work Results for Plumbing section "Testing, Cleaning, and Sterilization for Plumbing Piping".

END OF SECTION

SECTION 223413 – GAS DOMESTIC TANKLESS WATER HEATERS

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. Division 22 Common Work Results for Plumbing sections apply to work of this section.

C. Extent of water heater work is indicated on drawings and schedules, and by requirements of this section.

D. Refer to Division 26 sections for power supply wiring from power source to power connection on water heaters. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory installed, by manufacturer.

1.2 Codes and Standards: Provide water heaters that are certified and tested by American Gas Association (AGA).

1.3 Approval Submittals:

A. Product Data: Submit manufacturer’s specifications, performance data, materials, dimensions, weights, installation and startup instructions, and capacity data with selection point clearly indicated.

1.4 O&M Data Submittals:

A. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to controls and pumps. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

B. Maintenance Data: Submit a copy of approval data and maintenance data and parts lists for each type of heater, pump, control, and accessory, including troubleshooting maintenance guide. Include this data, product data, and wiring diagrams in O&M manual.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide water heaters by A.O. Smith, Laars, Noritz, Rinnai, or approved equal.

2.2 General: Provide factory-tested water heaters with thoroughly cleaned and painted galvanized

steel jacket. Provide water heaters of same type by same manufacturer.

2.3 Type: Instantaneous for use without storage tank. Provide two pass water tube heat exchanger of integral finned straight copper tubes. Tubes shall be rolled directly into ASME bronze or glass-lined headers rated for 160 psi working pressure. The heat exchanger shall be low water volume, explosion-proof design.

2.4 Inspection: Provide covers for inspection of all headers and removable flanges for maintenance and removal of heat exchangers.

2.5 Pump: Provide an integral, factory-wired, heater-mounted pump. The pump shall be bronze-fitted, 115 volt, single phase, easily removed for maintenance. The pump shall be sized by the manufacturer to match water heater capacity and local hard water conditions.

2.6 Gas: Provide gas manifolds outside the combustion chamber. Provide listed gas train consisting of: manual pilot valve, pilot gas valve, pilot gas regulator, manual shutoff valve, motorized safety gas valve, and lubricated plug cock. All combustion air shall be drawn directly from outside the water heater. Burners shall be atmospheric type constructed of stainless steel. Provide an integral draft diverter.

2.7 Combustion Chamber: Provide combustion chamber lined with cast refractory at least two inches thick. Refractory shall be rated for service to 2000°F.

2.8 Thermometer: Provide straight stem thermometer and well to indicate supply water temperature.

2.9 Firing Mode: Provide motorized modulating gas valve with proportioning aquastat and 115 volt control system.

2.10 Controls: Provide intermittent electronic ignition and electronic flame supervision with the following additional features:

Alarm bell and indicator lights.
Electronic flame relay.
High and low gas pressure switches.
High limit with manual reset.
Low water cutoff-float type.
On-off switch.
Operating control.
Water flow sensing device.
Normally open vent valve.

PART 3 - EXECUTION

3.1 Examine areas and conditions under which water heaters are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 General: Install water heaters where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that water heaters comply with requirements and serve intended purposes.

3.3 Access: Provide access space around water heaters for service as indicated, but in no case less than that recommended by manufacturer.

3.4 Support: Install water heaters with stainless steel wall hardware.

3.5 Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

A. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment startup until wiring installation is acceptable to equipment installer.

3.6 Piping Connections: Refer to Division 22 plumbing piping sections. Provide piping, valves, accessories, gauges and supports. Eliminate strain on headers.

3.7 Startup: Startup in accordance with manufacturer's instructions.

3.8 Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 224000 – PLUMBING FIXTURES

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. Division 22 Common Work Results for Plumbing sections apply to work of this section.

C. Extent of plumbing fixtures work is indicated on drawings and schedules, and by requirements of this section.

1.2 Codes and Standards:

A. Plumbing Fixture Standards: Comply with applicable portions of Uniform Plumbing Code pertaining to materials and installation of plumbing fixtures.

B. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.

C. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.

D. AHRI Compliance: Construct and install water coolers in accordance with AHRI Standard 1010 "Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers", and provide Certification Symbol.

E. ANSI Compliance: Construct and install barrier-free plumbing fixtures in accordance with ANSI Standard A117.1 "Accessible and Usable Buildings and Facilities".

F. NSF Compliance: Faucets and fixture fittings that supply drinking water for human ingestion shall conform to the requirements of NSF 61, Section 9.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, furnished specialties and accessories, and installation instructions. Submit manufacturer's assembly-type drawings indicating dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. The submittal shall be organized by “fixture number” and each fixture package shall be identified. Each fixture package shall include all of the required fittings and trim, even if such devices are used for more than one fixture.

1.4 O&M Data Submittals: Submit a copy of all approval submittals. Submit maintenance data and parts list for each type of plumbing fixture and accessory, including troubleshooting

maintenance guide. Include in O&M Manual.

1.5 Handle all plumbing fixtures carefully to prevent breakage, chipping, and scoring fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

PART 2 - PRODUCTS

2.1 General: Provide factory-fabricated fixtures of type, style, and material indicated. For each type fixture, provide trim, carrier, seats, and valves as specified. Where not specified, provide products as recommended by manufacturer, and as required for complete installation. Where more than one type is indicated, selection is Installer's option; however, all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

2.2 Model Numbers: Basis of design model numbers of a particular manufacturer are listed in the fixture schedule as an aid to contractors. Where conflicts between the model number and the written description occur, the written description shall govern. Where acceptable manufacturers are listed, products are subject to compliance with requirements.

2.3 Materials:

A. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting seam marks, roller marks, foundry sand holes, stains, de-coloration, or other surface imperfections on finished units are not acceptable.

B. All fixtures shall be white vitreous china unless otherwise specifically noted. Where enameled iron fixtures are specified, they shall be furnished with acid resisting enamel.

C. Where fittings, trim, and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.

D. Stainless Steel Sheets: ASTM A167, Type 302/304, hardest workable temper. Finish shall be No. 4, bright, directional polish on exposed surfaces.

E. Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C554.

F. Synthetic Stone: High quality, free from defects, glaze on exposed surfaces, stain resistant.

2.4 Plumbing Fittings, Trim and Accessories:

A. General: Faucets and fixture fittings shall conform to ASME A112.18.1.

B. Faucets: At locations where water is supplied (by manual, automatic, or remote control),

provide commercial quality chrome-plated, cast-brass faucets, valves, or other dispensing devices, of type and size indicated, and as required to operate as indicated.

1. Aerators: Provide aerators of types approved by Health Department having jurisdiction.

2. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: American Standard, Chicago Faucet Co., Symmons, Kohler Co., Speakman Co., TOTO USA, T & S Brass and Bronze Works.

C. Stops: Provide chrome-plated brass, angle type, manual shutoff valves and d" chrome-plated flexible supply pipes to permit fixture servicing without shutdown of water supply piping systems for all fixtures. Coordinate with fixture requirements.

1. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Sioux Chief, or approved equal.

D. Waste Outlets: Provide removable P-traps, drains, waste arms, tailpieces, and wastes-to-wall where drains are indicated for direct connection to drainage system for all fixtures unless otherwise noted. Provide drains, tailpieces, and waste arms where indirect drains are indicated. Waste outlets shall be full size of fixture drain connection.

1. Provide chrome-plated cast-brass P-traps and drains with cleanout.

2. P-traps, wastes, and drains of all types shall be 17-gauge.

3. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Sioux Chief, or approved equal.

E. Flush Valves: Provide quiet-flush, chrome-plated, cast-brass flush valves with vacuum breaker and screwdriver stop in compliance with ASSE 1037. Vacuum breakers shall conform to the performance requirements of ASSE 1001. Where accessible service is indicated, provide ADA compliant handles with the handle on the wide side of the stall.

1. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Sloan Valve Co., Delany Co., Moen, TOTO.

F. Carriers: Provide cast-iron supports for fixtures of either graphitic gray iron, ductile iron, or malleable iron or steel as indicated. Coordinate with specific fixture requirements and conditions of the project.

1. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Josam, Sioux Chief, Zurn, J.R. Smith.

G. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome-plated brass sheet steel escutcheons with friction clips.

H. Comply with additional fixture requirements listed for each fixture and as required for a complete and functional system.

2.5 Water Closets:

A. General: Provide white china siphon jet type unless otherwise noted, and in compliance with ASME A112.19.2 or ASME A112.19.3.

1. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: American Standard, Kohler, TOTO.

B. Fixture Seats: Provide white, heavy molded plastic fixture seats with stainless steel self-sustaining check hinges.

1. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Bemis Mfg. Co., Beneke Corp., Church, Sperzel, Olsonite, TOTO.

2.6 Lavatories:

A. General: Provide white china lavatories in compliance with ASME A112.19.1, ASME A112.19.2, or ASME A112.19.3.

B. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: American Standard, Kohler, TOTO.

2.7 Electric Water Coolers:

A. General: Provide self-contained electric water cooler with entire water system free of lead. All joints shall be made using silver solder. Units shall be complete with an air-cooled refrigeration system consisting of a hermetic compressor, cooler, pre-cooler, condenser fan, thermostat safety controls, and all other related devices. The unit shall have a capacity of 8 gallons per hour. The cabinet shall be stainless steel with vermin proof insulation. The top shall be fabricated of stainless steel with a No. 4 finish. Where accessible units are indicated, the bubbler and fountain shall be ADA compliant.

B. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Elkay Mfg. Co., Halsey Taylor Div., Haws Drinking Faucet Co., Sunroc, Oasis.

2.8 Mop Receptors:

A. General: Provide one-piece mop receptors with 3" integral stainless steel grid drain. Provide wall-mounted faucet with arm handles, vacuum breaker, stops, hose connection, and hose bracket. Provide 30" hose.

B. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Stern-Williams Co., Fiat.

2.9 Service Sinks:

A. General: Provide acid resistant service sinks with back and wall hanger. Provide double faucet with bucket hook, vacuum breaker, stops and hose end. Provide 3" trap to wall, enameled inside, painted outside with foot support. Provide stainless steel rim guard. Paint outside of sink and trap black.

B. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: American Standard, Fiat Products, Kohler Co., Stern-Williams Co.

2.10 Stainless Steel Sinks:

A. General: Provide Type 302, 18 gauge self-rimming stainless steel back ledge with No. 4 finish. Provide sound deadening material on the sides and bottom of the sink. Provide grid drain or strainer with removable crumb cup and stopper as indicated. Sinks shall conform to ASME A112.19.1, ASME A112.19.2, or ASME A112.19.3.

B. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Elkay, Franke, Just.

2.11 Showers: Provide prefabricated showers and shower compartments in compliance with ASME A112.19.2.

PART 3 - EXECUTION

3.1 General:

A. Examine rough-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. Install plumbing fixtures of types indicated where shown and at indicated heights. Install in accordance with fixture manufacturer's written instructions, rough-in drawings, and with recognized industry practices. Install in accordance with ADA and applicable accessible code requirements. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of Uniform Plumbing Code pertaining to installation of plumbing fixtures. Furnish templates for cut-outs in countertops. Coordinate exact fixture locations with countertop shop drawings.

C. Fasten plumbing fixtures securely to indicated supports or building structure, and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement. Mount at heights shown on the drawings. Fixture heights are floor-to-rim distance. Fitting heights are to centerline.

D. Install stop valve in water supply to each fixture.

E. After fixtures are set, the crack between the fixture and wall shall be caulked with DAP silicone-based caulking, or approved equal.

F. Protect installed fixtures from damage during remainder of construction period.

G. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

H. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new units.

I. Clean plumbing fixtures, trim, aerators, and strainers of dirt and debris upon completion of installation.

J. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow stream and specified gpm.

K. Adjust or replace washers to prevent leaks at faucets and stops.

END OF SECTION

SECTION 230000 – HVAC GENERAL

PART 1 - GENERAL

1.1 The work covered by this division consists of providing all labor, equipment and materials and performing all operations necessary for the installation of the mechanical work as herein called for and shown on the drawings. The work shall include but shall not be limited to the following:

Provide all HVAC (Heating, Ventilating, and Air Conditioning) and associated controls systems for the project. Fully coordinate all mechanical requirements with work by other Divisions under this construction contract. All systems shall be complete and fully functional.

1.2 Related Documents:

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

B. Provisions of this section apply to work of all Division 23 sections.

C. Review all other contract documents to be aware of conditions affecting work herein.

1.3 Definitions:

A. Provide: Furnish and install, complete and ready for intended use.

B. Furnish: Supply and deliver to the project site, ready for subsequent requirements.

C. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.

1.4 Permits and Fees: Contractor shall obtain all necessary permits, meters, and inspections required for Division 23 work and pay all fees and charges incidental thereto.

1.5 Verification of Owner's Survey Data: Prior to commencing any work, the Contractor shall verify the accuracy of all survey data as indicated in these plans and specifications and/or as provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, such items shall immediately be notified to the Architect/Engineer so that proper adjustments can be anticipated and ordered. Commencement by the Contractor of work shall be held as an acceptance of the data after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions or inaccuracies of the said data.

1.6 Delivery and Storage of Materials: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. All material shall be stored to provide

protection from the weather and accidental damage.

1.7 Extent of work is indicated by the drawings, schedules, and the requirements of the specifications. Singular references shall not be construed as requiring only one device if multiple devices are shown on the drawings or are required for proper system operation.

1.8 Field Measurements and Coordination:

A. The intent of the drawings and specifications is to obtain a complete and satisfactory installation. Separate divisional drawings and specifications shall not relieve the Contractor or subcontractors from full compliance of work of his trade indicated on any of the Drawings or in any Section of the Specifications. Report conflicts prior to start of work.

B. Verify all field dimensions and locations of equipment to ensure close, neat fit with other trades' work. Make use of all contract documents and approved shop drawings to verify exact dimension and locations.

C. Coordinate work in this division with all other trades in proper sequence to ensure that the total work is completed within contract time schedule and with minimum cutting and patching.

D. Locate all equipment, ductwork, piping, and apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on mechanical drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others. Provide all required work clearances as defined by code and manufacturer’s recommendations.

E. Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval from Engineer or Architect.

F. Carefully examine any existing conditions, piping, ductwork, and premises. Compare drawings with existing conditions. Report any observed discrepancies. It shall be the Contractor’s responsibility to properly coordinate the work and to identify problems in a timely manner. Written instructions will be issued by the Engineer to resolve discrepancies.

G. Because of the small scale of the drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members, wall and partition locations, trusses, and room dimensions and take actual measurements on the job. Locate piping, ductwork, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and for coordination with all trades. Contractor shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the drawings. If field measurements show that equipment or material cannot be fitted, the Engineer shall be consulted. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

1.9 Guarantee and Service:

A. The Contractor shall guarantee labor, materials and equipment for a period of one (1) year from Substantial Completion, or from Owner's occupancy, whichever is earlier. Contractor shall make good any defects and shall include all necessary adjustments to and replacement of defective items without expense to the Owner. Manufacturer warranties do not relieve the Contractor of this responsibility.

B. Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond or relieving Contractor of his responsibilities during guarantee period.

C. Contractor shall provide service of all new equipment during the guarantee period without additional expense to the Owner.

1.10 Approval Submittals:

A. Shop drawings, product literature, and other approved submittals will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions and Division 1 Specification sections and the following:

1. Submittals shall include all applicable items referenced in each specification section, and not include items from more than one specification section in the same submittal.

2. Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control numbers, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approved stamps. A sample cover sheet is included at the end of this section.

3. Submittals shall have been reviewed and approved by the General Contractor (or Prime Contractor). Evidence of this review and approval shall be an “Approved” stamp with a signature and date on the cover sheet.

4. Submittals shall be combined into a single submittal package with a table of contents. Submittals shall not be issued as multiple individual submittal packages.

5. The electrical design shown on the drawings supports the mechanical equipment basis of design specifications at the time of design. If mechanical equipment is submitted with different electrical requirements, it is the responsibility of the mechanical contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the mechanical submittal with a written statement that this change will be provided at no additional cost. Mechanical submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost.

B. Before ordering any materials or equipment, and within 30 days after the award of the contract, the Contractor shall submit to the Architect/Engineer one complete schedule showing the make, type, manufacturer's name and trade designation of all equipment.

1. This schedule shall be accompanied by the required number of copies of the manufacturer's printed specifications and shop drawings for each piece of equipment or specialty and shall give dimensions, diagrams, descriptive literature, capacity or rating, kind of material, finish, guarantee, etc., and such other detailed information as the Architect/Engineer may require.

2. When approved, such schedule shall be an addition to these specifications, and shall be of equal force in that no deviation will be permitted except with the approval of the Architect/Engineer.

C. If the shop drawings show variation from the requirements of the contract documents, the Contractor shall make specific mention of such variation in his letter of transmittal. If acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the contract.

D. Review of shop drawings, descriptive literature, catalog data, or schedules shall not relieve the Contractor from responsibility for deviations from Contract Drawings or Specifications, unless he has in writing called to the attention of the Architect/Engineer such deviation at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings, descriptive literature, catalog data, or schedules. Any feature or function specified but not mentioned in the submittal shall be assumed to be included per the specification.

E. Submit shop drawings and any other drawings called for in other sections. Shop drawings shall consist of plans, sections, elevations and details to scale (not smaller than 1/4" per foot), with dimensions clearly showing the installation. Direct copies of small-scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other sections and shall show space allotted for it. Include construction details and materials.

F. Submit product data after award of the contract and before any equipment or materials are purchased. Product data are defined as manufacturer's printed literature specifically marked to indicate size and model and accompanied by rating sheets listing values showing that equipment meets scheduled or specified values. Properly coded stamp from the Engineer on returned submittal is required before ordering equipment.

G. Coordinate with other divisions supplying equipment prior to submitting shop drawings.

H. Shop drawings shall be submitted in one package unless approved otherwise by the Engineer. Provide an index of sections listing manufacturers and “as-specified” or not. Each specification section shall be tabbed with equipment inserted.

1.11 Test Reports and Verification Submittals: Submit test reports, certifications and verification letters as called for in other sections. Contractor shall coordinate the required testing and documentation of system performance such that sufficient time exists to prepare the reports, review the reports, and take corrective action within the scheduled contract time.

1.12 O&M Data Submittals: Submit Operations and Maintenance data as called for in other sections when a copy of approved submittals is included in the O&M Manual, only the final “Furnish as Submitted” or “Furnish as Corrected” copy shall be used. Contractor shall organize these later in the O&M Manuals tabbed by specification number. Prepare O&M Manuals as required by

Division 1 and as described herein. Submit manuals at the Substantial Completion inspection.

PART 2 - PRODUCTS

2.1 All materials shall be new or Owner-supplied reused as shown on the Drawings, the best of their respective kinds, suitable for the conditions and duties imposed on them. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following sections.

2.2 Equipment and Materials:

A. Equipment and materials furnished under this division shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of three years. Where practical, all of the components shall be products of a single manufacturer in order to provide proper coordination and responsibility. Where required, Contractor shall furnish proof of installation of similar equipment or materials.

B. Each item of equipment shall bear a nameplate showing the manufacturer's name, trade name, model number, serial number, ratings and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated or painted.

C. The label of the approving agency, such as UL, ASME, AHRI, or AMCA, by which a standard has been established for each particular item, shall be in full view.

D. The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be a product of the manufacturer’s latest design.

E. A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

F. Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.

G. Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material and type of construction desired. Manufacturer's products shown on the drawings have been used as basis for design; it shall be the Contractor's responsibility to ascertain that alternate manufacturer's products meet detailed specifications and that size and arrangement of the equipment are suitable for installation.

H. Model Numbers: Catalog numbers and model numbers indicated in the drawings and specifications are used as a guide in the selection of the equipment and are only listed for the Contractor's convenience. The Contractor shall determine the actual model numbers for ordering equipment and materials in accordance with the written description of each item and with the intent of the drawings and specifications.

2.3 Requests for Substitution:

A. Where a particular system, product or material is specified by name, consider it as standard basis for bidding, and base proposal on the particular system, product or material specified. Other systems, products, equipment or materials may be accepted only if in the opinion of the Engineer, that they are equivalent in quality and workmanship and will perform satisfactorily its intended purpose. The Engineer shall approve all such substitutions in materials or equipment in writing. This shall occur prior to bidding.

B. In making requests for substitutions, the Contractor shall list the particular system, product, equipment or material he wishes to substitute and, at bid time, the Contractor shall state the amount he will add or deduct from his base bid if the substitution is approved by the Engineer. If the Contractor allows no deduction or addition to the base bid for such substitution, it shall be stated on the request.

C. Requests by the Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

1. Required product cannot be supplied in time for compliance with Contract time requirements.
2. Required product is not acceptable to governing authority, or determined to be non-compatible, or cannot be properly coordinated, warranted or insured, or has other recognized disabilities as certified by the Contractor.
3. Substantial cost advantage is offered to the Owner after deducting offsetting disadvantages including delays, additional compensation for redesign, investigation, evaluation and other necessary services and similar considerations.

D. All requests for substitution shall contain a “Comparison Schedule” and clearly and specifically indicate any and all differences and omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include, but not limited to, data as follows for both the specified and substituted products:

1. Principle of operation.
2. Materials of construction or finishes.
3. Thickness or gauge of materials.
4. Weight of item.
5. Deleted features or items.
6. Added features or items.
7. Changes in other work caused by the substitution.
8. Performance and rating data.

E. If the approved substitution contains differences or omissions not specifically called to the attention of the Engineer, the Owner reserves the right to require equal or similar features to be added to the substituted products at the Contractor’s expense.

2.4 Prior Approval: Prior Approval shall be required for any manufacturer other than those listed for all specified items in the Drawings and Specifications. Submit all requests for approval of the alternate manufacturer’s products two weeks prior to bid opening. Approval will be in the form of an Addendum to the Specifications and Drawings. Clearly indicate all differences

between the specified and proposed product following the guidelines for substitution herein. This requirement may be waived if, in the opinion of the Engineer, it is in the best interest of the Owner. Submittals received after award of the bid for equipment that has not been Prior Approved shall be subject to immediate rejection.

PART 3 - EXECUTION

3.1 Workmanship: All materials and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat and/or workmanlike appearance, or do not allow adequate space for maintenance, shall be removed and replaced when so directed by the Architect/Engineer.

3.2 Coordination:

A. The Contractor shall be responsible for full coordination of the mechanical systems with shop drawings of the building construction so the proper openings and sleeves or supports are provided for piping, ductwork, or other equipment passing through slabs or walls.

B. Any additional steel supports required for the installation of any mechanical equipment, piping, or ductwork shall be furnished and installed under the section of the specifications requiring the additional supports.

C. It shall be the Contractor's responsibility to verify all equipment such as valves, dampers, filters and such other apparatus or equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the drawings.

D. All connections to devices and equipment shown on the drawings shall be considered diagrammatic unless otherwise indicated by detail. The actual connections shall be made to fully suit the requirements of each case and adequately provide for expansion and servicing.

E. The Contractor shall protect equipment, material, and fixtures at all times during storage and construction. The Contractor shall replace all equipment, material, and fixtures which are damaged as a result of inadequate protection.

F. Prior to starting and during progress of work, examine work and materials installed by others as they apply to work in this division. Report conditions which will prevent satisfactory installation.

G. Start of work will be construed as acceptance of suitability of work of others.

3.3 Interruption of Service: Before any equipment is shut down for disconnection or tie-ins, arrangements shall be made with the Architect/Engineer and this work shall be done at the time best suited to the Owner. This will typically be on weekends and/or holidays and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this work shall be included in the base bid.

3.4 Cutting and Patching: Contractor shall be responsible for cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under these Specifications. Utilize experienced trades for cutting and patching. Obtain permission from Architect/Engineer before cutting any structural items.

3.5 Equipment Setting: Bolt equipment directly to concrete pads or vibration isolators as required, using hot-dipped galvanized anchor bolts, nuts and washers. Level equipment.

3.6 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 23. Obtain matched color coatings from the manufacturer and apply as directed. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint as required. If corrosion is found to be extensive by the Engineer, the equipment shall be removed and replaced with factory new at the expense of the Contractor.

3.7 Cleanup: Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials and remove all oil and grease spots. Repaint or touch up as required to look like new. During progress of work, Contractor is to carefully clean up and leave premises and all portions of building free from debris and in a clean and safe condition.

3.8 Startup and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, startup shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety, and operating control shall be included in startup check.

3.9 Climate Control: Operate heating and cooling systems as required after initial startup to maintain temperature and humidity conditions to avoid freeze damage and warping or sagging of ceilings and carpet. Operate ventilation systems as required after initial startup in coordination with interior building finishes. Provide and maintain temporary filter media at return air and exhaust air inlets as required to prevent circulation of construction dust / debris through ductwork, coils, and related system components; this filter media is in addition to construction filters protecting coils at air handling equipment. Contractor is responsible for internal cleaning of ductwork and air handling equipment if contaminated by construction dust and debris.

3.10 Record Drawings:

A. During the progress of the work, the Contractor shall record on his field set of drawings the exact location, as installed, of all piping, ductwork, equipment, and other systems which are not installed exactly as shown on the contract drawings.

B. Upon completion of the work, record drawings shall be prepared as described in the General Conditions, Supplementary Conditions, and Division 1 sections.

3.11 Acceptance:

A. Request inspections as required under the Supplementary or General Conditions. Conceal no work until inspected.

B. Punch List: Submit written confirmation that all punch lists have been checked and the required work completed. The Contractor shall pay, at the Engineer's current billing rate, for additional field time required by the Engineer to report or check on previous punch list deficiencies.

C. Instructions: At completion of the work, provide a competent and experienced person who is thoroughly familiar with project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems.

D. Operation and Maintenance Manuals: Furnish complete manuals electronically and organized by system or section. Manuals shall contain:

1. Detailed operating instructions and instructions for making minor adjustments.
2. Complete wiring and control diagrams.
3. Routine maintenance operations.
4. Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.
5. Copies of approved submittals.
6. Copies of all manufacturers' warranties.
7. Copies of test reports and verification submittals.

E. Test and Balance Report: Submit electronic copies. Report shall be submitted for review prior to Substantial Completion, unless otherwise required by Division 1.

F. Warranties: Submit copies of all manufacturers' warranties.

G. Record Drawings: Submit record drawings.

H. Acceptance will be made on the basis of tests and inspections of the work. A representative of firm that performed test and balance work shall be in attendance to assist. Contractor shall furnish necessary mechanics to operate system, make any necessary adjustments and assist with final inspection.

This is a sample cover sheet. Use one for each shop drawing.

PROJECT NAME
PROJECT NUMBER

SAMPLE

ARCHITECT/ENGINEER: Dell Consulting, LLC

CONTRACTOR: XYZ Construction

SUBCONTRACTOR: ABC Mechanical Contractor

SUPPLIER: Supply Company

MANUFACTURER: Manufacturer

DATE: MM/DD/YYYY

Any standard heading is acceptable

SECTION: 23 XX XX / Section Name

1. Description: Manufacturer, Model

2. Description: Manufacturer, Model

3. Description: Manufacturer, Model

4. Description: Manufacturer, Model

5. Description: Manufacturer, Model

List each item separately; include manufacturer name and model number

General Contractor's APPROVAL stamp must be on this sheet.

END OF SECTION

SECTION 230010 – CODES AND STANDARDS

PART 1 - GENERAL

1.1 All work under Division 23 shall be constructed in accordance with the codes and standards listed herein. The design has been based on the requirements of these codes and standards. While it is not the responsibility of the Contractor to verify that all work called for complies with these codes and standards, the Contractor shall be responsible for calling to the Architect/Engineer's attention any details on the drawings or specifications that are not in conformance with these or other codes and standards.

1.2 Comply with regulations and codes of utility suppliers.

1.3 Where no specific method or form of construction is called for in the contract documents, the Contractor shall comply with code requirements when carrying out such work.

1.4 Where code conflict exists, the most stringent requirement applies. Comply with current code edition, unless noted.

PART 2 - CODES

2.1 The following codes shall govern all work:

1. Florida Building Code – Eighth Edition (2023) – Building
2. Florida Building Code – Eighth Edition (2023) – Energy Conservation
3. Florida Building Code – Eighth Edition (2023) – Mechanical
4. Florida Building Code – Eighth Edition (2023) – Fuel Gas
5. National Electric Code (NFPA 70) – 2020
6. Fire Alarm and Signaling Code (NFPA 72) – 2019
7. Standard for Air Conditioning and Ventilating Systems (NFPA 90A) – 2015
8. Florida Fire Prevention Code Fifth Edition
    a. Fire Code (NFPA 1) – 2021
    b. Life Safety Code (NFPA 101) – 2021

PART 3 - STANDARDS

3.1 All mechanical materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments, to the extent referenced:

1. Underwriters' Laboratories (UL)
2. American National Standards Institute (ANSI)
3. American Society of Testing Materials (ASTM)
4. National Fire Protection Association (NFPA)
5. National Electrical Manufacturers Association (NEMA)
6. Air Conditioning, Heating, and Refrigeration Institute (AHRI)
7. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
8. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
9. Air Movement and Control Association (AMCA)

END OF SECTION

SECTION 230020 – HVAC RELATED WORK

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. This is a Common Work Results for HVAC section. Provisions of this section apply to work of all Division 23 sections.

C. Coordinate with the General Contractor for all cutting and patching. Contractors performing Division 23 work shall inform the General Contractor of all cutting and patching required prior to bidding and shall coordinate installation.

PART 2 - DIVISION 3 – CONCRETE

2.1 Refer to Division 3 – Concrete for:

A. Rough grouting in and around mechanical work.

B. Cutting and patching concrete to accommodate mechanical work.

2.2 The following work is part of Division 23, complying with the requirements of Division 3:

A. Curbs, foundations and pads for mechanical equipment.

PART 3 - DIVISION 4 – MASONRY

3.1 Refer to Division 4 – Masonry for:

A. Installation of wall louvers.

B. Installation of access doors in walls.

PART 4 - DIVISION 5 – METALS

4.1 Refer to Division 5 – Metals for:

A. Framing openings for mechanical equipment.

4.2 The following work is part of Division 23:

A. Supports for mechanical work.

PART 5 - DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

5.1 Refer to Division 6 – Wood, Plastics, and Composites for:

A. Framing openings for mechanical equipment.

PART 6 - DIVISION 7 – THERMAL AND MOISTURE PROTECTION

6.1 Refer to Division 7 – Thermal and Moisture Protection for:

A. Caulking and waterproofing of all wall- and roof-mounted mechanical work.

6.2 The following work is part of Division 23, complying with the requirements of Division 7:

A. Fire barrier penetration seals.

PART 7 - DIVISION 8 – OPENINGS

7.1 Refer to Division 8 – Openings for:

A. Installation of all door grilles.

B. Providing all door undercuts.

PART 8 - DIVISION 9 – FINISHES

8.1 Refer to Division 9 – Finishes for:

A. Painting exposed ductwork, piping, and equipment.

B. Painting structural metal and concrete for mechanical work.

C. Painting door grilles and access panels.

D. Installation of access doors in gypsum drywall.

8.2 Colors shall be selected by the Architect for all painting of exposed mechanical work in occupied spaces, unless specified herein. Do not paint insulated or jacketed surfaces.

8.3 The following work is part of Division 23:

A. Touch-up painting of factory finishes.

B. Painting of all hangers.

PART 9 - DIVISION 11 – EQUIPMENT

9.1 Refer to Division 11 – Equipment for:

A. All food service equipment including ranges, ovens, dishwashers, and related food preparation equipment and accessories.

B. Cooking hoods with fire suppression.

9.2 The following work is part of Division 23:

A. All ducts, fans, connections, and related devices to make kitchen hoods operational.

PART 10 - DIVISION 26 – ELECTRICAL

10.1 Mechanical contractor shall coordinate the exact electrical requirements of all mechanical equipment being provided with the electrical contractor. Where approval submittals are required, this coordination shall be accomplished prior to making the submittals. The electrical design shown on the drawings supports the mechanical equipment basis of design. If mechanical equipment is submitted with different electrical requirements, it is the responsibility of the mechanical contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the mechanical submittal with a written statement that this design will be provided at no additional cost. Mechanical submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost.

10.2 Mechanical contractor shall provide all HVAC control wiring including the Energy Management Control System sensors, alarms, and input/output signals and all relays, interlocks, warning lights, and control devices, complying with the requirements of Division 26. The intent is for the mechanical contractor to be responsible for the entire HVAC control system, including point-to-point wiring.

10.3 Electrical contractor shall provide disconnect switches, starters, and contactors for mechanical equipment unless specifically noted as being furnished as part of the mechanical equipment.

10.4 Electrical contractor shall provide all power wiring, raceway and devices, and make final electrical connections to all mechanical equipment, switches, starters, contactors, controllers, and similar equipment.

END OF SECTION

SECTION 230513 – MOTORS

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. This section is a Division 23 Common Work Results for HVAC section, and is part of each Division 23 section making reference to motors specified herein.

C. Extent of motors required by this section is indicated on drawings and/or specified in other Division 23 sections.

D. Comply with the requirements of Division 26.

1.2 Compliance: Comply with applicable UL standards pertaining to motors.

1.3 Approval Submittals:

A. Product Data: When required by other Division 23 sections, submit manufacturers' standard product data sheets for each type of motor provided. Submit with Division 23 section using the motors, not as a separate submittal. Mark data sheet with arrows indicating product being supplied and list by unique descriptive name all motors to which each data sheet applies. Clearly indicate type, service factor, rpm, duty cycle, voltage, phase, nominal full load efficiency, power factor, and insulation class. Field verify and coordinate mounting and frame requirements for matching the drive.

1.4 O&M Data Submittals: Submit a copy of approval submittals. Submit operation and maintenance data for each type of motor. Include these data in O&M Manual. Submit two copies of nameplate data sheet for each motor. One copy shall be included with the O&M Manual and a second copy shall be inserted in a waterproof pouch or bag and attached to the motor. Nameplate data sheets shall be typed or neatly printed and shall include all data on the motor nameplate plus a unique motor description such as "AHU-3 Fan Motor", "Distribution Pump #1", or similar description.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide motors by General Electric, Baldor, US Electric, or approved equal.

2.2 General:

A. Motors shall conform to applicable portions of NEMA Standard MG-1, Motors and Generators.

B. Motors shall be sized for the application such that when the driven equipment is operated at rated capacity the motor current will not exceed the full-load nameplate current. Service factor shall not be used in normal operation.

2.3 Motor Design:

A. Integral Horsepower Motors:

1. Motors shall be open drip-proof or totally enclosed fan cooled as shown on the drawings or listed in the Division 23 section requiring motors.

2. Motors shall be three phase, 60 hertz, nominal 1800 rpm, rated at 200 volts for 208 volt systems, 230 volts for 240 volt systems, and 460 volts for 480 volt systems.

3. Motors shall be NEMA Design B and shall have 1.15 service factor or greater at 60 hertz.

4. Insulation Systems:

a. In fixed speed applications, motors shall have Class B insulation with 80°C rise over 40°C ambient.

b. For variable frequency drive (VFD) applications, motors shall have Class F insulation with 105°C rise over 40°C ambient. Motor manufacturer shall identify motors being used for VFD applications by marking the motor with a stainless steel name-plate “Inverter Duty”. Motors shall be provided with one set of thermostatic sensors.

c. Motor efficiencies shall be based on IEEE-112, 2004, Test Method B, as specified in NEMA Standard MG1-12.55. NEMA motor efficiency and power factor shall be clearly shown on the motor nameplate. Inverter duty motors shall have a CIV rating based on NEMA.

d. Motors shall be premium efficiency type and shall meet or exceed the following minimum nominal efficiencies at rated voltage.

230/460 VOLT, 3 PHASE

HORSEPOWER RANGE	MINIMUM NOMINAL EFFICIENCY	MINIMUM ACCEPTABLE POWER FACTOR
1 hp	85.5 pct.	75.0 pct
1.5 to 2 hp	86.5 pct.	77.0 pct
3 to 5 hp	89.5 pct.	77.0 pct
7.5 to 10 hp	91.7 pct.	80.0 pct
15 hp	92.4 pct.	80.0 pct
20 hp	93.0 pct.	82.0 pct
25 to 30 hp	93.6 pct.	82.0 pct
40 hp	94.1 pct.	82.0 pct
50 hp	94.5 pct.	85.0 pct
60 hp	95.0 pct.	85.0 pct
75 to 125 hp	95.4 pct.	85.0 pct
150 hp	95.8 pct.	87.0 pct
over 150 hp	96.2 pct.	87.0 pct

200 VOLT, 3 PHASE

HORSEPOWER RANGE	MINIMUM NOMINAL EFFICIENCY	MINIMUM ACCEPTABLE POWER FACTOR
1 hp	85.5 pct.	75.0 pct
1.5 to 2 hp	86.5 pct.	77.0 pct
3 to 5 hp	89.5 pct.	77.0 pct
7.5 to 10 hp	91.7 pct.	80.0 pct
15 hp	92.4 pct.	80.0 pct
20 hp	93.0 pct.	82.0 pct
25 hp	93.6 pct.	82.0 pct

e. Motors 25 hp and larger which are to be installed outdoors or in other high humidity areas shall be equipped with silicone rubber space heaters. Space heaters shall be energized when motor is de-energized.

B. Fractional Horsepower Motors one-half hp and above:

1. Motors shall be open drip-proof or totally enclosed fan cooled as shown on the drawings or listed in the Division 23 section requiring motors.

2. Motors shall be three phase, 60 hertz, nominal 1800 rpm, rated at 200, 230 or 460 volts as shown on the drawings.

3. Motors shall be NEMA Design B with class B insulation, unless used with variable frequency drives.

C. Fractional Horsepower Motors less than one-half hp:

1. Motors shall be single phase, 60 hertz, rated at 120 volts with integral thermal protection.

D. Overload Protection: Properly sized overload protection shall be provided for each motor. This protection may be an integral part of the motor or may be part of the motor controller and shall interrupt each ungrounded conductor.

PART 3 - EXECUTION

3.1 Motor Size and Location:

A. Size and location of motors shown on the drawings are based on a particular design and may change with a different manufacturer. Submittal of shop drawings or product literature indicating motor sizes or locations different from that designed indicates that Contractor has fully coordinated any required changes to the electrical system with other trades. Approval (if made) is on this basis and no additional cost will be allowed for any changes.

B. Contractor shall verify and make any necessary adjustments to electrical service, branch circuit wiring, branch circuit protection, overload protection, disconnect and controller (starter), or VFD based on actual nameplate data of the motors supplied prior to installation. Where applicable, connect motor winding thermostat to VFD.

C. Motor Voltages: Contractor shall field verify system voltage prior to ordering or installing any motors. Submittal of shop drawings or product literature indicating motor voltages indicates that Contractor has fully coordinated the motor with the electrical system and that any discrepancies have been resolved. Approval (if made) is on this basis and no additional cost will be allowed for any changes.

D. Motor Mounting: Adjust motor mounting as required to adjust the drive train for proper operation and to accommodate requirements of the test and balance work.

END OF SECTION

SECTION 230517 – SLEEVES AND SLEEVE SEALS

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. This section is a Division 23 Common Work Results for HVAC section, and is part of each Division 23 section making reference to or requiring sleeves and sleeve seals specified herein.

1.2 Approval Submittals:

A. Product Data: Submit product data for fire barrier sealants with installation instructions and UL listing under Division 7.

PART 2 - PRODUCTS

2.1 General: Provide factory-fabricated sleeves and sleeve seals recommended by manufacturer for use in service indicated. Provide sleeves and sleeve seals of type indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

2.2 Escutcheons:

A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

2.3 Fire Barrier Penetration Seals:

A. Provide seals for any opening through fire-rated walls, floors, or ceilings used as passage for mechanical components such as piping or ductwork in accordance with the requirements of Division 7.

2.4 Fabricated Piping Specialties:

A. Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2". Reinforce top, either by structural angles or by rolling top over 1/4" steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connection.

B. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet-Metal: Fabricate from galvanized sheet metal, round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3" and smaller, 20 gauge; 4" to 6" 16 gauge; over 6", 14 gauge.

2. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.

3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.

C. Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:

1. Caulking and Sealant: Provide foam or caulking and sealant compatible with piping materials used.

PART 3 - EXECUTION

3.1 Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

3.2 Fire Barrier Penetration Seals: Provide pipe sleeve as required. Fill entire opening with sealing compound. Adhere to manufacturer's installation instructions. Refer to Division 7.

3.3 Drip Pans: Locate drip pans under piping passing over or within 3' horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

3.4 Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 2" above finished floor.

Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

A. Install sleeves in fire-rated assemblies in accordance with the listing of the assembly and the fire barrier sealant.

B. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings. Fill annular space with caulking or fire barrier sealant as required.

C. Install steel-pipe sleeves at floor penetrations. Sleeves shall extend 2” above floor and be flush with bottom of slab. Fill annular space with caulking or fire barrier sealant as required.

D. Install iron-pipe sleeves at all foundation wall penetrations and at exterior penetrations, both above and below grade. Fill annular space with caulking or mechanical sleeve seals.

END OF SECTION

SECTION 230529 – HANGERS AND SUPPORTS

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. This section is a Division 23 Common Work Results for HVAC section, and is part of each Division 23 section making reference to or requiring hangers and supports specified herein.

C. Extent of hangers and supports required by this section is indicated on drawings and/or specified in other Division 23 sections.

1.2 Codes and Standards:

A. Code Compliance: Comply with applicable codes pertaining to product materials and installation of hangers and supports.

B. MSS Standard Compliance:

1. Provide pipe hangers and supports of which materials, design, and manufacture comply with ANSI/MSS SP-58.

2. Select and apply pipe hangers and supports, complying with MSS SP-69.

3. Terminology used in this section is defined in MSS SP-90.

C. UL Compliance: Provide products which are UL listed.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide supports and hangers by Grinnell, MAPA Products, B-Line Systems, or approved equal.

2.2 Horizontal-Piping Hangers and Supports: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.

A. Adjustable Steel Clevises: MSS Type 1.

B. Steel Double Bolt Pipe Clamps: MSS Type 3.

C. Adjustable Steel Band Hangers: MSS Type 7.

D. Steel Pipe Clamps: MSS Type 4.

2.3 Vertical-Piping Clamps: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

A. Two-Bolt Riser Clamps: MSS Type 8.

B. Four-Bolt Riser Clamps: MSS Type 42.

2.4 Hanger-Rod Attachments: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

A. Steel Turnbuckles: MSS Type 13.

B. Malleable Iron Sockets: MSS Type 16.

2.5 Saddles and Shields: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

A. Protection Shields: MSS Type 40, of length recommended by manufacturer to prevent crushing of insulation.

2.6 Miscellaneous Materials:

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ANSI/ASTM A 36.

C. Cement Grout: Portland cement (ANSI/ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ANSI/ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes or continuous channel struts selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

3.1 Preparation:

A. Proceed with installation of hangers and supports only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including, but not limited to, proper placement of inserts, anchors and other building structural attachments.

B. Prior to installation of hangers, supports, and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, and installers of other work requiring coordination with work of this section for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.2 Installation of Hangers and Supports:

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacing complying with MSS SP-69 or as listed herein, whichever is most limiting. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

1. Horizontal copper tube 1-1/2" diameter and smaller: support on 6-foot centers.

2. Horizontal copper tube over 1-1/2" diameter: support on 10-foot centers.

3. Vertical copper tube: support at each floor.

4. Plastic pipe: support in accordance with manufacturer's recommendations.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

C. Paint all black steel hangers with black enamel. Galvanized steel and copper clad hangers do not require paint.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

E. Provision for Movement:

1. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

2. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.

F. Insulated Piping: Comply with the following installation requirements:

1. Shields: Where low-compressive-strength insulation or vapor barriers are indicated, install coated protective shields.

2. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

3.3 Equipment Bases:

A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division 23. Size bases to extend minimum of 6" beyond equipment base in any direction, and 4" above finished floor elevation (6” above finished floor elevation for boilers). Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands. Prime and paint with black enamel.

END OF SECTION

SECTION 230548 – VIBRATION ISOLATION

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. This section is a Division 23 Common Work Results for HVAC section, and is part of each Division 23 section making reference to or requiring vibration isolation specified herein.

C. Extent of work required by this section is indicated on drawings and/or specified in other Division 23 sections. Types of vibration isolation specified in this section include equipment support isolators.

1.2 Quality Assurance:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration isolation, of types and sizes required, whose products have been in satisfactorily used in similar service for not less than five years.

B. All equipment provided under Division 23 shall operate under all conditions of load, free of objectionable sound and vibration. Sound and vibration conditions considered objectionable by the Architect/Engineer shall be corrected in an approved manner.

1.3 Approval Submittals:

A. Product Data: Where required by other Division 23 sections, submit product data sheets for each type of vibration isolation equipment including configuration and rating data. Submit with Division 23 Section using vibration isolation, not as a separate submittal. Provide calculations showing supported weight, deflection, and isolator size and type for each item of supported equipment. Submit for:

1. Equipment Mountings. Type EM.

2. Hangers. Type HA.

1.4 O&M Data Submittals: Submit a copy of approval submittals. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 General: Provide factory-fabricated products recommended by manufacturer for use in service indicated. Provide products of types and deflections indicated; provide proper selection as determined by Installer to comply with specifications and installation requirements. Provide

sizes which properly fit with equipment. All metal parts installed outside shall be hot-dipped galvanized after fabrication.

2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide vibration isolation equipment of: Mason Industries, Keflex, Consolidated Kinetics, Vibration Mountings & Controls, Wheatley, or approved equal. All vibration isolators shall be supplied by a single approved manufacturer.

2.3 Equipment Mountings:

A. Select mountings with the required deflection and fastening means. Provide steel rails or bases as required to compensate for equipment rigidity and overhang.

B. Types of equipment mountings (EM):

1. Pads (EM5): Waffle or ribbed pattern neoprene pads shall be fabricated from 40-50 durometer neoprene. Provide rigid steel plate and mounting angles as required. Basis of design: Mason Industries Super W.

2.4 Hangers:

A. Select hangers with the required deflection. Provide all required hanger rods and fasteners.

B. Types of hangers (HA):

1. Hangers (HA1): Vibration hangers shall contain a steel spring set in a neoprene cup manufactured with a grommet to prevent short-circuiting of the hanger rod. The cup shall contain a steel washer designed to properly distribute the load on the neoprene and prevent its extrusion. Spring diameters and hanger box lower-hole sizes shall be large enough to permit the hanger rod to swing through a 30° 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. Basis of Design: Mason Industries 30.

2. Hangers (HA2): Vibration hangers shall contain a laterally stable steel spring and 0.3" deflection neoprene or fiberglass element in series. A neoprene neck shall be provided where the hanger rod passes through the steel box supporting the isolator mount to prevent metal to metal contact. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° 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. Basis of Design: Mason Industries 30N.

3. Hangers (HA3): Double deflection neoprene-in-sheer or EPDM hangers. Units shall be complete with projected neoprene bushing to prevent steel-to-steel contact between hanger box and hanger rod. Average static deflection shall be not less than 0.4 inches. Basis of Design: Mason Industries HD.

PART 3 - EXECUTION

3.1 General:

A. Install vibration isolation devices for the duty indicated and for ease of inspection, adjustment, and proper operation. Install in accordance with the manufacturer's written instructions and coordinate with shop drawings of supported equipment.

B. All connections to devices and equipment shown on the drawings shall be considered diagrammatic unless otherwise indicated by detail. The actual connections shall be made to fully suit the requirements of each case and adequately provide for expansion and servicing.

C. Piping, ductwork and conduit shall not be suspended from one another or physically contact one another. Vibrating systems shall be kept free from non-vibrating systems.

3.2 Equipment Mountings:

A. Unless otherwise shown or specified, all floor-mounted equipment shall be set on housekeeping equipment bases. Refer to Division 23 section "Hangers and Supports".

B. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators, and such direct support is approved by the equipment manufacturer. All support frames shall be sufficiently stiff and rigid so as to prevent distortion and misalignment of components installed thereon.

C. Align equipment mountings for a free, plumb installation. Isolators that are binding, offset or fully compressed will not be accepted.

3.3 Hangers:

A. Position vibration isolation hangers so that hanger housing may rotate a full 360° without contacting any object.

B. Install steel angles, channels, rods and fasteners to level equipment, piping or ductwork and to evenly distribute the supported weight.

3.4 Connections of Ducts: Ducts shall be connected to fan intakes and discharges by means of flexible connectors in accordance with Division 23 section "Ductwork Accessories" so that all vibrating equipment is fully isolated.

END OF SECTION

SECTION 230553 – HVAC IDENTIFICATION

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. This section is a Division 23 Common Work Results for HVAC section, and is part of each Division 23 section making reference to or requiring identification devices specified herein.

C. Extent of HVAC identification work required by this section is indicated on drawings and/or specified in other Division 23 sections.

D. Refer to Division 26 sections for identification requirements of electrical work (not work of this section). Refer to other Division 23 sections for identification requirements for HVAC controls (not work of this section).

1.2 Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

PART 2 - PRODUCTS

2.1 General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 23 sections. Where more than a single type is specified for application, selection is the Contractor’s option, but provide single selection for each product category.

2.2 Painted Identification Materials:

A. Stencils: Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than 1-1/4" high letters for ductwork and not less than 3/4" high letters for access door signs and similar operational instructions.

B. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.

C. Identification Paint: Standard identification enamel.

2.3 Plastic Pipe Markers:

A. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers.

B. Snap-On Type: Provide manufacturer's standard pre-printed, color-coded pipe markers designed to snap around the pipe without the need for adhesive.

C. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with name as shown or specified.

D. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.4 Engraved Plastic-Laminate Signs:

A. General: Provide engraving stock melamine plastic laminate, in the sizes and thicknesses indicated, engraved with engraver's standard letter style a minimum of 3/4" tall and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 square inches or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

PART 3 - EXECUTION

3.1 Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 Ductwork Identification:

A. General: Identify air supply, return, exhaust, intake, and relief ductwork with stenciled signs and arrows, showing ductwork service and direction of flow, in black or white.

B. Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs every 25' and a minimum of once within each room.

C. Access Doors: Provide stenciled signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions and appropriate and procedural information.

3.3 Piping System Identification:

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:

1. Plastic pipe markers.
2. Stenciled markers of black or white for best contrast.

B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces and exterior non-concealed locations.

1. Near each branch, excluding short take-offs for equipment and terminal units. Mark each pipe at branch where there could be question of flow pattern.
2. Near locations where pipes pass through walls or floors/ ceilings or enter non-accessible enclosures.
3. Near major equipment items and other points of origination and termination.
4. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
5. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.4 Mechanical Equipment Identification:

A. General: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device. Label shall indicate type of system and area served. Provide signs for the following general categories of equipment and operational devices:

1. Air conditioning indoor and outdoor units.
2. Fuel-burning equipment including furnaces and heaters.
3. Fans, blowers.

3.5 Adjusting and Cleaning:

A. Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Clean face of each identification device.

END OF SECTION

SECTION 230590 – STARTUP REQUIREMENTS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 Intent: It is the intent of this section to require that the startup requirements and report noted herein be performed prior to starting TAB work on each system. Work can be phased with permission of the Engineer.

1.2 Coordination:

A. The Contractor shall furnish to the TAB Contractor a complete set of plans, specifications, addenda, shop drawings, equipment performance data sheets, change orders, etc. as requested by the TAB Contractor.

B. The Contractor shall participate in a TAB coordination meeting to discuss interface requirements with the TAB Contractor and to establish a schedule for TAB work prior to start of TAB work.

1.3 Test Reports and Verification Submittals: Submit Startup Report as described herein for each system. Attach Factory Startup Report for equipment as required by other Division 23 sections.

PART 2 - PRODUCTS: None

PART 3 - EXECUTION

3.1 General:

A. The TAB work shall not commence until the Engineer has received written notice from the Contractor that HVAC systems are 100% complete and are fully operational. Submit Startup Report as described herein.

B. The Contractor shall place all HVAC systems and equipment into complete operation during each working day of TAB work.

C. The Contractor shall provide access to HVAC systems and equipment by supplying ladders, and opening access panels and equipment room doors.

D. The TAB Contractor will provide to the Contractor TAB punch lists of non-complying HVAC work as they are discovered. The Contractor shall replace or repair non-complying work as soon as possible in order not to delay completion of TAB work.

3.2 Airside Systems: The Contractor shall provide the following information to the Engineer to substantiate proper startup and preliminary adjustments of air handling units, fans, and duct systems.

A. Verify that air grilles (supply, return, exhaust, transfer, outdoor, etc.) are installed and connected to the duct system.

B. Verify that duct systems are clean of debris.

C. Verify that ducts attached with flexible connectors are aligned within 1/2" and have a uniform gap between ducts of 1"-1.5". Flexible connectors shall not leak and shall be insulated.

D. Verify that filters are clean.

E. Verify that balancing dampers at grilles and branch ducts are operational and are fully opened.

F. Verify that fan discharges are appropriate for the outlet ductwork with regards to the "system effect" per AMCA Publication 201. Inappropriate fan discharges will not be accepted.

G. Verify proper fan rotation.

H. Verify proper motor drive alignment.

I. Verify fan motor overload elements are correctly sized.

J. Adjust fan speed until CFM is at or above design CFM. Verify that motor is not overloaded.

K. Verify that HVAC control systems are fully operational.

3.3 Startup Report: The Contractor shall submit the startup information required by this section to the Engineer in a typed report organized as outlined herein. The Startup Report is required to meet the written notice described herein prior to starting TAB work. TAB work will not start until the Startup Report has been submitted and approved.

END OF SECTION

SECTION 230593 – TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 Scope of Work: Extent of testing, adjusting, and balancing work (TAB) is indicated by the requirements of this section, and also by drawings and schedules. TAB is defined to include, but is not necessarily limited to, air distribution systems and associated equipment and apparatus of mechanical work. The work consists of setting speed and volume (flow) adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required.

1.2 References to Other Sections: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section. Division 23 Common Work Results for HVAC sections apply to work of this section.

1.3 Coordination: Coordinate with the General Contractor and Mechanical Contractor responsible for the HVAC system installation as required to complete the TAB work.

1.4 Description of Work:

A. Components to be tested, adjusted, and balanced specified in this section shall include the following as applied to mechanical equipment:

1. Air handling units
2. Fans
3. Ductwork systems

1.5 Tolerances: The intent of this specification to balance HVAC systems within the tolerances listed, maintaining the pressure relationships indicated, with a minimum of noise.

A. Airflow Tolerances:

1. Air Handling: Supply air, return air and outdoor air quantities shall be balanced within ±10% of design values.

2. Exhaust Fans: Exhaust fan quantities shall be balanced within ±10% of design values.

3. Ceiling Diffusers, Supply Registers, Return and Exhaust Inlets: Air quantities shall be balanced within ±10% of design values.

B. Temperature Tolerances:

1. Room Temperatures: Balance systems and controls within ±2°F of indicated settings.

1.6 Quality Assurance:

A. The TAB contractor shall meet one of the following:

1. A firm certified by National Environmental Balancing Bureau (NEBB) in those testing and balancing disciplines required for this project, which is not the installer of the system to be tested and is otherwise independent of project. Comply with NEBB's "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems" as applicable to this work.
2. A firm certified by Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project. AABC-certified firms are independent by definition. Comply with AABC's Manual MN-1 "AABC National Standards", as applicable to this work.

B. Industry Standards: Comply with American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to measurements, instruments, and testing, adjusting and balancing, except as otherwise indicated.

1.7 Job Conditions:

A. Do not proceed with testing, adjusting, and balancing work until HVAC work (including controls) has been completed and system is operable. Ensure that there is no residual work still to be completed.

B. Do not proceed until system scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discarded building materials.

C. Do not proceed until architectural work that would affect balancing (walls, ceiling, windows, doors, etc.) has been completed.

D. Testing may proceed system by system, but each HVAC system must be completed as described herein.

E. The mechanical contractor shall make any changes to fan speeds and dampers, and/or add dampers as required for correct balancing.

1.8 Approval Submittals:

A. Submit the name of the proposed test and balance company for the Engineer's approval within thirty (30) days after awarding of contract.

B. Submit copies of the dated test and balance report upon completion of TAB work. The report shall include a list of instruments used for the work. The report shall be signed by the supervisor who performed the TAB work.

PART 2 - PRODUCTS

2.1 Patching Materials: Except as otherwise indicated, use the same products as used by the original installer for patching holes in insulation, ductwork, and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.

2.2 Test Instruments: Utilize test instruments and equipment of the type, precision, and capacity as recommended in the referenced standard. All instruments shall be in good condition and shall have been calibrated within the previous twelve (12) months, or more recently if required by standard.

PART 3 - EXECUTION

3.1 General:

A. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned and is operable. Do not proceed with TAB work until unsatisfactory conditions have been corrected in manner acceptable to the tester.

B. Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable standards, and as modified or detailed herein.

C. Test, adjust and balance system during summer season for air conditioning systems and during winter season for heating systems, including at least a period of operation during outside conditions within 5ºF wet bulb temperature of maximum summer design condition and within 10ºF dry bulb temperature of minimum winter design condition. When seasonal operation does not permit measuring final temperatures, take final temperature readings when seasonal operation does permit. The Contractor shall return for a change of seasons test at no additional cost to the Owner and submit the revised TAB report.

D. Punch List: Prepare a deficiency (punch) list for the Contractor with a copy to the Engineer that lists all items that are incorrectly installed or are functioning improperly. Provide a retest after all items are corrected.

E. Prepare TAB Report of test results, including instrumentation calibration reports, in the format recommended by applicable standards, modified as required to include all data listed herein.

F. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in manner recommended by original Installer.

G. Mark equipment settings including damper control positions, fan speed control levers, and similar controls and devices, to show final settings at completion of TAB work. Provide markings with paint or other suitable permanent identification materials.

H. Include in the TAB Report recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

I. Include an extended warranty of ninety (90) days after completion of testing, adjusting, and balancing work, during which time the Engineer, at his discretion, may request a recheck, or resetting of any component as listed in test report. TAB contractor shall provide technicians and instruments and make any tests required by the Engineer during this time period.

3.2 Controls:

A. Check all temperature controllers for location and calibration.

B. Check operation of all controllers and controlled devices to verify proper action and connection. Check operation of all interlocks.

C. Check all motorized damper motors for leakage when in closed position. If leakage is more than 5%, the mechanical contractor shall reset damper linkages.

3.3 Air Balancing:

A. Leakage tests on ductwork must have been completed before air balancing can begin.

B. Set dampers, volume controls, and fan speeds to obtain specified air delivery with minimum noise level. Rebalance as required to accomplish this. Simulate fully loaded filters during test.

C. Set grille deflections as noted on drawings. Modify deflections if required to eliminate drafts or objectionable air movement.

D. Record air terminal velocity after completion of balance work.

E. Record final grille and register deflection settings if different from that specified on Contract Drawings.

3.4 Data Collection:

A. In addition to the data required for any specified performance tests, measure and record the temperatures, pressures, flow rates, and nameplate data for all components listed herein.

B. It is the intent of this section to record data on balanced systems, under normal operating or design conditions.

C. Temperatures:

1. Outside dry and wet bulb temperatures.
2. Dry bulb temperature in each room and at least one wet bulb temperature in each zone.
3. Inlet and outlet temperature of each heat exchange device.

D. Pressures:

1. Suction and discharge static pressure of each fan.

E. Flow rates:

1. Air flow rate through each fan.

F. Nameplate Data:

1. Complete nameplate data for all other equipment.
2. Motor data to include horsepower, phase, voltage, RPM, full load nameplate current, fuse rating in disconnect switch, number or manufacturer's size designation, and ampere rating of overcurrent and low voltage protection devices in starters.

END OF SECTION

SECTION 230713 – DUCT 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. Division 23 Common Work Results for HVAC sections apply to work of this section.

1.2 Approval Submittals:

A. Product Data: Submit manufacturer's product data sheets and installation instruction on each insulation system including insulation, coverings, adhesives, sealers, protective finishes, and other material recommended by the manufacturer for applications indicated. Submit for:

1. Rigid duct insulation.
2. Flexible duct insulation.

1.3 O&M Data Submittals: Submit a copy of all approval submittals. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide insulation products by Knauf, Owens-Corning, Johns Manville, Certainteed, Pittsburgh Corning, or approved equal.

2.2 Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, coverings, sealers, mastic, and adhesive) with a flame spread rating of 25 or less, and a smoke-developed rating of 50 or less as tested by ANSI/ASTM E84.

2.3 Duct Insulation Materials:

A. Rigid Fiberglass Insulation Board: ASTM C612, Class 1 (non-load bearing). Boards shall be 3 pcf density with UL rated aluminum foil vapor barrier (FSK).

B. Flexible Fiberglass Insulation: ASTM C553, Type I, Class B-3 (temperature less than 350°F). Duct wrap shall be 1 pcf density with UL rated aluminum foil vapor barrier (FSK).

C. General Purpose Mastic: Benjamin Foster 35-00 Series, Insulcoustic VIAC Mastic, Childers CP-10, or approved equal. The final selection of this product for the specific application indicated is the responsibility of the insulation supplier. The insulation system must meet the specified application.

D. Vapor Barrier Sealant: Benjamin Foster 30-35, Insulcoustic IC-501, 3M EC-1378, Childers CP-30, or approved equal. Provide "Low Odor" type. The final selection of this product for the specific application indicated is the responsibility of the insulation supplier. The insulation system must meet the specified application.

E. Adhesive: Benjamin Foster 85-20, Insulcoustic IC-205, 3M EC-35, Childers CP-82, Childers CP-89, or approved equal. The final selection of this product for the specific application indicated is the responsibility of the insulation supplier. The insulation system must meet the specified application.

F. Fiber-Glas Mesh: 10x10 Mesh. Foster Mastafab or equal.

PART 3 - EXECUTION

3.1 Installation of Rigid Ductwork Insulation:

A. Insulate all supply, return, and outside air ductwork exposed in mechanical rooms, mezzanines, fan lofts or in any finished spaces with 1-1/2" thick rigid fiberglass insulation with vapor barrier and a minimum *installed* R-value of 6.0. Do not field insulate exposed, double-wall round or flat oval supply air ductwork.

B. Clean and dry ductwork prior to insulating. Butt insulation firmly together to ensure complete and tight fit over surfaces to be covered. Install insulation materials with smooth and even surfaces. Maintain integrity of vapor barrier wherever possible. Extend insulation without interruption through walls, floors and similar ductwork penetrations except where otherwise indicated.

C. Adhere insulation to duct with 50% coverage using approved insulation adhesive applied in 6-inch wide swaths with 6-inch spaces between swaths. Additionally, secure insulation with perforated pins and Tuff-Bond or by self-sticking pins with a 3/8-inch self-tapping screw. Space on 12-inch centers and 3 inches from all edges. Ducts up through 24" width only require one row of pins. Ducts over 24" width shall have pins spaces as described herein.

D. Seal all joints, punctures and breaks in aluminum vapor barrier with 4-inch wide strip of open mesh glass fabric applied over one coat of vapor barrier mastic. When dry, apply second coat of general purpose mastic with color to match vapor barrier finish.

3.2 Installation of Flexible Ductwork Insulation:

A. Insulate all supply, return, transfer, and outside air ductwork concealed above ceilings, in chases, or elsewhere, and the backs of all supply outlets with 2" thick fiberglass blanket insulation with vapor barrier and a minimum *installed* R-value of 6.0.

B. Insulate elbows and fittings with blanket secured in place with steel wire. Apply a smoothing coat of insulating cement and finish with a heavy coat of vapor barrier sealant. Thickness shall be equal to adjoining duct covering.

C. Clean and dry ductwork prior to insulating. Adhere insulation to duct with 100% coverage using approved insulation adhesive. Lap all joints 2 inches with 4-inch wide strips of open mesh glass fabric embedded in two coats of general purpose mastic.

D. Seal all punctures and breaks in vapor barrier with open mesh glass fabric and vapor barrier sealant.

END OF SECTION

SECTION 230719 – HVAC PIPING 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. Division 23 Common Work Results for HVAC sections apply to work of this section.

1.2 Approval Submittals:

A. Product Data: Submit manufacturer's product data sheets and installation instruction on each insulation system including insulation, coverings, adhesives, sealers, protective finishes, and other material recommended by the manufacturer for applications indicated. Submit for:

1. Flexible unicellular pipe insulation.

1.3 O&M Data Submittals: Submit a copy of all approval submittals. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide insulation products by Knauf, Owens-Corning, Johns Manville, Certainteed, Pittsburgh Corning, U.S. Rubber, or approved equal.

2.2 Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, coverings, sealers, mastic, and adhesive) with a flame spread rating of 25 or less, and a smoke-developed rating of 50 or less as tested by ANSI/ASTM E84.

2.3 Pipe Insulation Materials:

A. Flexible Unicellular Pipe Insulation: ASTM C534, Type I (tubular, suitable for use up to 200°F).

B. Staples, Bands, Wires, and Cement: As recommended by the insulation manufacturer for applications indicated.

C. Adhesives, Sealers, Protective Finishes: Products recommended by the insulation manufacturer for the application indicated.

D. Jackets: ASTM C921, Type I (vapor barrier) for piping below ambient temperature, Type II (vapor permeable) for piping above ambient temperature. Type I may be used for all piping at

Installer’s option.

PART 3 - EXECUTION

3.1 General:

A. Install thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapor barrier on insulation and protect it to prevent puncture and other damage.

D. Do not apply insulation to surfaces while they are hot or wet.

E. Do not install insulation until systems have been checked and found free of leaks. Surfaces shall be clean and dry before attempting to apply insulation. A professional insulator with adequate experience and ability shall install insulation.

F. Do not install insulation until the building is “dried-in”.

3.2 Installation of Flexible Unicellular Pipe Insulation:

A. Insulate the following piping systems:

1. Condensate drains from air conditioning units: 1/2” thick.
2. Refrigerant piping: 3/4” thick.

B. Apply insulation in accordance with the manufacturer's recommendations and instructions. Miter cut insulation to fit pipe fittings. Use approved cement to seal all joints and ends in the insulation.

C. Insulation outside the building shall be protected by a smooth 0.016" thickness aluminum jacket secured with aluminum bands on 12" centers. All joints in metal jacketing (longitudinal and transverse) shall be sealed with silicone sealant.

END OF SECTION

SECTION 230900 – INSTRUMENTATON AND 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. Division 23 Common Work Results for HVAC sections apply to work of this section.

C. Extent of Energy Management Control and DDC Systems (EMCS/DDC) work required by this section is indicated on drawings and input/output schedules, and by requirements of this section. The EMCS/DDC shall consist of all thermostats, control sensors, controllers, software, relays, transformers, automatic dampers, actuators, switches, panels, and necessary equipment and wiring to provide a complete and fully-functional system. Control sequences are specified on drawings.

D. Refer to other Division 23 sections for installation of dampers in mechanical systems (not work of this section).

E. Refer to Division 26 sections for power supply wiring from power source to power connection on controls and/or EMCS panels. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

F. Provide the following electrical work as work of this section, complying with requirements of Division 26 sections: control wiring between field-installed controls, equipment, indicating devices, and EMCS/DDC panels.

1.2 Codes and Standards:

A. Electrical Standards: Provide electrical products which have been tested, listed and labeled by UL and comply with NEMA standards.

B. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electric control systems.

C. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

D. FCC Compliance: Comply with Federal Communication Commission (FCC) as required.

E. ASHRAE Standards: Comply with ASHRAE Standard 135-2016 “BACnet® - A Data Communication Protocol for Building Automation and Control Networks”.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer's technical product data for each EMCS/DDC panel and control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials. Include installation instructions and startup instructions. Provide technical specification data for each component and software module.

B. Shop Drawings: Submit shop drawings for the EMCS/DDC containing the following information:

1. Schematic flow diagram of system showing fans, coils, dampers and control devices.

2. Indicate all required electrical wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed. The point-to-point wiring diagram shall show all interconnections.

3. Provide details of faces of EMCS/DDC panels, including controls instruments and labeling.

4. Include written description of sequence of operation.

1.4 Test Reports and Verification Submittals: Submit system verification letter from manufacturer’s representative stating that all HVAC controls have been checked, calibrated, started up, and verified for proper operation. State that the Owner training has been completed and provide a roster of attendees.

1.5 O&M Data Submittals:

A. Maintenance Data: Submit maintenance instructions and spare parts lists for each type of control device. Include that type data, and a copy of all approval submittals, in O&M Manual.

B. System Manual: In addition to the maintenance data requirements, provide an EMCS/DDC Owner's Manual in a separate binder specifically for this project. This manual shall provide a description of the information flow to and from panels and devices and shall describe the overall communications network. The manual shall also include operating instructions, block diagrams, schematics, schedules, and system descriptions; control point schedules shall include point type, system name, object name, expanded ID, and address. Instruct Owner's personnel with this manual during the required training periods.

C. Software: Submit a copy of all software.

D. Service: Submit name, address, and telephone number of company that will provide service and training for the system.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide EMCS/DDC

control systems by Trane in accordance with Escambia County Facilities Management control standards. Provide a direct digital control (DDC) system based on Trane Tracer SC+ web-based open protocol BACnet system without the use of 3rd party integration hardware or software.

2.2 General:

A. Provide EMCS/DDC control products in sizes and capacities indicated, consisting of dampers, sensors, controllers, and other components as required for complete installation. Except as otherwise indicated, provide manufacturer's standard control system components as indicated by published product information, designed and constructed as recommended by manufacturer. Provide an EMCS/DDC controls system with the following functional and construction features as indicated.

B. The control system specified is based on an electric/electronic design of direct digital control (DDC) and based on BACnet architecture. It is the intent of this specification to describe the basic architecture and performance requirements of the EMCS. All control components shall be new and the latest products of the manufacturer.

2.3 Quality Assurance:

A. Provide equipment of firms regularly engaged in manufacture of EMCS/DDC equipment, of types required, whose products have been in satisfactory use in similar service for not less than three years. Provide evidence that software has been in use satisfactorily for at least one year.

B. Contractor shall have at least three years of experience in the installation and servicing of EMCS/DDC equipment similar to that being installed. Contractor shall have an office within 100 miles of the project and shall maintain a remote terminal capable of communication with the EMCS/DDC during the year warranty period. The local office shall have certified technicians capable of working on the installed system in order to service and warranty the installation. The local office shall also maintain a supply of spare parts.

2.4 EMCS/DDC Associated Components:

A. Provide field-programmable microprocessor-based, stand-alone EMCS/DDC panels as specified herein. The EMCS/DDC panel manufacturer shall be responsible for the complete engineering of the panel. The panel shall be UL listed and housed in a metal cabinet. Parts shall be plug in (modular) for easy repair or expansion. Power input shall be 24V or 120 V. Relays and contacts shall be rated at 24 VA at 24 VAC or 125 VA at 120 and 230 VAC, as required.

B. The panels shall have the capability to be upgraded through modules.

C. Coordinate with the EMCS/DDC manufacturer and ensure that all wire and conduit (type and size) is suitable for the equipment being installed.

D. Each EMCS/DDC panel shall have at least the minimum number of output and input channels for controlling loads as shown on the drawings.

E. Communication Module: The EMCS/DDC shall be supplied with all necessary communication

modules as required for a remote data terminal to program and recall data. Provide all necessary equipment to allow remote programming and monitoring of input channels and on/off status from a personal computer (PC).

F. Hardware: Provide NEMA-1 metal cabinet, modular components for expandability and maintenance, keyboard entry, battery backup to prevent loss of memory for at least 48 hours, local manual override, AC line voltage surge protection.

G. Channel Bypass and Override: Provide bypass switches for each digital output channel such that the controlled device can operate normally as if the EMCS/DDC was not installed. Provide remote override timers where shown in the input/output schedule on the drawings.

H. Associated Hardware: Provide actuators, relays, and other interface devices as required to execute the indicated control functions. Coordinate with HVAC control sequences and input/output schedules on the drawings.

I. Graphics: Provide an overall building graphical user interface with navigation buttons for each major piece of controlled equipment (air conditioning units, dehumidifiers, fans, sensors).

2.5 EMCS/DDC Functions:

A. Control Functions: Provide for closed-loop control by proportional, proportional-integral (PI), proportional-integral derivative (PID), incremental, and/or floating modes. Control accuracy: plus or minus 0.5°F of set point for all steady state load conditions. Provide specific control functions described in sequence of operation.

B. Management Functions: Provide capability for trending of variables, totalizing, and historical data storage. Provide for monitoring of selected parameters locally and remotely.

C. Time of Day Program: Provide the ability to turn loads on and off per the input/output schedule. The system shall be designed such that equipment can have a different schedule each day of the week and multiple on-off schedules per day. The system shall include a holiday feature which shall include its own time schedules and holiday duration. It shall be possible to program holidays up to one year in advance. The program shall automatically changeover from Daylight Savings to Standard Time.

D. Optimized Start/Stop Program: The EMCS shall have the ability to vary the start time of heating system equipment based on outdoor air temperature. It shall be possible to modify the base start time, as well as the start time as a function of outdoor air temperature. The system shall utilize a solid-state temperature sensor to determine startup time.

E. Timed Override: Remote override timers (where indicated on the drawings and input/output schedule) shall enable after hour or off-schedule use of the controlled equipment.

F. Automatic Restart Programming: Provide for sequential automatic restart of all equipment in the normal mode following a power outage.

G. Temperature Indication: The EMCS shall monitor remote temperatures where indicated on the drawings and input/output schedule.

H. Alarms: Provide alarms for control points out of range (adjustable) and provide alarm summary capability.

2.6 EMCS/DDC Input Devices:

A. Temperature Sensors: Provide resistance temperature detector (RTD) or thermistor type sensors for duct or room mounting as required by duty indicated. Duct-mounted sensors having greater than 20 sq. ft. cross section shall be serpentine averaging type. Accuracy: ±0.5°F.

B. Temperature Transmitters: Provide 3 or 4 wire resistance temperature detector (RTD) type transmitters for duct or room mounting as required by duty indicated if RTD type sensors are used. Provide metal enclosure sealed against moisture. Accuracy: ±0.25°F. Install wells to accommodate sensors. Wells must be of sufficient size to allow insertion of an electronic probe with the sensor for calibration.

C. Humidity Transmitters: Provide 0-5 VDC, 0-10 VDC or 4-20 mA relative humidity transmitters where indicated or required by the sequence of operation. Accuracy: ±3% RH.

D. Pressure Transmitters: Provide 0-5 VDC, 0-10 VDC or 4-20 mA pressure transmitters where indicated or required by the sequence of operation. Accuracy: ±1% of span.

E. DDC Thermostat: Provide for all space control locations. Thermostat shall have an integral temperature sensor, setpoint adjustment, and tenant override pushbutton.

F. Differential and Static Pressure Sensors (Air): Provide 0-6" w.g. adjustable in 2" w.g. span pressure sensors with 0.5% full scale accuracy. Provide zero and span adjustments. Provide overpressure protection to 10 psig positive or negative.

G. Differential Pressure Switches (Air): Provide 0.05 to 5" w.g. differential pressure switches with adjustable setpoint and SPDT contact rated for duty indicated. Provide overpressure protection to 1 psig positive or negative.

2.7 Dampers: Refer to Division 23 section “Ductwork Accessories” for dampers. Actuators are work of this section.

2.8 Actuator Motors: Size each actuator to operate dampers or valves with sufficient reserve power to provide smooth modulating action or two-position action as specified. Provide 24V actuators unless otherwise noted.

A. Provide permanent split-capacitor or shaded pole type motors with gear trains completely oil-immersed and sealed. Equip spring-return actuators, where indicated on drawings or in operational sequence, with integral spiral-spring mechanism. Furnish entire mechanism in housing designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

B. Equip motors for outdoor locations and for outside air intakes with “O-ring” gaskets designed to make motors completely weatherproof, and equip with internal heaters to permit normal operation at 10°F.

2.9 Guarantee:

A. All components, parts, and assemblies shall be guaranteed against defects in material and workmanship for a period of one year after acceptance. Expressed warranties are conditionally based on the requirement that the items covered within the guarantee are used and maintained in accordance with the manufacturer's recommendations. Guarantee commences at time of acceptance and continues for one year. Acceptance shall not occur until the Owner's operators are able to use the EMCS/DDC and receive reliable information from inputs and outputs.

B. The first year guarantee shall, as part of the base bid for the EMCS/DDC, include full service and maintenance of the EMCS/DDC. This service and maintenance shall include all necessary repair, reprogramming, calibration, cleaning, minimum (4) quarterly inspections, call back service, etc. This first year service, maintenance and guarantee shall be included in the base bid of the EMCS/DDC.

PART 3 - EXECUTION

3.1 Examine areas and conditions under which EMCS/DDC work is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Installation of EMCS/DDC:

A. General: Install systems and materials in accordance with manufacturer's instructions, shop drawings, and details on drawings. Install electrical components and use electrical products complying with requirements of applicable Division 26 sections of these specifications. Mount panels at convenient locations and heights.

B. Control Wiring: The term "control wiring" is defined to include wire, conduit and miscellaneous materials as required for mounting and connecting electric control devices. All low voltage control wiring, except wiring located above accessible ceilings, shall be installed in conduit. Low voltage control wiring above accessible ceilings may be installed without conduit, provided it is run at right angles to the building structure and is tie-wrapped and supported per Division 26 and code requirements.

C. Wiring System: Install complete control wiring system for the EMCS/DDC. Conceal wiring, except in mechanical rooms and areas where other conduit and piping are exposed. Provide multi-conductor instrument harness (bundle) in place of single conductors where number of conductors can be run along common path. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.

D. Install control wiring in accordance with the National Electric Code and Division 26 requirements.

E. Identification: Number-code or color-code conductors, excluding those used for local individual room controls, appropriately for future identification and servicing of control system. Tag all sensor wiring to identify zone number and room number where sensor is located.

F. Labeling: Label all sensors, dampers, safety devices, and controllers with engraved tags

matching the shop drawings. Label all thermostats and similar zone-level sensors by equipment being controlled (e.g. AHU-1).

3.3 Programming of EMCS/DDC:

A. The Contractor shall obtain operational schedules for the controlled equipment from the Engineer. Submittal data relevant to operational schedules shall be forwarded from the Contractor to the Engineer. Upon receipt of approval, the Contractor shall proceed with installation, setup, calibration, and check out of the various control and monitoring systems.

Having completed component and system installation, the Contractor shall submit a written request to the Engineer to inspect and approve their satisfactory operation.

B. The EMCS/DDC shall perform all functions on the equipment as described in HVAC sequence of operation and input/output schedules specified on the drawings. This defines the scope and extent of the project with regard to the required number of panels, control point relays, and devices. Field verify voltages at point-of-interface and provide relays as required.

C. Channel numbers may be reassigned by the Contractor during shop drawing submittal.

D. Model numbers, horsepowers, voltages, and other information equipment where listed on the drawings are for Contractor's convenience. Verify all information in the field as necessary for preparation of shop drawings.

3.4 Functional Requirements of EMCS/DDC:

A. Provide all necessary relays, sensors, wiring and contacts to achieve proper operation.

B. Connect EMCS/DDC panels to remote panels where shown.

3.5 Startup: Startup, test, and adjust the EMCS/DDC systems in presence of manufacturer's authorized representative. Demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

3.6 Adjusting and Cleaning:

A. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

B. Final Adjustment: After completion of installation, adjust the program, relays, interface devices, and similar equipment provided as work of this section for optimum operation.

3.7 Owner's Instructions:

A. During system startup, and at such time acceptable performance of the EMCS/DDC hardware and software has been established, the Contractor shall provide on-site operator instruction.

This instruction shall be performed during normal working hours and shall be conducted by a competent representative of the Contractor familiar with the system's software, hardware, and accessories. The Contractor shall maintain a roster of all attendees at all training sessions.

B. At a time mutually agreed upon during system training as stated above, the Contractor shall give up to 4 hours (as needed) of instruction to the Owner's designated personnel on the operation of all equipment within the EMCS/DDC and describe its intended use with respect to the programmed functions specified.

C. Operator orientation of the EMCS/DDC shall include, but not be limited to, the overall operational program, equipment functions both individually and as part of the total integrated system, commands, advisories, and appropriate operator intervention required in responding to the EMCS/DDC operation.

D. Provide at least 14-day notice to Owner and Engineer of training dates.

3.8 System Verification: The manufacturer's authorized representative shall state in writing to the Engineer that the EMCS/DDC system is operating properly, final adjustments and calibrations are complete, and Owner training has been accomplished.

END OF SECTION

SECTION 233113 – METAL DUCTWORK

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. Division 23 Common Work Results for HVAC sections apply to work of this section.

C. Extent of HVAC metal ductwork is indicated by drawings and schedules, and by requirements of this section.

D. Refer to other Division 23 sections for exterior insulation of metal ductwork.

E. Refer to other Division 23 sections for ductwork accessories.

1.2 Codes and Standards:

A. SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" 2020 Edition for fabrication and installation of metal ductwork, unless otherwise noted.

B. NFPA 90A Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.3 Approval Submittals:

A. Product Data: Submit manufacturer's technical product data and installation instructions for the following:

1. Factory-fabricated ductwork
2. Sealants
3. Flexible duct

PART 2 - PRODUCTS

2.1 Ductwork Materials:

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

B. Galvanized Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized

sheet steel complying with ASTM A527, lockforming quality, with G90 zinc coating in accordance with ASTM A525, and mill phosphatized for exposed locations. Stamp gauge and manufacturer's identification on each sheet. Break sheets so that identification is exposed.

2.2 Miscellaneous Ductwork Materials:

A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Duct Sealant: Provide non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.

C. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

D. Flexible Ducts: Provide flexible ductwork with an installed R-value of R-6. The use of flexible ductwork for connection of supply air and return air devices is acceptable only where shown on the drawings.

1. Construction: Provide reinforced metalized polyester jacket that is tear and puncture resistant, air tight inner core with no fiberglass erosion in the air stream and an encapsulated wire helix. Flexible ductwork shall have a recommended operating pressure of 6" w.g. for sizes 4" through 12" diameter and 4" w.g. for sizes 14" through 20" diameter. All diameters shall be suitable for a negative operating pressure of 0.75" w.g. Flexible ductwork shall meet the requirements of UL-181, the Florida Energy Conservation Code, SBCC, NFPA 90A and NFPA 90B.

2. Acceptable Manufacturers: Subject to compliance with requirements, provide R-6 flexible ductwork by: Atco 36, Flexmaster 6M-R6 or Thermaflex M-KE R6.

E. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15° change of direction per section. Unless specifically detailed otherwise, use 45° laterals and 45° elbows for branch takeoff connections. Where 90° branches are indicated, provide conical type tees.

2.3 Fabrication:

A. Shop fabricate ductwork in 4, 8, 10 or 12-ft lengths, unless otherwise indicated or required to complete runs. Preassemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

B. Shop fabricate ductwork of gauges and reinforcement complying with SMACNA "HVAC Duct Construction Standards", except provide sealant at all joints. Supply duct from air conditioning units and all return and exhaust duct shall be minimum 2" pressure class unless otherwise noted.

C. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius

equal to 1-1/2 times associated duct width, and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers.

D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-23 section "Ductwork Accessories" for accessory requirements.

2.4 Factory-Fabricated Low Pressure Ductwork (Maximum 2" W.G.):

A. Material: Galvanized sheet steel complying with ASTM A527, lockforming quality, with ASTM A525, G90 zinc coating, mill phosphatized.

B. Gauge: 28-gauge minimum for round ducts and fittings, 4" through 14" diameter, unless penetrating fire-rated assemblies (26-gauge minimum). 26-gauge minimum 16" through 18", 24-gauge minimum 20" through 24".

C. Elbows: One piece construction for 90° and 45° elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.

D. Divided Flow Fittings: 90° tees, constructed with saddle tap spot welded and bonded to duct fitting body.

E. Acceptable Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork by Semco Mfg., Inc., United Sheet Metal Div., United McGill Corp, or approved equal.

PART 3 - EXECUTION

3.1 General: Examine areas and conditions under which HVAC metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Installation of Metal Ductwork:

A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3" w.g. and under) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling.

B. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements. Seal joints in round ductwork with hard cast or shrink bands, and sheet metal screws, or by welding.

C. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally.

Avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. In finished and occupied spaces, conceal ductwork from view by locating in mechanical shafts, hollow wall construction or above suspended ceilings, unless specifically noted as "Exposed". Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

D. Electrical Equipment Spaces: Do not route ductwork through transformer vaults or other electrical equipment spaces and enclosures.

E. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and substrate. Where ducts pass through fire-rated floors, walls, or partitions, provide firestopping between duct and substrate.

F. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

G. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards. Fan discharge outlet ducts shall be installed correctly with regard to "system effect" per AMCA Publication 201.

3.3 Installation of Flexible Ducts:

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 5'-0" extended length. Flexible duct shall only be allowed as detailed on the drawings.

B. Installation: Install in accordance with Section III of SMACNA's "HVAC Duct Construction Standards, Metal and Flexible". Support flexible ducts to eliminate pinching and kinking which would restrict flow.

C. Peel back insulation and slide the inner core over the spin-in or diffuser neck, seal with duct sealant and install Panduit strap tightly. Slide insulation back over the inner core and install another Panduit strap over the insulation outer jacket.

D. Seal all exposed edges of fiberglass insulation with glassfab and mastic or insulation tape.

3.4 Leakage Tests: After each duct system is completed, test for duct leakage in accordance with Sections 3 and 5 of the SMACNA HVAC Air Duct Leakage Test Manual. Test pressure shall be equal to pressure class of duct, less 0.5" static pressure. Repair leaks and repeat tests until total leakage is less than 5% of system design airflow.

3.5 Equipment Connections: Connect metal ductwork to equipment as indicated. Provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

3.6 Clean ductwork internally until free of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration. Keep ducts closed with poly during construction to prevent contamination by construction dust and debris.

3.7 Balancing: Refer to Division 23 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork (not work of this section). Seal any leaks in ductwork that become apparent in balancing process.

3.8 System Adjustment: Adjust the system to provide functional operation to the extent possible, and leave ready for testing and balancing work. It is not the intent of this section to provide final testing and balancing, but to leave the system operational with a minimum of noise.

END OF SECTION

SECTION 233300 – DUCTWORK 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. Division 23 Common Work Results for HVAC sections apply to work of this section.

C. Extent of ductwork accessories work is indicated by drawings and schedules, and by requirements of this section.

D. Refer to other Division 23 sections for testing, adjusting, and balancing of ductwork accessories (not work of this section).

1.2 Codes and Standards:

A. SMACNA Compliance: Comply with applicable portions of both SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

B. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems" pertaining to installation of ductwork accessories.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer's technical product data each type of ductwork accessory, including dimensions, capacities, materials of construction, and installation instructions for the following:

1. Spin-in fittings
2. Side takeoff fittings
3. Low pressure manual dampers
4. Control dampers
5. Duct access doors
6. Flexible connections

1.4 O&M Data Submittals: Include product data and a copy of approval submittals in O&M Manual.

PART 2 - PRODUCTS

2.1 Duct Spin-in and Side Takeoff Fittings: Provide round branch duct run-outs as follows.

A. Supply air diffuser connections shall be conical with damper and one-inch high insulation stand-off equal to Crown 3200 DS or Flexmaster CBDE-BO.

B. Return air grille connections shall be straight-sided with damper and one-inch high insulation standoff equal to Crown 724-D5 or Flexmaster FLD-BO.

C. Exhaust air grille connections shall be straight-sided with damper equal to Crown 724 or Flexmaster FLD.

D. Where duct height does not permit the use of conical spin-in fittings, use low profile side take-off fittings equal to Crown 3300-DS or Flexmaster STOD-BO.

2.2 Dampers:

A. Low Pressure (<2.0" W.G.) Manual Dampers: Provide 22 gauge dampers of single-blade type (12" maximum blade width) or multi-blade type. Damper blades to be gang-operated from a single shaft with nylon or ball bearings on each end. Provide indexed locking quadrant. Parallel or opposed blade style is acceptable. Provide 2" standoff on locking quadrant for externally insulated duct.

B. Control Dampers: Provide dampers with parallel blades for 2-position control or opposed blades for modulating control. Provide heavy-duty molded self-lubricating nylon bearings. Provide sponge rubber or felt blade edges. Provide galvanized steel finish with aluminum touch-up. Actuators (motors) are furnished by control damper manufacturer.

C. Acceptable Manufacturers: Subject to compliance with requirements, provide dampers by Greenheck, Honeywell, Pottorff, Ruskin Mfg. Co., or approved equal.

2.3 Turning Vanes: Provide manufactured or fabricated single wall turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards".

2.4 Flexible Connections:

A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

B. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following: Duro Dyne Corp., Flexaust (The) Co., or Ventfabrics, Inc.

PART 3 - EXECUTION

3.1 Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to

Installer.

3.2 Installation of Ductwork Accessories:

A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

B. Install balancing dampers at all main ducts adjacent to units in return air, outside air, and where indicated.

C. Install control dampers in the outside air duct for each air handler, and elsewhere as indicated.

D. Install turning vanes in square or rectangular 90° elbows in supply, return, and exhaust air systems, and elsewhere as indicated.

E. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

F. Install flexible connections in ductwork such that the clear length of the connector is approximately two inches. Provide thrust restraints as required. Flexible material shall not be so slack as to take a definite concave or convex shape during fan operation.

G. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.3 Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories as required to obtain proper operation and leakproof performance.

3.4 Adjusting and Cleaning:

A. Adjust ductwork accessories for proper settings.

B. Final positioning of manual dampers is specified in Division 23 section "Testing, Adjusting, and Balancing". However, the system shall be left functional with all dampers open or throttled.

C. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 233400 – 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. Division 23 Common Work Results for HVAC sections apply to work of this section.

C. Extent of fan work required by this section is indicated by drawings and schedules, and requirements of this section.

D. Refer to Division 23 section "Testing, Adjusting, and Balancing" for balancing of fans.

E. Refer to Division 26 sections for power supply wiring from power source to power connection on fans. Division 26 work includes starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

1.2 Codes and Standards: In addition to the codes and standards listed in Section 230010, comply with the following:

A. AMCA Compliance: Provide fans which have been tested and rated in accordance with AMCA standards, and bear AMCA Certified Ratings Seal.

B. UL Compliance: Provide fans which are listed by UL and have UL label affixed.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer's technical data for fans, including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions. Submit assembly-type drawings showing unit dimensions, construction details, methods of assembly of components, and field connection details.

1. Fans
2. Vibration Control

1.4 O&M Data Submittals: Submit maintenance data and parts list for each type of fan, accessory, and control. Include these data, a copy of approved submittals, and wiring diagrams in O&M Manual.

PART 2 - PRODUCTS

2.1 General: Except as otherwise indicated, provide standard prefabricated fans of type and size

indicated, modified as necessary to comply with requirements, and as required for complete installation. Provide accessories as listed in the schedule on the Drawings and as described herein. Motors shall be high efficiency.

2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide fans manufactured by Acme, Greenheck, Loren Cook, PennBarry, or approved equal unless otherwise noted herein.

2.3 Centrifugal Ceiling Exhaust Fans:

A. Fan Assembly: Provide steel housing, plastic or aluminum grille, backdraft damper, statically and dynamically balanced fan wheel, permanently lubricated motor with internal thermal overloads, vibration isolation, and all required mounting hardware and brackets. Provide acoustically-treated housing for all fans larger than 60 cfm. Mounting type shall be as indicated on the drawings or on the schedule.

B. Connectors: Provide adaptors, connectors, and eave elbows as required to connect fan discharges to outlets.

C. Outlets: Provide where shown on the drawings (or required by the installation) wall caps, vent caps, or roof jacks, each with birdscreen, to match fans and surrounding construction.

2.4 Propeller Wall Fans:

A. Housing: Provide heavy duty all-welded steel housing and supports with epoxy finish. Panels shall have streamlined orifices.

B. Fan: Provide airfoil type steel or aluminum propellers.

C. Drive: Provide direct or belt drive as scheduled with pre-lubricated, ball bearing, continuous duty type motors. Provide vibration isolation equipment for the entire drive.

D. Wall Collar or Housing: Provide galvanized steel fan wall collar or housing as required.

E. Fan Guard: Provide OSHA approved galvanized steel mesh fan guard.

2.5 Fan Accessories and Features: Where indicated on the schedule or drawings, provide accessories and features listed herein.

A. Direct Drive: Direct drives shall have multispeed motors or speed controllers to achieve scheduled flow.

B. Bird Screens: Provide bird screens of 1/2" mesh aluminum or galvanized steel hardware cloth.

C. Backdraft Dampers: Where indicated, provide aluminum louvered dampers with felt-edged blades and nylon bearings.

D. Disconnect Switches: Provide factory installed local disconnecting means.

E. Thermal Overloads: Provide internal thermal overloads.

F. Speed Controller: Where indicated, provide speed controller.

G. Motorized Dampers: Where indicated, provide aluminum louvered dampers with felt-edged blades and nylon bearings with 120 volt motors wired to operate with the fan. Provide limit switch to prevent fan starting until damper is at least half open.

H. Vibration Isolation: Mount fans on vibration isolators in accordance with the requirements of Division 23 Section "Vibration Isolation" and the following list.

1. Hangers: Type HA1, HA2, HA3.

PART 3 - EXECUTION

3.1 General: Except as otherwise indicated or specified, install fans in accordance with manufacturer's installation instructions and recognized industry practices to ensure that fans serve their intended function.

3.2 Coordinate fan work with work of walls and ceilings as necessary for proper interfacing. Framing of openings and caulking are not work of this section.

3.3 Ductwork: Refer to Division 23 section "Metal Ductwork". Connect ducts to fans in accordance with manufacturer's installation instructions. Provide flexible connections in ductwork at fans.

3.4 Install fans on vibration isolation equipment as required. Set level and plumb.

3.5 Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical Installer. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Verify proper rotation direction of fan wheels. Do not proceed with equipment startup until wiring installation is acceptable to equipment installer.

3.6 Remove shipping bolts and temporary supports within fans. Adjust dampers for free operation.

3.7 Testing: After installation of fans has been completed, test each fan to demonstrate proper operation of units at performance requirements specified. When possible, field correct malfunctioning units, and then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

3.8 Cleaning: Clean factory-finished surfaces. Remove all tar and soil. Repair any marred or

scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 233439 – HIGH VOLUME, LOW SPEED PROPELLER 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. Division 23 Common Work Results for HVAC sections apply to work of this section.

C. Extent of work required by this section is indicated by drawings and schedules, and requirements of this section.

D. Refer to Division 26 sections for power supply wiring from power source to power connection on high volume, low speed (HVLS) propeller fans. Division 26 work includes starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

1.2 Codes and Standards: In addition to the codes and standards listed in Section 230010, comply with the following:

A. ETL/Intertek Compliance: Provide HVLS fans which have been tested and rated in accordance with ANSI/UL 507.

B. NFPA Compliance: Provide HVLS fans which are compliant with NFPA 13, NFPA 70, and NFPA 72.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer's technical data for HVLS fans, including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, controller information, and installation instructions. Submit assembly-type drawings showing unit dimensions, construction details, methods of assembly of components, and field connection details.

1.4 O&M Data Submittals: Submit maintenance data and parts list for each type of HVLS fan, accessory, and control. Include these data, a copy of approved submittals, and wiring diagrams in O&M Manual.

PART 2 - PRODUCTS

2.1 General: Except as otherwise indicated, provide standard prefabricated HVLS fans of type and size indicated, modified as necessary to comply with requirements, and as required for complete installation. Provide accessories as listed in the schedule on the Drawings and as described herein. Motors shall be high efficiency per Division 23 section "Motors".

A. Acceptable Manufacturers: Subject to compliance with requirements, provide HVLS fans by Big Ass Fans, Greenheck, Hunter Industrial, MacroAir, or approved equal.

B. Control Panel: The fan controller shall consist of a variable frequency drive (VFD) enclosed in an aluminum enclosure, pre-mounted on the downrod along with receptacles and electrical whip for a plug-n-play installation.

1. Provide wall-mounted digital variable speed controller.
2. Provide 100-ft of CAT5 cable for connecting the fan controller to the fan's VFD and to provide power to the controller.

C. Airfoil System: The fan shall be equipped with multiple airfoils made from 6005A structural grade aluminum. Each airfoil shall be connected to the hub by high strength set screws with pivoting saddles and a secondary locking pin system. Each airfoil shall be manufactured with a precision cut, swept style tip.

D. Hub Motor: The fan motor shall be a high torque permanent magnet motor (brushless DC, electronically commutated, or synchronous) rated for continuous operation at maximum speed without the use of a gearbox or other mechanical torque multiplier. The motor shall be a totally enclosed non-ventilated design with the capacity for continuous operation in 32°F to 140°F ambient conditions. The hub motor enclosure shall be precision cast A380 for low weight and maximum strength.

E. Mounting System: The mounting system shall be designed for quick, secure installation to a wide variety of ceiling structural supports. All components of the mounting system shall be made from A36 steel and ERW tubing. The downrod shall be pre-wired with a pin and sleeve connection for simple, safe, and economical installation. All mounting bolts shall be SAE Grade 5 or equivalent.

F. Safety Cables: The fan shall be equipped with a safety cable composed of high-tensile ANSI 316 stainless steel. The minimum breaking strength of the cable assembly supplied shall be 4,750 lb. Wire rope conforms to ASTM A492. In addition, multiple malleable wire rope clamps shall be included.

G. Guy Wires: The fan shall be equipped with a custom guy wire system comprised of four separate components:

1. Beam clamps with a swivel for inclined applications supplied with a high tensile set screw for a secure grip on both parallel and tapered flanges.
2. Turnbuckle designed to be tightened by hand with brass tipped set screws to prevent loosening.
3. Gripple, a locking fastener that is wire-diameter specific, for terminating cable when bracing and suspending static and dynamic loads. After installation, locking screws shall be fully inserted to secure the internal wedges in place.
4. Guy wire cables, wire ropes with integrated hook for quick and easy attachment to the provided beam clamp.

PART 3 - EXECUTION

3.1 General: Except as otherwise indicated or specified, install HVLS fans in accordance with

manufacturer's installation instructions and recognized industry practices to ensure that HVLS fans serve their intended function.

3.2 NFPA Compliance: Coordinate installation with the fire sprinkler contractor for compliance with NFPA 13 and NFPA 72.

3.3 Coordinate work with walls, ceilings, and roof as necessary for proper interfacing. Maintain minimum required clearances:

A. Airfoils must be at least 10-ft above the floor.

B. The sweep area (horizontally and vertically) must be at least 2-ft from any obstructions such as lights and cables.

C. The fan shall not be applied in any location where it may be subject to cross winds over 25 mph or near HVAC or radiant heat outputs.

3.4 Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical Installer. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment startup until wiring installation is acceptable to equipment installer.

3.5 Testing: After installation of HVLS fans has been completed, test each fan to demonstrate proper operation. When possible, field correct malfunctioning units, and then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

3.6 Cleaning: Clean factory-finished surfaces. Remove all tar and soil. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 233713 – DIFFUSERS, REGISTERS, AND GRILLES

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. Division 23 Common Work Results for HVAC sections apply to work of this section.

C. Extent of diffusers, registers, and grilles work is indicated by drawings and schedules, and by requirements of this section.

D. Refer to other Division 23 sections for ductwork and duct accessories required in conjunction with diffusers, registers, and grilles and for air balancing.

1.2 Codes and Standards:

A. ADC Compliance: Test and rate diffusers, registers, and grilles in certified laboratories under requirements of ADC 1062 “Certification, Rating and Test Manual”. Provide diffusers, registers, and grilles bearing ADC Certified Rating Seal.

B. NFPA Compliance: Install diffusers, registers, and grilles in accordance with NFPA 90A “Standard for the Installation of Air Conditioning and Ventilating Systems”.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer's technical product data for diffusers, registers, and grilles indicating construction, finish, and mounting details.

B. Performance Data: For each type of diffuser, register, and grille furnished, provide aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections and data as required.

1.4 O&M Data Submittals: Submit cleaning instructions for finishes and spare parts lists. Include this data and a copy of approval submittals in O&M Manual.

PART 2 - PRODUCTS

2.1 General:

A. Except as otherwise indicated, provide manufacturer's standard diffusers, registers, and grilles where shown, of size, shape, capacity and type indicated. Construct of materials and components as indicated, and as required for complete installation.

B. Manufacturers not listed in the following specification will not be considered for approval unless accepted by addendum prior to bid.

C. Performance: Provide diffusers, registers, and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device equal to the basis of design.

D. Ceiling and Wall Compatibility: Provide diffusers, registers, and grilles with border styles that are compatible with adjacent wall and ceiling systems, and that are specifically manufactured to fit into ceiling module or wall with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems and walls which will contain each type of diffuser, grille, or register.

E. Appearance: All grilles and registers shall be aluminum construction and all diffusers shall be aluminum construction, unless otherwise noted, with uniform matching appearance for each type of outlet. Ceiling-mounted grilles and registers shall be set to be sight tight from the predominant exposure.

F. Finish: All ceiling-mounted diffusers, registers, and grilles shall be finished with baked white enamel. Wall- and door-mounted grilles and registers shall be finished with clear anodized or baked white enamel as specified by Architect.

2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products by Titus, Price, or Greenheck.

2.3 Diffusers, Registers, and Grilles:

A. Square Ceiling Diffusers (CD): Provide square face, 360° pattern plaque diffusers with round necks. Provide lay-in panel as required. Provide trim ring for diffusers in hard ceilings to allow opening to be used for access. Diffusers with 24”x24” face: Titus OMNI-AA. Diffusers with 12”x12” face: Titus OMNI-AA.

B. Rectangular Ceiling Diffusers (CD2): Provide supply registers with 1-, 2-, 3-, or 4-way adjustable louvers as indicated on drawings and based on register location. Provide opposed blade damper, manually operated from the face where remote balancing damper is not specified above accessible ceiling. Provide mounting frame. Provide rectangular to round transition to accommodate round duct runout as required. Titus 250-AA.

C. Return Grilles (RG): Provide return grilles with one set of 45° fixed louvers, parallel to the long dimension. Provide mounting frame for all wall and plaster ceiling installations. Titus 350 FL.

D. Return Registers (RR): Provide return registers with one set of 45° fixed louvers, parallel to the long dimension. Provide opposed blade damper, screwdriver operated from the face. Provide mounting frame for all wall and plaster ceiling installations. Titus 350 FL.

E. Sidewall Supply Registers (SR): Provide supply registers with two sets of individually adjustable airfoil registers, spaced at 3/4", with the front set parallel to the long dimension. Provide opposed blade damper, screwdriver operated from the face. Provide mounting frame.

Titus 272 FL.

F. Ceiling Supply Registers (CR): Provide supply registers with 1-, 2-, 3-, or 4-way adjustable louvers as indicated on drawings and based on register location. Provide opposed blade damper, manually operated from the face. Provide mounting frame. Provide rectangular to round transition to accommodate round duct runout as required. Titus 250-AA.

G. Transfer Grilles (TG): Provide transfer grilles with one set of 45° fixed louvers, parallel to the long dimension. Titus 350 FL.

H. Door Grilles (DG): Provide steel door grilles with vee core, fixed louvers, spaced 1/2", flanged frame, and telescoping auxiliary flanged frame. Provide prime coat ready for field painting. Titus T-700.

PART 3 - EXECUTION

3.1 Coordinate installation with ceiling and light fixture installation. Locate ceiling outlets as indicated on architectural Reflected Ceiling Plans. Unless otherwise indicated, locate ceiling outlets in the center of acoustical ceiling modules with sides parallel to the grid.

3.2 Install diffusers, registers, and grilles in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that products serve intended functions.

3.3 Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of diffusers, registers, and grilles with other work.

3.4 Set air volumes to values shown on the drawings so that the system is functional. Leave ready for Test and Balance Contractor.

END OF SECTION

SECTION 233719 – WALL LOUVERS

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. Division 23 Common Work Results for HVAC sections apply to work of this section.

C. Extent of wall louver work is indicated by drawings and schedules, and by requirements of this section.

D. Refer to other Division 23 sections for ductwork, duct accessories, and controls work.

1.2 AMCA Compliance: Test and rate louvers in accordance with AMCA Standard 500. Test and rate louvers in hurricane-prone regions with AMCA Standard 540 and AMCA Standard 550. Provide AMCA certified rating seal.

1.3 Approval Submittals: Submit manufacturer's technical product data for louvers including model number, accessories furnished, construction, finish, mounting details, and performance data.

1.4 O&M Data Submittals: Submit maintenance data, including cleaning of finishes. Include this data and a copy of approval submittals in O&M Manual.

PART 2 - PRODUCTS

2.1 General: Except as otherwise indicated, provide manufacturer's standard louvers where shown, of size, shape, capacity and type indicated, constructed of materials and components as indicated, and as required for complete installation. Provide Kynar 500 coated, corrosion resistant finish; color to be selected by the Architect.

2.2 Acceptable Manufacturers: Subject to compliance with requirements, submit products by Arrow, Greenheck, Pottorff, Ruskin, or AMCA-labeled approved equal.

2.3 Substrate Compatibility: Provide louvers with 3-inch or 4-inch frame unless otherwise indicated, flange and sill extension piece that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.

2.4 Materials: Construct of aluminum extrusions, ASTM B 221, Alloy 6063-T5. Weld units or use stainless steel fasteners.

2.5 Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh aluminum wire bird screens mounted in removable extruded aluminum frames.

2.6 Wind-Driven Rain Resistant Louvers in Florida: Ruskin EME3625MD, Greenheck EVH-302D, Pottorff ECV-345-MD. Where indicated, provide parallel blade, low-leakage, 120 VAC motorized damper with spring return in combination with the louver (similar to Ruskin CD-40).

PART 3 - EXECUTION

3.1 Install where shown on the drawings in accordance with the manufacturer's printed instruction. Exercise care to prevent scratches.

3.2 Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of louvers with other work.

3.3 Verify size of louvers shown on drawings prior to fabrication. Coordinate with wall openings. Sizes may be altered subject to approval by Engineer provided free area remains approximately the same as indicated.

END OF SECTION

SECTION 237339 – GAS-FIRED HEATING 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. Division 23 Common Work Results for HVAC sections apply to work of this section.

C. Extent of gas-fired heating unit work is indicated by drawings and schedules, and requirements of this section.

D. Refer to other Division 23 sections for piping, controls, ductwork, and testing, adjusting, and balancing in conjunction with gas-fired heating units (not work of this section).

E. Refer to Division 26 sections for power connection on gas-fired heating units. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

F. Refer to other Division 23 sections for automatic temperature controls not factory-installed, required in conjunction with gas-fired heating units (not work of this section).

1.2 Codes and Standards:

A. ANSI Compliance: Construct and install gas-fired heating units in accordance with latest ANSI standards.

B. NFPA Compliance: Install fuel gas piping and gas-fired heating units in accordance with NFPA 54 "National Fuel Gas Code".

C. AGA Compliance: All units shall be AGA certified.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights, furnished specialties and accessories; and installation and start-up instructions. Submit manufacturer's assembly-type drawings indicating dimensions, required clearances, and methods of assembly of components.

1. Infrared heaters
2. Vibration isolation

B. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to gas-fired heating units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and

portions to be field-installed.

1.4 O&M Data Submittals: Submit maintenance data and parts list for infrared heaters, control, and accessory; including "trouble-shooting" maintenance guide. Include this data, product data and a copy of approval submittals in O&M manual.

PART 2 - PRODUCTS

2.1 Gas Infrared Heaters:

A. General: Provide natural gas-fired infrared space heaters as indicated, of type and minimum capacity as scheduled, and as specified herein.

B. Construct casing of galvanized steel with baked enamel finish. Provide integral inserts for hanger rods.

C. Construct heat exchanger of welded aluminum, stainless steel, or cast iron. Provide round flue collar.

D. Construct burner of same material as heat exchanger and include integral burner crossover. Design burner to be suitable for fuel specified.

E. Provide the following controls, factory-piped and prewired to an electrical junction box mounted on unit:

1. 115 or 24 volt automatic gas valve.
2. Safety pilot with 100% shutoff.
3. Pressure regulator with leak limiting device.
4. Manual main and adjustable pilot valves.
5. High limit switch.

F. Provide temperature controls consisting of line or low voltage room thermostat with thermostat guard.

G. Provide the following accessories:

1. Electric spark ignition.
2. Gas valve providing modulated control from 100% to approximately 50% of full unit rating.

H. Acceptable Manufacturers: Subject to compliance with requirements, provide gas unit heaters by Modine, Reznor, Space-Ray, or approved equal.

2.2 Gas Vents: Provide Type B double wall gas vent system for gas-fired appliances, except where noted otherwise on the drawings. Metalbestos Style RV(3"-8") or QC(10"-24"). The system shall include pipe, top, flashing cone, storm collar, joist shield, support plates, firestops, and fittings as required by the manufacturer for a complete installation. Acceptable Manufacturer:

Subject to compliance with requirements, provide products of one of the following: Metalbestos, Hart and Cooley, or approved equal.

2.3 Vibration Isolation: Provide vibration isolation products complying with Division 23 section "Vibration Isolation" and the following listing:

A. Hangers: Type HA1, HA2, HA3 as applicable.

PART 3 - EXECUTION

3.1 Examine areas and conditions under which gas-fired heating units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 General: Install gas-fired heating units as indicated, and in accordance with manufacturer's published installation instructions.

3.3 Hang units from substrate using threaded rods and building attachments, secure rods to unit hanger attachments. Adjust hangers so unit is plumb and level.

3.4 Access: Provide access space around gas-fired heating units for service as indicated, but in no case less than that recommended by manufacturer.

3.5 Vibration Isolation: Mount gas-fired heating units on vibration isolators, in accordance with the requirements of Division 23 section “Vibration Isolation” and the manufacturer’s instructions.

3.6 Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical Installer. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.7 Coordinate installation of gas piping to ensure that proper gas pressure is available and that gas piping union, drip leg and runout do not interfere with servicing or removal of unit.

3.8 Install gas vents in accordance with NFPA 54 and the manufacturer's instructions. Provide all flashing and related materials.

3.9 Startup: Check entire assembly for correctness of installation, alignment, and control sequencing. Start all component parts in proper sequence. Make all adjustments required to ensure proper smooth quiet operation.

END OF SECTION

SECTION 238126 – SPLIT-SYSTEM AIR CONDITIONING 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. Division 23 Common Work Results for HVAC sections apply to work of this section.

C. Extent of split-system air conditioning unit work is indicated by drawings and schedules, and requirements of this section.

D. Refer to other Division 23 sections for piping, ductwork, and testing, adjusting, and balancing of split-system air conditioning units (not work of this section).

E. Split-system air conditioning units shall be owner furnished, contractor installed where indicated by drawings and schedules.

1.2 Quality Assurance:

A. Provide units tested by UL, ARL or ETL.

B. Construct refrigeration system in accordance with ASHRAE 15 (ANSI B 9.1) "Safety Code for Mechanical Refrigeration".

C. Test and rate units in accordance with the applicable AHRI standards and provide certified rating seal. Sound test and rate units in accordance with AHRI 270.

D. Provide units with system efficiency ratings that meet or exceed the Florida Energy Conservation Code and schedules on the drawings.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer's technical product data, including dimensions, ratings, electrical characteristics, weight, capacities, materials of construction, and installation instructions.

1. Split-system air conditioning units.
2. Vibration isolation.

1.4 O&M Data Submittals: Submit manufacturer’s maintenance data including parts list. Include with a copy of approval submittals and wiring diagrams in O&M Manual.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide split-system air conditioning units by Trane or approved equal.

2.2 General:

A. Units shall be factory-assembled, wired and tested. All controls shall be factory-adjusted and preset to the design conditions.

B. Casings: Construct of heavy gauge steel (or aluminum) formed panels rigidly reinforced and braced. Each unit shall be provided with removable panels to permit the unit (including fans and compressors) to be properly maintained and serviced. Entire casing shall be painted with factory-applied finish. Casing for outdoor units shall be provided with weatherproof construction with all seams bolted.

2.3 Condensing Unit:

A. Condenser Fans and Drives: Fan shall be of rustproof construction: hot-dipped galvanized steel, stainless steel or aluminum. Unit shall have a variable speed motor suitable for the duty indicated. Provide a close fretwork galvanized steel or non-ferrous fan and guard. Motors shall be the permanently lubricated type, resiliently mounted.

B. Condenser Coil: Construct of copper tubes and copper or aluminum fins. Provide inlet guard to protect condenser fins. Provide seacoast or heresite coating on condenser coil.

C. Compressor: Shall be scroll design with vibration isolation. Each compressor shall have separate refrigerant circuit. Motors shall be ball bearing, high starting torque, low starting current type for compressor service. Compressors shall not produce objectionable noise or vibration inside the building. Compressors shall have five (5) year warranty. Provide multi-stage or variable speed compressor machines if scheduled.

D. Service Valves: Provide for high and low pressure readings.

E. Supports: Provide concrete pad a minimum of 4" larger than the unit on all sides with chamfered edges.

2.4 Evaporator Unit:

A. Interior of unit shall be thermally and acoustically insulated with minimum R-4.2 insulation. Provide removable panels to permit the unit to be properly serviced and maintained.

B. The evaporator shall include centrifugal fan, fan motor, and lubricated bearings. Motors shall be high efficiency type. Provide cooling coils constructed of copper tubes and copper or aluminum fins. Filters and coils shall be selected for a maximum face velocity of 500 fpm. Provide thermal expansion valve, sight glass, refrigerant drier, strainer, controls and other necessary devices for a completely automatic unit.

C. Each unit shall be equipped with sloped IAQ drain pans under the entire evaporator coil to prevent condensate carry-over.

2.5 Electric Heater Section:

A. Provide electric heating coils controlled by one or more magnetic contactors. Three phase coils shall be wired for balanced current in each wire, if possible. Furnish and install necessary overheating and airflow controls to meet the requirements of the National Electric Code. Provide built-in airflow switch and heater interlock relay.

B. Heaters shall be factory-mounted and wired with all required fuses and contactors to provide single point connection.

2.6 Unit Controls:

A. All safety and operational controls shall be factory wired.

B. Safety and Operational Control Features:

Internal compressor overtemperature protection.
Crankcase heaters.
Individual motor overcurrent protection.
High pressure cutout.
Low pressure cutout.
Anti-recycle timer (5-minute).
Timer-type defrost control.
Liquid line solenoid.

C. Room thermostat shall be low voltage, remote-mounted with sub-base and thermometer for controlling heating and cooling cycles. The fan selector shall include "AUTO-ON" controls. The system selector shall include "OFF-COOL-HEAT-EM HT" controls.The room thermostats shall be manually adjustable by occupants and shall indicate setting and temperature in degrees Fahrenheit. Coordinate thermostats with multiple zone control damper systems where specified.

2.7 Refrigerant Piping:

A. Copper tubing 3/4" and smaller: Type ACR, soft annealed temper with cast copper-alloy fittings for flared copper tubes and flared joints.

B. Copper tubing 3/4" and larger: Type ACR, hard-drawn temper tubing with wrought-copper, solder-joint fittings and brazed joints.

C. Silver solder material: Silver solder bearing at least 15% silver; Sil Fos.

2.8 Basic Vibration Isolation: Provide vibration isolation products complying with Division 23 section "Vibration Isolation" and the following list:

A. Equipment Mounting: Type EM5.

PART 3 - EXECUTION

3.1 Installation: Install in accordance with producer's printed instructions.

3.2 Condensing Unit Support: Mount units on concrete pads with manufacturer's recommended service and operating clearance.

3.3 Air Handling Unit Support: Hang air handling units level and plumb from structure using threaded rods and vibration isolators. Where units are above ceilings, provide secondary drain pans.

3.4 Brush out fins on all coils.

3.5 Refrigerant Piping: Comply with ANSI B31.5, "Refrigerant Piping," (except lower pressure limits below 15 psig), and ASHRAE 15 (ANSI B9.1). Make all joints carefully and neatly. Clean pipe and fittings before fluxing. Remove burrs. Braze by the sweat method using Sil Fos. Install field installed refrigerant devices and valves as required.

3.6 Testing: After job erection, or modification of factory installed piping, pressure test for leaks at 150 psig using a nominal amount of a suitable tracer refrigerant and dry nitrogen or a suitable refrigerant. Perform leak tests with an electronic halide leak detector. Refrigeration piping will not be accepted unless it is gas tight.

3.7 Evacuation: After completing the successful pressure test, multiple-evacuate the system. Leave the compressor isolation valves shut and connect the vacuum pump to both the high and low sides. Evacuate the system to an absolute pressure of 1,500 microns. Then break vacuum to 2 psig with dry nitrogen. Repeat this process. Install the proper biflow drier in the liquid line and evacuate the system to 500 microns. Leave vacuum pump running for at least two hours without interruption. Break vacuum with the refrigerant to be used and raise pressure to 2 psig. Do not operate compressors during the evacuation procedure.

3.8 Charging: After completing the successful evacuation procedure, charge refrigerant directly to the system from the original containers through a filter drier. Charge to the manufacturer's stated conditions of pressure for required temperature. Weigh the refrigerant added and record on the startup report.

3.9 Construction Filters: Provide 1" thick filters in all units during construction. After construction

(but prior to the test and balance being performed) install clean final filters.

3.10 Cleaning: Clean tar and all other soil from housing exterior. Leave ready for Division 7, Caulking Work. Caulk around pipe sleeves.

3.11 Condensate Drain: Pipe trapped copper or PVC condensate drain (full size of unit outlet) to nearest floor/roof drain or as shown on the drawings. Refer to Division 23 section "HVAC Piping Insulation" for pipe insulation.

3.12 Startup: Check entire assembly for correctness of installation, alignment, and control sequencing. Start all component parts in proper sequence. Make all adjustments required to insure proper smooth quiet operation.

END OF SECTION

SECTION 238128 – DUCTLESS SPLIT-SYSTEM AIR CONDITIONING 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. Division 23 Common Work Results for HVAC sections apply to work of this section.

C. Ductless split-system air conditioning units shall be owner furnished, contractor installed where indicated by drawings and schedules.

1.2 Quality Assurance:

A. Test and rate split system air conditioning units in accordance with AHRI Standard 210, 240 or 360 as applicable, and provide certified rating seal.

B. Construct refrigeration system in accordance with ASHRAE 15 (ANSI B 9.1) "Safety Code for Mechanical Refrigeration".

C. Provide units with system efficiency ratings that meet or exceed the Florida Energy Conservation Code and schedules on the drawings.

D. Provide units that are designed, manufactured, and tested in accordance with UL or ETL requirements.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer's technical product data, including dimensions, ratings, electrical characteristics, weight, capacities, materials of construction, and installation instructions. Submit assembly-type drawings showing all piping and electrical connections and all mounting requirements. Show methods of fastening and assembly of components. Provide wiring diagrams.

1.4 O&M Data Submittals: Submit manufacturer’s maintenance data including parts list. Include with a copy of approval submittals in O&M Manual.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide ductless split-system air conditioning units by Mitsubishi, Trane, or approved equal.

2.2 General:

A. Casings: Construct of painted mill galvanized steel (or aluminum) formed panels rigidly reinforced and braced. Each unit shall be provided with removable panels to permit the unit (including fans and compressors) to be properly maintained and serviced.

2.3 Condensing Unit:

A. Condenser Fans and Drives: Fan shall be of rustproof construction: hot-dipped galvanized steel, stainless steel or aluminum. Unit shall have a variable speed motor suitable for the duty indicated. Provide a close fretwork galvanized steel or non-ferrous fan and guard. Motors shall be the permanently lubricated type, resiliently mounted.

B. Condenser Coil: Construct of copper tubes and copper or aluminum fins. Provide inlet guard to protect condenser fins. Provide seacoast or heresite coating on condenser coil.

C. Compressor: Shall be scroll design with vibration isolation. Compressors shall not produce objectionable noise or vibration inside the building. Compressors shall have five (5) year warranty.

D. Service Valves: Provide for high and low pressure readings.

E. Supports: For equipment installed on grade, provide concrete pad 4" larger than the unit on all sides.

2.4 Evaporator Unit:

A. Interior of unit shall be thermally and acoustically insulated with 1-inch fiberglass insulation. Provide removable panels to permit the unit to be properly serviced and maintained.

B. The evaporator shall include variable speed, direct drive fan. Provide cooling coil, snap-out washable filters, refrigerant drier, controls, and other necessary devices for a completely automatic unit. Coils shall have copper tubes and aluminum fins.

2.5 Controls:

A. All safety and operational controls shall be factory wired.

B. Provide remote microprocessor-based controls with room thermostat, timer, and fan speed switch.

2.6 Refrigerant Piping:

A. Copper tubing 3/4" and smaller: Type ACR, soft annealed temper with cast copper-alloy fittings for flared copper tubes and flared joints.

B. Brazing material: Silver solder bearing at least 15% silver; Sil Fos.

2.7 Basic Vibration Isolation: Provide vibration isolation products complying with Division 23 section "Vibration Isolation" and the following list:

A. Equipment Mounting: Type EM5.

PART 3 - EXECUTION

3.1 Installation: Install in accordance with producer's printed instructions.

3.2 Condensing Unit Support: Install floor-mounted condensing units on vibration isolation on concrete pads with manufacturer’s recommended service and operating clearance.

3.3 Mount condensing units on neoprene pads for vibration isolation.

3.4 Brush out fins on all coils.

3.5 Refrigerant Piping: Comply with ANSI B31.5, “Refrigerant Piping,” (except lower pressure limits below 15 psig), and ASHRAE 15 (ANSI B9.1). Make all joints carefully and neatly. Clean pipe and fittings before fluxing. Remove burrs. Braze by the sweat method using Sil Fos.

3.6 Testing: After job erection, pressure test for leaks at 150 psig using a nominal amount of a suitable tracer refrigerant and dry nitrogen or a suitable refrigerant. Perform leak tests with an electronic halide leak detector. Refrigeration piping will not be accepted unless it is gas tight.

3.7 Evacuation: After completing the successful pressure test, multiple-evacuate the system. Leave the compressor isolation valves shut and connect the vacuum pump to both the high and low sides. Evacuate the system to an absolute pressure of 1,500 microns. Then break vacuum to 2 psig with dry nitrogen. Repeat this process. Install the proper biflow drier in the liquid line and evacuate the system to 500 microns. Leave vacuum pump running for at least two hours without interruption. Break vacuum with the refrigerant to be used and raise pressure to 2 psig. Do not operate compressors during the evacuation procedure.

3.8 Charging: After completing the successful evacuation procedure, charge refrigerant directly to the system from the original containers through a filter drier. Charge to the manufacturer’s stated conditions of pressure for required temperature. Weigh the refrigerant added and record on the startup report.

3.9 Cleaning: Clean tar and all other soil from housing exterior. Leave ready for Division 7, Caulking Work. Caulk around pipe sleeves.

3.10 Condensate Drain: Pipe trapped copper or PVC condensate drain (full size of unit outlet) to nearest floor drain or as shown on the drawings. Refer to Division 23 section "HVAC Piping Insulation" for pipe insulation.

3.11 Startup: Check entire assembly for correctness of installation, alignment, and control sequencing. Start all component parts in proper sequence. Make all adjustments required to ensure proper smooth quiet operation.

END OF SECTION

SECTION 238416 – DEHUMIDIFIERS

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. Division 23 Common Work Results for HVAC sections apply to work of this section.

C. Refer to other Division 23 sections for piping, ductwork, and testing, adjusting, and balancing of dehumidifiers (not work of this section).

D. Refer to Division 26 sections for power supply wiring from power source to power connection on dehumidifiers. Include disconnects and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer. Interlock wiring between dehumidifiers, air handling units, and field-installed control devices.

E. Provide the following electrical work as work of this section, complying with requirements of Division 26 sections: control wiring between field-installed controls, indicating devices, and dehumidifier control panels. Interlock wiring specified as factory-installed is work of this section.

F. Dehumidifiers shall be owner furnished, contractor installed where indicated by drawings and schedules.

1.2 Approval Submittals:

A. Product Data: Submit manufacturer's product data for dehumidifiers showing dimensions, capacities, ratings, performance characteristics, and installation instructions. Submit assembly-type drawings showing unit dimensions, construction details, and field connection details.

B. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to dehumidifiers. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

1.3 O&M Data Submittals: Submit maintenance instructions. Submit a copy of approval submittals. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide dehumidifiers by Aprilaire or approved equal.

2.2 General: Provide self-contained, cabinet type electric dehumidifiers of the type, size, and capacity as shown on the drawings.

2.3 Cabinet: Provide painted steel or aluminum cabinet with locking access door for electrical compartment.

2.4 Controls: Provide microprocessor control for modulation and sequencing of dehumidification system. Provide wall-mounted humidistat with local display for setpoint adjustment.

PART 3 - EXECUTION

3.1 Examine areas and conditions under which dehumidifiers are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 General: Install dehumidifiers as indicated, and in accordance with the manufacturer's installation instructions. Observe required upstream and downstream unobstructed duct recommendations.

3.3 Locate units as shown, coordinate with other trades to assure correct orientation of units.

3.4 Install trapped, copper or PVC condensate drain piping and extend to disposal point as part of this section’s work.

3.5 Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical Installer. Coordinate with controls contractor.

3.6 Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment startup until wiring installation is acceptable to equipment installer.

3.7 After construction is completed, clean unit exposed surfaces.

3.8 Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION

SECTION 260000 - GENERAL ELECTRICAL

PART 1 - GENERAL

1.1 The work covered by this division consists of providing all labor, equipment and materials and performing all operations necessary for the installation of the electrical work as herein called for and shown on the Drawings. The work shall include but shall not be limited to the following:

Provide all power, lighting, fire alarm, intercom, telephone, communications, and other electrical systems for the project. Fully coordinate all electrical requirements of equipment being furnished by other Divisions under this construction contract. Each system shall be complete and fully functional.

1.2 Related Documents:

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

B. Provisions of this Section apply to work of all Division 26 Sections.

C. All control wiring for Division 23 shall be governed by Division 26 requirements. All control wiring shall be in conduit in compliance with the Specifications.

D. Review all project Drawings to be aware of conditions affecting work herein.

1.3 Definitions:

A. Provide: Furnish, install, and test, complete and ready for intended use.

B. Furnish: Supply and deliver to project site, ready for subsequent requirements.

C. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.

1.4 Permits and Fees: Contractor shall obtain all necessary permits, meters, and inspections required for his work and pay all fees and charges incidental thereto.

1.5 Verification of Owner's Survey Data: Prior to commencing any excavation or grading the Contractor shall satisfy himself as to the accuracy of all survey data indicated on the Drawings and/or provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the survey data, he shall immediately notify the Engineer. Commencement by the Contractor of any excavation or upgrading shall be held as an acceptance of the survey data by

him after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions or inaccuracies of the said survey data.

1.6 Delivery and Storage of Materials: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. All material shall be stored to provide protection from the weather and accidental damage.

1.7 Extent of work is indicated in the Drawings, Schedules, and Specification. Singular references shall not be construed as requiring only one device if multiple devices are shown on the Drawings or are required for proper system operation.

1.8 Field Measurements and Coordination:

A. The intent of the Drawings and Specifications is to obtain a complete and satisfactory installation. Separate divisional Drawings and Specifications shall not relieve the Contractor or Subcontractors from full compliance of work of his trade indicated on any of the Drawings or in any Section of the Specifications. Report conflicts prior to start of work.

B. Verify all field dimensions and locations of equipment to ensure close, neat fit with other trades' work. Make use of all Contract Documents and approved shop drawings to verify exact dimension and locations. Do not scale electrical drawings; rely on dimensions shown on architectural or structural drawings.

C. Coordinate work in this Division with all other trades in proper sequence to ensure that the total work is completed within Contract time schedule and with minimum cutting and patching.

D. Locate all equipment, materials, and apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on mechanical drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others. Provide all required work clearances as defined in the NEC.

E. Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings, and passageways. Cut no structural members without written approval from Engineer or Architect.

F. Carefully examine any existing conditions, piping, and premises. Compare Drawings with existing conditions. Report any observed discrepancies. Written instructions will be issued by the Engineer to resolve discrepancies.

G. Because of the small scale of the Drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members, wall and partition locations, trusses, and rooms dimensions and take actual measurements on the job. Locate material, equipment, and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment or material cannot be fitted, the Engineer

shall be consulted. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

H. Coordinate all equipment being supplied in other divisions to ensure proper electrical connections. Obtain full manufacturer's electrical information and coordinate with electrical system specified. Make adjustments prior to submitting electrical shop drawings. Mark on shop drawings necessary modifications due to equipment being supplied. Contractor shall be responsible for replacement and upgrade of electrical equipment if at time of completion, it is apparent that electrical requirements do not meet the electrical system's supply.

I. Verify all ceiling clearances prior to ordering panelboards and switchboards. Dimensioned drawings are required for all electrical rooms showing actual plan and elevation layouts. Any equipment ordered prior to verifying that it will fit, will be returned at the contractor's expense. Coordinate panelboard and switchboard locations with structural members, beams and column foundations.

J. Coordinate location of electrical equipment with pipes and duct work being supplied by other Divisions. The equipment space including all referenced NEC clearances shall be maintained. If any pipes or duct work violate any electrical clearance requirements, it shall be removed and relocated at the contractor's expense. Drip pans are not permitted unless specifically called for in the construction documents.

K. Guarantee and Service:

1. The Contractor shall guarantee labor, materials and equipment for a period of one (1) year from Substantial Completion, or from Owner's occupancy, whichever is earlier. Contractor shall make good any defects and shall include all necessary adjustments to and replacement of defective items without expense to the Owner.
2. In addition to the manufacturer's guarantee of each item, Contractor shall provide his standard guarantee after final acceptance and make good any defects of materials or workmanship occurring during this period without expense to the Owner.
3. Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving Contractor of his responsibilities during guarantee period.

1.9 Shop Drawings:

A. Shop drawings, product literature, and other approved submittals will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions and Division 1 Specification sections and the following:

1. Submittals shall include all applicable items referenced in each specification section, and not include items from more than one specification section in the same submittal.
2. Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control numbers, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approved stamps. A sample cover sheet is included at the end of this section.
3. Submittals shall have been reviewed and approved by the General Contractor (or Prime Contractor). Evidence of this review and approval shall be an "Approved" stamp with a signature and date on the cover sheet.

4. Submittals shall be combined into a single submittal package with a table of contents. Submittals shall not be issued as multiple individual submittal packages.
5. Submittals that include a series of fixtures or devices (such as lighting fixtures) shall be organized by the fixture number and be marked accordingly. Each fixture must include all items associated with that fixture regardless of whether or not those items are used on other fixtures.
6. The electrical design shown on the drawings supports the mechanical equipment basis of design specifications at the time of design. If mechanical equipment is submitted with different electrical requirements, it is the responsibility of the mechanical contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the mechanical submittal with a written statement that this change will be provided at no additional cost. Mechanical submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost.

B. Before ordering any materials or equipment, and within 30 days after the award of Contract the Contractor shall submit to the Engineer one complete schedule showing the make, type, manufacturer's name and trade designation of all equipment.

1. This schedule shall be accompanied by six (6) copies of the manufacturer's printed specifications and shop drawings for each piece of equipment or specialty and shall give dimensions, diagrams, descriptive literature, capacity or rating, kind of material, finish, guarantee, etc., and such other detailed information as the Engineer may require.
2. When approved, such schedule shall be an addition to these Specifications, and shall be of equal force in that no deviation will be permitted except with the approval of the Engineer.
3. Each shop drawing shall reference the Specification section.
4. The submittal should reference any delivery/scheduling problems with the equipment being supplied.
5. The submittal shall not contain any equipment and/or systems that have not been either listed in the construction documents or provided in an addendum as “approved for bidding”. This formality may be waived by the Engineer, if in his opinion, it is to the Owner’s benefit.

C. If shop drawings show variation from the requirements of the Contract Documents, the Contractor shall make specific mention of such variation in his letter of transmittal. If acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract.

D. Review of shop drawings, descriptive literature, catalog data, or schedules by the Engineer shall not relieve the Contractor from responsibility for deviations from Contract Drawings or Specifications, unless he has in writing called to the attention of the Engineer such deviation at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings, descriptive literature, catalog data, or schedules. Any feature or function specified but not mentioned in the submittal shall be assumed to be included per the specification.

E. Submit shop drawings and any other drawings specifically called for in other sections. Shop drawings shall consist of plans, sections, elevations, and details to scale (not smaller than 1/4" per foot), with dimensions clearly showing the installation. Direct copies of small-scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account

equipment furnished under other Sections and shall show space allotted for it. Include construction details and materials.

F. Submit product data after award of the Contract and before any equipment or materials are purchased. Product data are defined as manufacturer's printed literature specifically marked to indicate size and model and accompanied by rating sheets listing values showing that equipment meets scheduled or specified values. Properly coded stamp from the Engineer on returned submittal is required before ordering equipment.

G. Coordinate with other division's supplying equipment prior to submitting shop drawings.

H. Shop drawings shall be submitted in one package unless approved otherwise by the Engineer. Provide an index of sections, list manufacturers, and "as-specified" or not. Each Specification Section shall be tabbed with equipment inserted.

I. Electrical Room Drawings: A detailed, 1/4"=1'-0" scaled plan view drawing shall be submitted for each electrical room to ensure that the equipment being supplied will fit properly. Include on the drawings any obstruction from building structural or mechanical. Review all duct work and piping shop drawings to ensure proper clearance. Specific grounding requirements shall be noted on the drawings. This includes additional driven grounds and bonding to building steel, water piping, and foundation rebar. This drawing shall make specific mention of any NEC violation. Conduit and/or equipment placement shall take into account any structural or foundation interference. All equipment within the electrical room shall be labeled and actual dimensions shown. The drawings shall be submitted with the shop drawings and manufacturer's product sheets. Failure to supply scaled drawings shall be the basis of rejecting the entire submittal package.

1.10 Test Reports and Verification Submittals: Submit test reports, certifications, and verification letters as called for in other sections. Contractor shall coordinate the required testing and documentation of system performance such that sufficient time exists to prepare the reports, review the reports, and take corrective action within the scheduled contract time.

1.11 O & M Data Submittals: Submit Operations and Maintenance data as called for in other sections. When a copy of approved submittals is included in the O & M Manual, only the final "Furnish and Submitted" or "Furnish as Corrected" copy shall be used. Contractor shall organize these later in the O & M Manuals tabbed by specification number. Prepare O & M Manuals as required by Division 1 and as described herein. [Submit O & M manuals on CD-Rom in addition to required hard bound copies.] Submit manuals at the substantial completion inspection.

PART 2 - PRODUCTS

All materials shall be new and unused, Owner-supplied, or reused as shown on the Drawings, the best of their respective kinds, suitable for the conditions and duties imposed on them. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following Sections.

2.1 Equipment and Materials

A. Equipment and materials furnished under this Division shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of three years. Where practical, all of the components shall be products of a single manufacturer in order to provide proper coordination and responsibility. Where required, Contractor shall furnish proof of installation of similar equipment or materials.

B. Each item of equipment shall bear a nameplate showing the manufacturer's name, trade name, model number, serial number, ratings, and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated or painted.

C. The label of the approving agency, such as UL or NEMA, by which a standard has been established for the particular item shall be in full view. Materials shall be UL-listed for the application specified or indicated on the Drawings or Specifications.

D. The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be a product of the manufacturer's latest design.

E. A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

F. Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.

G. Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material, and type of construction desired. Manufacturer's products shown on the Drawings have been used as basis for design; it shall be the Contractor's responsibility to ascertain that alternate manufacturer's products meet detailed specifications and that size and arrangement of equipment are suitable for installation.

H. Model Numbers: Catalog numbers and model numbers indicated in the Drawings and Specifications are used as a guide in the selection of the equipment and are only listed for the Contractor’s convenience. The Contractor shall determine the actual model numbers for ordering equipment and materials in accordance with the written description of each item and with the intent of the Drawings and Specifications.

2.2 Requests for Substitution:

A. Where a particular system, product or material is specified by name, consider it as standard basis for bidding, and base proposal on the particular system, product or material specified. Other systems, products, equipment, or materials may be accepted only if in the opinion of the Engineer, they are equivalent in quality and workmanship and will perform satisfactorily its intended purpose. The Engineer shall approve all such substitutions in materials or equipment in writing. This shall occur prior to bidding.

B. In making requests for substitutions, the Contractor shall list the particular system, product, equipment or material he wishes to substitute and at bid time the Contractor shall state the amount he will add or deduct from his base bid if the substitution is approved by the Engineer. If the Contractor allows no deduction or addition to the base bid for such substitution, it shall be so stated on the request.

C. Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

1. Required product cannot be supplied in time for compliance with Contract time requirements.
2. Required product is not acceptable to governing authority, or determined to be non-compatible, or cannot be properly coordinated, warranted, or insured, or has other recognized disability as certified by Contractor.
3. Substantial cost advantage is offered Owner after deducting offsetting disadvantages including delays, additional compensation for redesign, investigation, evaluation and other necessary services and similar considerations.

D. All requests for substitution shall contain a "Comparison Schedule" and clearly and specifically indicate any and all differences or omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include but shall not be limited to data as follows for both the specified and substituted products:

1. Principle of operation.
2. Materials of construction or finishes.
3. Thickness of materials.
4. Weight of item.
5. Deleted features or items.
6. Added features or items.
7. Changes in other work caused by the substitution.
8. Performance and rating data.

If the approved substitution contains differences or omissions not specifically called to the attention of the Engineer, the Owner reserves the right to require equal or similar features to be added to the substituted products at the Contractor's expense.

2.3 Prior Approval: Prior Approval shall be required for any manufacturer other than those listed for all specified items in the Drawings and Specifications. Submit all requests for approval of the alternate manufacturer's products two weeks prior to bid opening. Approval will be in the form of an Addendum to the Specifications and Drawings. Clearly indicate all differences between the specified and proposed product following the guidelines for substitution herein. This requirement may be waived if, in the opinion of the Engineer, it is in the best interest of the Owner. Submittals received after the award of the bid for equipment that has not been Prior Approved is subject to immediate rejection. *Any Engineering time required due to equipment that has not been Prior Approved is subject to billing charged directly to the contractor at the Engineer's current billing rate.*

PART 3 - EXECUTION

3.1 Workmanship: All materials, fixtures, and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat and/or workmanlike appearance, or do not allow adequate space for maintenance, shall be removed and replaced when so directed by the Engineer.

3.2 Coordination

A. The Contractor shall be responsible for full coordination of the electrical systems with shop drawings of the building construction so the proper openings and sleeves or supports etc., are provided for conduit, devices, or other equipment passing through slabs or walls.

B. Any additional steel supports required for the installation of any electrical equipment, etc., shall br provided by the Contractor.

C. It shall be the Contractor's responsibility to see that all equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the Drawings.

D. All connections to fixtures and equipment shown on the Drawings shall be considered diagrammatic unless otherwise indicated by a specific detail on the Drawings. The actual connections shall be made to fully suit the requirements of each case and adequately provide for servicing.

E. The Contractor shall protect equipment and fixtures at all times during storage and construction. He shall replace all equipment and fixtures, which are damaged as a result of inadequate protection. Any electrical equipment with electronic components shall be stored off-site in a climate-controlled facility until the building conditions are suitable for installation. Any equipment damaged or compromised by unprotected climate control, in the opinion of the Engineer, shall be replaced at contractor’s cost with factory new equipment.

F. Prior to starting and during progress of work, examine work and materials installed by others as they apply to work in this division. Report conditions, which will prevent satisfactory installation.

G. Start of work will be construed as acceptance of suitability of work of others.

H. The Contractor shall review all equipment being supplied by other divisions prior to ordering electrical equipment. Any conflicts between equipment being supplied and the electronic requirements on the drawings shall be corrected and incorporated into the electrical submittals prior to ordering equipment. Installation of the electrical system is the contractor’s acceptance of equipment requirements. Any conflict with equipment’s electrical requirements after electrical system has been installed shall be the responsibility of the contractor to make corrective action. Any corrective action shall be at the contractor’s expense.

3.3 Utilities Coordination: The Contractor shall meet with respective personnel of the telephone, cable TV and electric utilities and review all details of the service and distribution. All details shown on contract documents shall be verified for adequacy and accuracy. The Contractor shall incorporate any required revisions without additional cost to the Owner.

3.4 Construction Electrical Utilities: Provide all temporary wiring for power and light required for construction purposes and remove such temporary wiring when use is no longer required. The contractor shall be responsible to provide all cabinets, meter enclosures and conduit required by the local utility for the permanent electrical service.

3.5 Interruption of Service: Before any equipment is shut down for disconnecting or tie-ins, arrangements shall be made with the Engineer and this work shall be done at the time best suited to the Owner. Outages must be scheduled through the Engineer. The Engineer shall review extent, length, and timing of outages. Services shall be restored the same day. Provide temporary power or other services as required during outages. All overtime or premium costs associated with this work shall be invoiced in the base bid.

3.6 Cutting and Patching: Contractor shall be responsible for cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under these Specifications. Obtain permission from Engineer before cutting any structural items.

3.7 Equipment Setting: Bolt equipment directly to concrete pads or foundations, using hot-dipped galvanized anchor bolts, nuts and washers. Level equipment. All floor mounted equipment shall be provided with a housekeeping pad at least 4” in depth.

3.8 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 26. Obtain matched color coatings from the manufacturer and apply as directed by manufacturer. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required. If corrosion is found to be extensive by the Engineer, the equipment shall be removed and replaced with factory new at the expense of the contractor.

3.9 Clean-up: Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials and remove all oil and grease spots. Repaint or touch up as required to look like new. During progress of work, Contractor is to carefully clean and leave premises free from debris and in a safe condition.

3.10 Start-up and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, a qualified representative of the manufacturer shall do start-up. Alignment, lubrication, safety, and operating control shall be included in start-up check.

3.11 Record Drawings:

A. During the progress of the work the Contractor shall record on their field set of Drawings the corrections, variations, and deviations for systems which are not installed exactly as shown on the Contract Drawings.

B. Upon completion of the work, record drawings shall be prepared as described in the General Conditions, Supplementary Conditions, and Division 1 Sections.

3.12 Certificate of Occupancy:

Following items are required for issue of Certificate of Occupancy. These shall be provided at or before of Substantial Completion Inspection:

A. Provide certification that asbestos containing products were not used in the project.

B. Fire Alarm Certification. In addition, the documentation shall contain witnessed accounts of the shut-down of electrical and mechanical equipment and the operation of fire doors as required by Code and the Construction Documents.

C. Provide certification that the Intercommunications System is fully operational (If applicable).

D. Provide certification that all emergency lights and exit signs are operational.

E. Provide certification that all selective protective devices have been set according to the coordination study/recommendations including all ground fault selections.

3.13 Acceptance

A. Request inspections as required under the Supplementary or General Conditions. Conceal no work until inspected.

B. Punch List: Submit written confirmation that all punch lists have been checked and the required work completed. The contractor at the Engineer’s current billing rate shall pay for additional field time required by the Engineer to report or check on past punch list deficiencies.

C. Instructions: At completion of the work, provide a competent and experienced person who is thoroughly familiar with the project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems.

D. Operation and Maintenance Manuals: Furnish four complete manuals bound in ring binders and organized by system or section. Manuals shall contain:

1. Detailed operating instructions and instructions for making minor adjustments.
2. Complete wiring and control diagrams.
3. Routine maintenance operations.
4. Manufacturer's catalog data, service instructions, and parts list for each piece of operating equipment.
5. Copies of approved submittals.
6. Copies of all manufacturers’ warranties.
7. Copies of test reports and verification submittals.

E. Control Diagrams: Frame under glass and mount on equipment room wall. Include copy in O and M Manuals.

F. Test together and separately to determine that:

1. System is free from short circuits and other faults.
2. Motor starter overload devices are sized correctly.
3. Motors rotate correctly.
4. All equipment operates correctly and as specified.

G. Warranties: Submit copies of all manufacturers' warranties.

H. Record Drawings: Submit "Record Drawings".

I. Install engraved metal or plastic nameplates or tags on controls, panels, switches, starters, timers, and similar operable equipment, keyed by number to operating instructions. Dymo type labels are not acceptable.

J. Acceptance will be on the basis of tests and inspections of the work. A representative of the firm that performed the testing shall be in attendance to assist during inspection. Contractor shall furnish necessary electricians to operate system, make any necessary adjustments and assist with final inspection.

This is a sample cover sheet. Use one for each shop drawing.

PROJECT NAME
PROJECT NUMBER

SAMPLE

ARCHITECT/ENGINEER: Dell Consulting, LLC

CONTRACTOR: XYZ Construction

SUBCONTRACTOR: ABC Electrical Contractor

SUPPLIER: Jones Supply Co.

MANUFACTURER: Various

DATE: 2/12/07

Use whatever standard headings you want here

SECTION: 26 51 00 / Interior Lighting

1. Type A
2. Type B
3. Type C
4. Type D
5. Type E

List each item separately

Typical - list mfr name & model number

General Contractor's APPROVAL stamp must be on this sheet.

END OF SECTION

SECTION 260010 - CODES AND STANDARDS

PART 1 - GENERAL

1.1 All work under Division 26 shall be constructed in accordance with the codes and standards listed herein. The design has been based on the requirements of these codes and standards. While it is not the responsibility of the Contractor to verify that all work called for complies with these codes and standards, he shall be responsible for calling to the Engineer's attention any details on the Drawings and/or Specifications that are not in conformance with these or other codes and standards. Current issue of code applies unless specifically noted otherwise.

1.2 Comply with regulations and codes of suppliers of utilities.

1.3 Where no specific method or form of construction is called for in the Contract Documents, the Contractor shall comply with code requirements when carrying out such work.

1.4 Where code conflict exists, generally the most stringent requirement applies.

1.5 Codes or standards applying to a specific part of the work may be included in that section.

PART 2 - CODES AND STANDARDS

2.1 Codes:

A. Florida Building Code – Building – 2023

B. Florida Building Code – Test – Protocols for High Velocity Hurricane Zones – 2023

C. National Electrical Code (NFPA-70) – 2020

D. National Fire Alarm Code (NFPA-72) – 2019

E. Uniform Fire Code (NFPA 1) – 2021 Florida Edition

F. National Electrical Safety Code (NESC)

G. Life Safety Code (NFPA 101) – 2021 Florida Edition

2.2

2.3 Standards:

A. All electrical materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments:

1. American National Standard Institutes (ANSI)
2. Illuminating Engineering Society (IES)
3. Institute of Electrical and Electronics Engineers (IEEE)
4. National Electrical Manufacturer's Associations (NEMA)
5. National Fire Protection Association (NFPA)
6. Occupational Safety and Health Act (OSHA)
7. Underwriter's Laboratories, Inc. (UL)
8. TIA/EIA-568.1-E Commercial Building Telecommunications Infrastructure Standard
9. ANSI/EIA/TIA-569-E Commercial Building Standard for Telecommunications Pathways and Spaces
10. ANSI/EIA/TIA-606-C Administration Standard for the Telecommunications Infrastructure
11. ANSI/J-STD-607-D Generic Telecommunications Bonding and Grounding for Customer Premises
12. BICSI - Telecommunications Distribution Methods Manual (TDMM) – 14th Edition
13. SCTE - Society of Cable Television Engineers

PART 3 - EXECUTION

3.1 Not used.

END OF SECTION

SECTION 260020 - WORK REQUIRED FOR EQUIPMENT FURNISHED BY OTHER DIVISIONS

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. Division-26 Basic Electrical Materials and Methods Sections apply to work of this Section.

C. Review all project drawings to be aware of conditions affecting work herein.

PART 2 - PRODUCTS

2.1 Materials for this section are specified in the Section "Basic Materials and Methods."

PART 3 - EXECUTION

3.1 Make connections for the electrical power to equipment furnished and installed in other Divisions.

3.2 Provide raceway boxes, fittings, devices and conductors for the electrical power to equipment furnished and installed in the other Divisions.

3.3 Coordinate wiring and conduit requirements with equipment being furnished prior to rough-in.

3.4 Verify voltage, phase, and current requirements for all equipment being supplied by other divisions. Any modifications shall be incorporated into the electrical submittals with references to any modification and reason. The electrical system is designed around the specified equipment. Any change in the equipment shall be coordinated so that proper electrical protection is obtained. In addition, if the supplied equipment has higher minimum circuit ampacity that the equipment specified, the contractor shall call the modification to the Engineer’s attention and make necessary conduit, wire, circuit breaker and equipment changes to accommodate the higher ampacity requirements.

3.5 Any change from the specified equipment requirements shall be the responsibility of the contractor.

3.6 The electrical contractor shall meet with the Division 23 contractor and fully coordinate locations of mechanical equipment, duct work and piping to ensure that proper working

clearance as required in the NEC is obtained. Any conflict shall be reported to the Engineer in writing prior to the installation of any of the equipment. Refer to additional requirements for planning drawings.

3.7 Coordinate exact locations and electrical rough-in requirements with other Divisions prior to installation to ensure proper clearances and code requirements are met.

END OF SECTION

SECTION 260500 - ELECTRICAL RELATED WORK

PART 1 - GENERAL

1.1 All Division 1 Sections apply to all Division 26 Sections.

1.2 Coordinate for all cutting and patching. Contractor shall review all cutting and patching required prior to bidding and shall coordinate installation.

PART 2 - DIVISION 2 - SITEWORK

2.1 Specific requirements for excavation and backfill for underground conduit are contained in Section 26 05 50.

PART 3 - DIVISION 3 - CONCRETE

3.1 Perform the following as part of Division 26 work, complying with the requirements of Division 3, Concrete.

A. Curbs, foundations, and pads for electrical equipment.

B. Encasement of electrical work.

C. Underground structural concrete to accommodate electrical work.

D. Rough grouting in and around electrical work.

E. Patching concrete cut to accommodate electrical work.

PART 4 - DIVISION 4 - MASONRY

4.1 Refer to Division 4, Masonry for:

A. Patching openings to accommodate electrical work.

PART 5 - DIVISION 5 - METALS

5.1 Refer to Division 5, Metals for:

A. Supports for electrical work.

B. Framing openings for electrical equipment.

PART 6 - DIVISION 6 - WOOD

6.1 Refer to Division 6, Wood for:

A. Supports for electrical work.

B. Framing openings for electrical equipment.

PART 7 - DIVISION 7 - THERMAL & MOISTURE PROTECTION

7.1 Refer to Division 7, Thermal and Moisture Protection for:

A. Installation of all supports for electrical work.

B. Caulking and waterproofing of all wall and roof mounted electrical work.

7.2 Perform the following as part of Division 26 work, complying with Division 7 requirements.

A. Fire barrier penetration seals.

B. Caulking and related shielding around ducts and pipes for sound isolation and attenuation.

PART 8 - DIVISION 8 - DOORS AND WINDOWS

8.1 Refer to Division 8, Doors & Windows for:

A. Installation of all access doors for electrical work.

PART 9 - DIVISION 9 - FINISHES

9.1 Refer to Division 9, Finishes for:

A. Painting exposed conduit and equipment.

B. Painting structural metal and concrete for electrical work.

C. Painting access panels.

9.2 Colors shall be selected by the Architect for all painting of exposed electrical work unless specified herein.

9.3 Perform the following as part of Division 26 work.

A. Touch up painting of factory finishes.

PART 10 - DIVISION 23 - MECHANICAL

10.1 Mechanical Contractor shall furnish to Electrical Contractor all necessary nameplate data, equipment power requirements, wiring diagrams, etc., pertaining to the electrical phase of mechanical installation, as well as all required motors, on/off switches, warning lights, relays, and control devices.

10.2 Contractor shall furnish and install all power wiring, starters and contactors, and make final electrical connections to motors, on/off switches, warning lights, relays, and control devices.

10.3 Disconnect switches for mechanical equipment shall be furnished and installed by the Contractor, unless specifically noted on the Drawings as being furnished as part of mechanical equipment.

10.4 Wiring for controls as indicated on the electrical drawings shall be furnished and installed by the electrical contractor. Control wiring and signal wiring between field installed controls, indicating devices and unit control panels as part of mechanical energy management system shall be provided by Division 23, complying with the requirements of Division 26 specifications.

PART 11 - DIVISION 27 - TELECOMMUNICATIONS

11.1 See “Contractor Coordination and Responsibilities Note” on the Drawings.

END OF SECTION

SECTION 260511- REINFORCED CONCRETE FOUNDATIONS

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. This Section includes all concrete foundations for electrical equipment.

1.3 Quality Assurance

A. Concrete shall have a minimum 28-day compressive strength of 3,000 psi when cured and tested per ASTM C 31 and C 39. Comply with IEEE C 57.12.91.

PART 2 - PRODUCTS

2.1 Materials

A. Concrete:

1. Concrete shall have a minimum 28-day compressive strength of 3,000 psi when cured and tested per ASTM C 31 and C 39.
2. Concrete shall be placed within 1-1/2 hours after adding cement.
3. Slump range shall be 2 to 4 inches and air entrainment between 3 percent and 6 percent by volume.

B. Reinforcing Steel:

1. Shall be deformed bars conforming to ASTM A 615, Grade 60 sized as shown on the Drawings.
2. Reinforcing steel shall be supported with concrete blocks of the same strength as the concrete mix. Use of broken concrete brick or stone for supporting reinforcing steel shall not be permitted.

C. Expansion Joint Filler:

1. Shall conform to ASTM D 994, 1/2-inch thick.

D. Non-shrink Grout:

1. Non-shrink grout shall conform to the Corps of Engineers Specification for Non-shrink Grout, CRD-C586-78

2. Grout shall be fluid and shall be nonmetallic. Grout shall be nongas-liberating type, cement base, premixed product, requiring only the addition of water for the required consistency. All components shall be inorganic.

E. Forms:

1. Use new plywood for exposed areas, and shiplap or plywood for unexposed areas. Materials shall produce tight forms and an acceptable finish.

F. Form Ties:

1. Form ties shall be constructed so the tie remains embedded in the wall, except for the removable portion at each end.
2. Form ties shall have conical or spherical type inserts. Inserts shall be fixed to remain in contact with forming material, and shall be constructed so that no metal is within one inch of the concrete surface when forms, inserts, and tie ends are removed.
3. Wire ties shall not be used.

G. Anchor Bolts:

1. Unless otherwise indicated on the Drawings, anchor bolts shall have minimum yield strength of 75,000 psi.
2. The thread area plus 6 inches of the bolts shall be hot-dip galvanized. In no case shall less than the top 18 inches of the bolt be galvanized. The remainder of the bolt shall not be galvanized, painted, or coated with oil.

PART 3 - EXECUTION

3.1 Installation

A. Forms:

1. Forms shall be constructed accurately with tight joints to prevent the escape of mortar and to avoid the formation of fins.
2. Brace forms to prevent distortion during concrete placement.

B. Placing Reinforcing Steel:

1. Reinforcing steel shall be placed in accordance with CRSI, Recommended Practice for Placing Reinforcing Bars.
2. Minimum length of splices shall be 18 inches. Splices shall be tied with 18-gauge annealed wire.

C. Placing Concrete:

1. Prior to placing concrete, remove water from excavation and all debris and foreign material from forms.
2. Before depositing new concrete on old concrete, clean surface and pour a 1-inch layer of cement sand grout over the surface of the old concrete.
3. Place concrete in 2 ft. layers without segregation or loss of ingredients and without splashing forms or steel above. Vertical drop to final placement shall not exceed 6 feet.
4. Do not place concrete when ambient temperature is below 40 degrees F or approaching 40 degrees F and dropping.

D. Compaction:

1. Concrete shall be vibrated in place until it becomes uniformly plastic. Vibrators shall penetrate the fresh placed concrete and into the previous layer of concrete below.

E. Concrete Finishing:

1. Screed surfaces to true level planes. After absorption of initial water, float with wood float and trowel with steel trowel to a smooth finish.
2. Do not absorb wet spots with neat cement.
3. Foundation shall not vary from level more than 1/4 inch in 10 feet.

F. Removal of Forms: Forms shall not be removed until the concrete has set sufficiently to carry the dead load and construction load it has to sustain. Forms shall be removed with care to minimize scarring or other surface damage.

G. Finishing Formed Concrete Surface:

1. Cut out honeycombed and defective areas. Cut edges perpendicular to surface at least 1 inch deep, no featheredge shall be allowed. Soak area to be patched for 24 hours. Allow surface to drain free of standing water and patch with non-shrink grout.
2. When forms are removed, remove fins or projections from surface of exposed areas and rub surface with wood float to provide a uniform surface texture.

H. Concrete Protection and Curing: Protect fresh concrete from direct rays of the sun, drying winds, and wash by rain. When forms are removed and finishing completed, cure formed surfaces with curing compound applied in conformance with manufacturer's directions.

I. Concrete Quality Control: Contractor shall furnish certified test reports for the concrete used. Cost of taking, storing, and testing of sample cylinders shall be included in the bid price.

J. Concrete Testing:

1. Three representative cylinders of each batch of concrete shall be taken and tested as follows:
   a. 1 at 7 days
   b. 1 at 28 days
   c. 1 Spare
2. Test cylinders shall be taken at the site of the pour and shall be prepared and cured in a manner similar to the concrete work being done.
3. Cylinders shall be tested by an approved testing laboratory to verify the strength of the concrete.

K. Anchor Bolts: Anchor bolts shall be set level, square, plumb, to the correct elevation, and properly spaced. Anchor bolts shall not be reinforcing bar. After concrete is set, no force shall be applied to anchor bolts in an attempt to move them and correct their separation. Bolt holes on equipment base plates shall not be reamed or redrilled to fit an improper anchor bolt installation.

END OF SECTION

SECTION 260516 - SERVICE ENTRANCE METHODS AND MATERIALS – UNDERGROUND

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. Division-26 Basic Electrical Materials and Methods Sections apply to work of this Section.

C. Review all project drawings to be aware of conditions affecting work herein.

PART 2 - PRODUCTS

2.1 Materials for this section are specified in the Section "Basic Materials and Methods."

PART 3 - EXECUTION

3.1 Installation shall comply with the requirements of the Utilities Company and the applicable paragraphs in Article "3.0 EXECUTION" of the Section "Basic Materials and Methods."

3.2 Comply with NEC 70 - Underground Services.

3.3 Comply with the Section "Excavation and Backfill."

3.4 The Utility Company will furnish and install the current transformers, potential transformer. The contractor shall coordinate the installation of service feeders with the Utility Company so that the current transformers can be installed. The Utility Company will furnish and install the meter. The contractor shall furnish and install CT cabinets, meter cabinets and all associated conduits. Coordinate exact requirements with local utility.

3.5 The electrical contractor shall provide the raceways and service conductors from the reinforced concrete transformer pad to the service equipment as indicated on the Drawings.

3.6 The Electrical Contractor shall provide the raceways from the transformer pad to the meter cabinet. Minimum conduit size is 1" and shall be RGS. Unless otherwise noted, the meter shall be mounted on a 6"x6"x8' concrete post, provided by the contractor. The location of the post shall be approved by the Utility Company.

3.7 Raceways for service conductors shall be schedule 80 PVC or bitumastic coated rigid metal conduit for straight lengths and bitumastic coated rigid metal conduit for any bends of 45 or 90 degrees. Service entrance raceways shall be concrete encased where specifically noted on the Drawings.

3.8 The 45 or 90-degree bends shall have a minimum radius of 36 inches.

3.9 Rigid metal conduit shall receive two undiluted coats of bitumastic free from holidays and pinholes.

3.10 The Electrical Contractor shall provide 200# test poly cord in each spare raceway.

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING

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. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 Submittals

A. Product Data: For each type of product indicated.

B. Field Test Reports: Submit written test reports to include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Test Reports and Verification Submittals:

1. Provide ground system drawings per section 3 of this specification.
2. Perform the following field tests and inspections and prepare test reports.
   a. Ground Resistance Test: See Part 3 of this specification.

1.4 Quality Assurance

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with UL 467.

B. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grounding Conductors, Cables, Connectors, and Rods:
   a. Harger Lightning Protection, Inc.
   b. Erico Inc.; Electrical Products Group.
   c. Thermoweld, Inc.

2.2 Grounding Conductors

A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

D. Grounding Electrode Conductors: Stranded cable.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Bare Copper Conductors: Comply with the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

G. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators. (Harger HDGBI series)

2.3 Connector Products

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Copper or Bronze bolted-pressure-type connectors, or compression type. Do not use below grade.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions. For use in below grade applications.

2.4 Grounding Electrodes

A. Ground Rods: Sectional type; copper clad steel.

1. Size: 3/4 by 120 inches (19 by 3000 mm) in diameter.

PART 3 - EXECUTION

3.1 Application

A. In raceways, use insulated equipment grounding conductors.

B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.

C. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch (25.4 mm) from wall and support from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.
3. Provide UL Listed compression lugs for all ground conductors to be connected to the ground bus.

3.2 Equipment Grounding Conductors

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated. As a minimum, provide a driven ground rod system (as described below), bond to building foundation rebar, building steel, and building water service.

B. Install equipment grounding conductors in all feeders and circuits. Bond all metal conduit to metal enclosures.

C. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 6AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4by-12-inch grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

D. Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

E. Common Ground Bonding with Lightning Protection System (where provided): Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

3.3 Installation

A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes. Configuration shall be an equilateral triangle. Any deviation from this shape shall be approved by the Engineer in writing.

1. Drive ground rods until tops are 6 inches below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
3. The total depth/length of each ground rod shall be 30’ minimum unless noted otherwise.
4. GPS locate and document location of all ground rods, conductors, and inspection wells.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

E. Building Foundation: The electrical service, remote buildings and transformers shall be tied to the building foundation. The rebar in the foundation shall be bonded electrically by metal wire. The rebar shall be turned up and extended through the slab by the equipment so the connection can be within sight and be inspected. The rebar shall be coated with protective paint where it penetrates the concrete slab.

F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

G. Bond each above ground portion of gas piping system upstream from equipment shutoff valve.

H. Building Steel: The electrical service, transformers and remote buildings shall be tied to building steel.

3.4 Connections

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable. Inspect molds prior to use and discard if deformed.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 Field Quality Control

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Ground Resistance Test
   a. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
   b. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth

at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

1) Equipment Rated 500 kVA and Less: 10 ohms.
2) Equipment Rated 500 to 1000 kVA: 5 ohms.
3) Equipment Rated More Than 1000 kVA: 3 ohms.
4) Substations and Pad-Mounted Switching Equipment: 5 ohms.
5) Manhole Grounds: 10 ohms.
6) Building grounding system: 10 ohms.

c. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 260530 - BASIC ELECTRICAL MATERIALS AND METHODS

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. This Section is a Division-26 Basic Materials and Methods Section and is part of each Division-26 Section making reference to or requiring products specified herein.

C. The requirements of these specifications also apply to Divisions 23, 27, and 28 unless clearly indicated within those Divisions.

1.2 Summary

A. This Section includes the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Concrete equipment bases.
5. Cutting and patching for electrical construction.
6. Touchup painting.

1.3 Definitions

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. RGS: Rigid galvanized steel conduit.

E. LFMC: Liquid tight flexible metal conduit.

F. RNC: Rigid nonmetallic conduit.

1.4 Submittals

A. Product Data: Submit the producer's standard descriptive data sheets for each type of product being provided. Mark the data sheet for the product being provided with an identifying mark or arrow. The following shall be submitted:

1. All Conduit.
2. All conduit fittings.
3. Floor Boxes.
4. Surface Metal Raceway.
5. Cabinets.
6. Conduit coating material for underground use.
7. Fire stopping compound (if required by project requirements).
8. Any other special items being supplied on the project.
9. Cable tray, fittings and shop drawings.

1.5 Quality Assurance

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. All materials and equipment specified herein shall be UL listed or approved according to the requirements of applicable NEC articles.

1.6 Coordination

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Coordinate electrical service connections to components furnished by utility companies.

1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."

E. Coordinate equipment clearance and working space with other equipment, pipes, duct work and obstructions prior to rough in. If clearances are compromised during construction, the contractor shall be required to relocate/modify as required to meet clearance requirements.

1.7 Other Divisions

A. The requirements of these specifications also apply to Divisions 23, 27 and 28 unless clearly indicated on the Drawings.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Allied Tube and Conduit;
2. Appleton Electric;
3. Belden Corporation;
4. W.H. Brady Co.;
5. Carlon;
6. Challenger,
7. Crouse-Hinds Co.;
8. ETP;
9. Elcen Metal Products Co.;
10. General Cable Co.;
11. General Electric Co.;
12. Hoffman Engineering Co.;
13. E-Box, Inc;
14. Harvey Hubbell, Inc.;
15. Midland-Ross Corporation;
16. Okonite Co.;
17. 0-Z/Gedney;
18. Raco, Inc.;
19. Republic Steel Corporation;
20. 3M; Southwire;
21. Seton Nameplate;
22. Square D Co.;
23. Thomas and Betts;
24. Triangle PWC, Inc.;
25. Walker Parkersburg Textron;
26. Wiremold Co.
27. Westinghouse.Engine Div.

2.2 Raceways

A. Electrical Metallic Tubing (EMT) Federal Specification WWC-563 and ANSI C80.3: ANSI C80.3, galvanized steel, protected inside and out. Maximum size of EMT shall be 4". Minimum size shall be 1/2” unless noted otherwise on the Drawings. EMT shall only be used with cables rated 600 volts or less and in indoor locations not subject to physical abuse.

B. Flexible Metal Conduit (FMC) NEC Article 348: galvanized steel protected inside and out.

C. Intermediate Metal Conduit (IMC) Federal Specification WWC-581: ANSI C80.6, galvanized steel, protected inside and out.

D. Rigid Galvanized Steel Conduit (RGS) NEC Article 344: galvanized steel, protected inside and out.

E. Liquid-tight Flexible Metal Conduit (LFMC) NEC Article 350: galvanized steel protected inside and out with sunlight and water resistant and mineral-oil-resistant extruded plastic jacket.

F. Rigid Non-metallic Conduit (RNC): NEMA TC 2, Schedule 40 or 80 PVC, with NEMA TC3 fittings as indicated on the Drawings.

G. Raceway Fittings: Specifically designed for the raceway type with which used.

1. Electrical Metallic Tubing (EMT): Federal Specification W-F-408, except only material of steel is acceptable. Couplings and connectors shall be concrete and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 2" (50mm) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 2" (50mm). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding. Set screw fittings shall be provided with double set screws for each conduit termination (4 set screws total). Indent type connectors or couplings are prohibited. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
2. Flexible Metal Conduit fittings shall be zinc plated steel or cadmium plated malleable iron screw type with insulated throat and angular wedge fitting between convolutions of conduit. Federal Specification A-A-50552 and UL 5.
3. Intermediate Metal Conduit shall have threaded galvanized steel fittings; threadless, compression, galvanized steel fittings or threadless, compression, cadmium plated malleable iron fittings. Fittings shall be rain tight/concrete tight.
4. Rigid Galvanized Steel Conduit shall have threaded fittings, galvanized steel or threadless compression galvanized steel or threadless compression cadmium plated malleable iron. Fittings shall be rain tight/concrete tight.
5. Rigid Non-Metallic Conduit shall have polyvinyl chloride (PVC) fittings suited for the purpose and joined together by a method approved for the purpose. Schedule 80 conduit sections may be joined together with threaded fitting connectors.
6. Liquidtight Flexible Metal Conduit fittings shall be cadmium plated, malleable iron or steel with compression type steel ferrule and neoprene gasket sealing rings, with insulated throat.
7. Wireway fittings shall be steel with rust resistant undercoat and finish coat to match the wireway. The fittings shall be so designed that the sections can be electrically and mechanically fitted together to form a complete system. Dead ends shall be closed.
8. Couplings and Unions shall be galvanized steel, tapered thread standard conduit couplings for intermediate metal conduit and rigid metal conduit. PVC couplings for rigid non-metallic conduit shall use approved adhesive, and threaded couplings shall be used for schedule 80 conduit. Split couplings shall be galvanized steel. Unions shall be ground joint type galvanized steel.
9. Conduit seals shall be galvanized steel, tapered threads for IMC and RMC with sealing compound and fiber.

H. Bushings: Shall be provided at the end of all conduits prior to pulling cables to protect the insulation of the conductor. Provide grounding bushings for metal raceways, boxes, and cabinets to ensure that all metallic surfaces are effectively grounded. Metallic raceway may be

bonded to cabinets, boxes and panelboards by double locknut and bushing to ensure the metallic parts are all effectively grounded. Bushings shall be one of the following types:

1. Zinc plated steel, threaded or threadless
2. Zinc plated steel of threaded or threadless, phenolic insulated with temperature rating of 150 degree C
3. Cadmium plated malleable iron, threaded or threadless
4. Cadmium plated malleable iron, threaded or threadless, phenolic insulated, with temperature rating of 150 degree C
5. Phenolic with temperature rating of 150 degree C
6. Zinc plated steel, or cadmium plated malleable iron; threaded or threadless; non-insulated or insulated with grounding connector or grounding lug.
7. Insulated bushings shall have phenolic insulation molded to the bushing (NEC Article 362).

2.3 Metal Wireways

A. Material and Construction: Shall be sheet metal troughs with hinged or removable covers, rust resistant undercoat and gray finish coat. Sizes shall be as indicated on the Drawings or determined by the Contractor based on NEC requirements according to the number of conductors enclosed. Exterior units shall be weatherproof. Steel shall be minimum 14 gauge.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.4 Cable Trays

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cablofil, Inc.
2. Cooper B-Line, Inc.
3. Flex Tray

B. Except as otherwise indicated, provide metal cable trays, of types, classes and sizes indicated with splice hangers and all other necessary accessories. Provide cable trays with rounded edges and smooth surfaces in compliance with applicable standards, and with the following construction features:

1. Basket Type Cable Tray:
    a. Material: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, comply with ASTM B 633, Type 1.
    b. Dimensions: 12 inches wide by 4 inches deep minimum. Wire mesh spacing shall not exceed 2 inches by 4 inches.

c. Supports: Cable tray shall be supported by trapeze style hanging clips on threaded rods on both sides of the tray. Center supports are prohibited. Exception: Cable tray in TRs which shall be supported by wall brackets.

2. Ladder Rack Cable Tray:
   a. Description: 1.5” high tubular side rail cable runway.
   b. Material: Metal, suitable for indoors, and protected against corrosion by factor powder coat, black unless specified otherwise.
   c. Dimensions: 12 inches wide by 1.5 inches deep minimum. Refer to drawings for alternate dimensions. Rung spacing shall be 9 inches on center.
   d. Supports: Ladder rack shall be supported by trapeze style hanging clips on threaded rod on both sides of the tray. Center supports are prohibited. Exception: Ladder rack in TRs which shall be supported by wall brackets.

3. Provide all necessary transitions at 90-degree angles, tees and change of cable tray size so that the cable tray is continuous. The drawings do not reflect these requirements due to the small scale. Transitions shall also be provided at all change of elevations.

C. Loading Capacities and Testing:
   1. Cable tray shall meet the loading requirements of NEMA 12C.
   2. Upon request, manufacturer shall provide test reports in accordance with the latest revision of NEMA VE-1 or CSA C22.2 No. 126-M91.

D. Coordinate installation with other trades to avoid conflicts prior to installation. Install as required to transition around, above, or below other trades work.

E. Shop Drawings: Provide complete shop drawings indicating all cable trays, devices, support points, offsets and transitions. Drawings shall be 1/8" scale. The Engineer will provide base sheets.

2.5 Boxes, Enclosures, And Cabinets

A. Sheet Metal Outlet and Device Boxes: Galvanized, NEMA OS 1. Boxes shall be 4"x 4" x 1-1/2" deep or larger(4” x 4” x 2 1/8” deep or larger for telecommunications and CATV). Use only in flush interior applications or non-finished surface mounted interior applications.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover. Use in exterior applications and interior finished surface mounted applications.

C. Floor Boxes: Per details on drawings.

D. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasket cover. Use in exterior applications and interior finished surface mounted applications.

E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
   1. Metal Enclosures: Galvanized steel, finished inside and out with manufacturer's standard enamel.

F. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include

metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

G. Fabricated Boxes shall be steel with inside and outside surfaces coated with corrosion-resistant paint or weather resistant coating. Covers shall be hinged or screwed with or without gaskets depending on location. All exterior boxes shall be rated NEMA 3R. Boxes shall be sized to meet the NEC Article 370-6 fill requirements.

H. Exterior In-Ground Junction Boxes: UL listed, polymer concrete construction, flared-wall, heavy duty cover (15,000 lbs. over a 10" square), open bottom construction. Equivalent to Quazite "PG" syle. Size as required or as indicated on the drawings, whichever is bigger.

2.6 Conductors

A. Conductors, No. 10 AWG and Smaller: 98% conductivity solid or stranded copper.

B. Conductors, No 8 AWG and Larger: 98% conductivity stranded copper.

C. Insulation: THW, THWN or XHHW unless noted otherwise on the Drawings.

D. Low Voltage Cables: Provide plenum rated where required.

E. Wire Connectors and Splices: Connectors for 600-volt conductors Size No. 18 to No. 6 AWG shall be pressure type, spring connectors. Use 600 volt splicer-reducer pressure connectors for copper conductors to 500 KCMIL. Use rectangular, solderless pressure connectors or split bolt-copper alloy connectors for copper conductors to 1000 KCMIL.

F. Wire Pulling Lubricant shall be a product produced specifically for wire pulling lubrication.

2.7 Supporting Devices

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-steel channel supports for multiple conduit (trapeze) hangers: Not less than 1-1/2"x1-1/2" (38 mm x 38mm), 12 gage steel, cold formed, lipped channels; with not less than 3/8" (9 mm) diameter steel hanger rods.

1. Channel Thickness: Adjust to suit structural loading of conduit and cables.
2. Fittings and Accessories: Products of the same manufacturer as channel supports.

D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Conduit Straps: All conduit shall be secured with two hole galvanized straps where the following conditions exist:

1. All exterior locations.
2. All interior locations other than mechanical and electrical rooms where the conduit is below 10'. Conduit concealed in wall finishes and ceilings may use single hole strap if allowed by NEC.
3. All other locations not listed above and approved by the NEC may use single hole galvanized straps.
4. Single hole or double hole straps may not be used on direct grade. All conduits on grade shall be mounted to galvanized strut and properly attached and anchored.

F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

G. Expansion Anchors: Carbon-steel wedge or sleeve type.

H. Toggle Bolts: All-steel springhead type.

2.8 Concrete Bases

A. Concrete Forms and Reinforcement Materials: Shall be provided for all floor mounted electrical equipment including, but not limited to: switchboards, transformers, etc. Concrete bases and structural steel to support this Division's equipment and raceways, and not specifically shown on Structural or Architectural Drawings shall be furnished by the Contractor whose equipment or raceways is to be supported. Provide a raised reinforced 4" concrete base for all floor supported equipment. Equipment installed outdoors on concrete slabs shall be provided with a 4" raised concrete base. Pad shall exceed the equipment's footprint by 4" on all sides. Provide a 1" chamfer on all exposed edges.

B. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength.

2.9 Touchup Paint

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.10 Equipment Backboards

A. Equipment Backboards shall be exterior grade 3/4" plywood finished on one side. Finish backboard with two coats of fire retardant gray paint before mounting. Exposed side of plywood shall be smooth interior grade. A copper ground bus shall be supplied with each backboard. The ground bus shall be Harger #TGBI14412TMGB or approved equal. The ground bus shall terminate the #6 AWG ground wire provided from the electrical system. Locate equipment backboards where indicated on the Drawings. Install straight and plumb. Secure to structure using screws, toggle bolts or masonry anchors. DO NOT use plastic or wood plugs in masonry or concrete. Do not install combustible backboards in air handling space, plenums or where prohibited by the local governing authority.

2.11 Sleeves: Sleeves shall be galvanized metal flanged type or schedule 40 galvanized steel pipe.

2.12 Concrete Inserts: Concrete inserts shall be galvanized steel, minimum 14 gauge cut to necessary length for the purpose. Use galvanized hardware.

2.13 Pull Wire and Pull Rope:

A. Pullwire shall be galvanized steel wire, No. 14 AWG minimum size.

B. Pullrope shall be ply cord with 2000 lbs. tensile strength, minimum.

2.14 Terminal Strips: Terminal strips shall be sectional barrier type made of molded phenolic for use in wiring control panels. Number of terminals and ampacity shall be as indicated on the Drawings. The binding head shall be screw in type.

PART 3 - EXECUTION

3.1 Electrical Equipment Installation

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom. Comply with NEC Requirements.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated. Materials and equipment shall be installed in a neat and workmanlike manner according to the standards of the industry. Materials and equipment installed and not meeting the standards of the industry may be rejected and required to be removed and reinstalled by the Contractor at no additional cost to the Owner. Minor location changes from those indicated may be necessary so that work can conform with the building as constructed, to fit work of other trades or to comply with the rules of authorities having jurisdiction. Refer to structural drawings for framed openings for raceways, etc., in floors and roofs. Contractor shall be responsible for locating and providing proper dimensions for all required electrical openings.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 Raceway Application

A. Use the following raceways for outdoor installations:

1. Exposed: RGS.
2. Concealed: IMC or RGS.
3. Underground: RGS. Feeders and branch circuit raceways installed below grade equal to and greater than 3/4" may be Schedule 80 PVC, at the contractor's option. If PVC is used underground or below slab, elbows and risers through grade or slab shall be RGS, except as listed below in paragraph 3.4. All exposed raceways penetrating concrete slab shall be

rigid metal conduit (no exceptions). Raceways shall not be routed in concrete slabs on grade. Raceways routed in concrete slabs above grade (second floor or above) shall be either RGS, IMC or Schedule 40 PVC. Communication raceways shall be run overhead within the building except for connection to floor boxes. Communication and/or low voltage system raceways that exit from under the building slab shall be metallic (in all cases). Any raceway not meeting this requirement shall be replaced at the contractor's expense. Additional construction time and compensation for the correction of the deficiency will not be allowed.

4. Rigid metal conduit installed underground or in contact with concrete shall be painted with two coats of alkali and acid resistant paint such as bitumastic or equal. Coating shall not be diluted and shall completely cover conduit. Coating for exposed conduits shall not extend more than 4” above finished grade. Coating system shall be approved by the Engineer prior to use/application.
5. Rigid metal conduit installed underground or in contact with concrete shall be fully wrapped UL Listed corrosion resistant tape. Tape wrap shall completely cover the metal conduit and shall extend not more than 4” above finished grade.
6. Connection to Vibrating Equipment: LFMC.
7. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant temperature rooms, air conditioned spaces, building exterior walls, roofs or similar spaces.
8. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. Use the following raceways for indoor installations:

1. Exposed: RGS or IMC, except EMT is acceptable in mechanical and electrical rooms above 6’ AFF. Conduit may be exposed in equipment rooms, vertical chases, mechanical and electrical rooms, other similar spaces not normally habitable or exposed to public view, and where electrical drawings specifically note "exposed conduit."
2. Concealed: EMT.
3. Connection to Mechanical, Plumbing and Fire Protection Equipment: LFMC; exceptions: controls not mounted on equipment, which shall comply with Section B above; and smaller air handling units such as variable air volume units and air terminal units mounted above ceilings outside mechanical rooms which shall be FMC.
4. Connection to Vibrating Equipment: FMC; except in wet or damp locations and as listed in B.4, use LFMC.
5. Damp or Wet Locations: IMC or RGS.
6. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.
7. Rigid non-metallic conduit where used for risers in concealed areas, shall transition to metallic conduit at the first junction box, but in no case shall it extend higher than 7’ within the space.

C. Use the following raceways for hazardous installations:

1. Raceways in hazardous (classified) areas shall be RGS.
2. Install UL approved sealing fittings that prevent passage of explosive vapors, in hazardous areas equipped with explosive proof lighting fixtures, switches, and receptacles as required by the NEC.
3. All devices and junction boxes shall be rated for the classified areas.

3.3 Raceway And Cable Installation

A. Conceal raceways, unless otherwise indicated, within finished walls, ceilings, and floors.

B. Install raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

C. Refer to structural drawings for framed openings for raceways, etc., in floors and roofs. Contractor shall be responsible for locating and providing proper dimensions for all required electrical openings. Review structural steel shop drawings and coordinate location of equipment with structural elements to ensure proper clearance and headroom.

D. Layout and install raceways with sufficient clearance to permit proper installation.

E. Install raceways straight and plumb. Squarely cut conduit and properly ream to remove all constriction and burrs before making up joints. Paint exposed threads to retard rusting. Bending of conduit with a pipe tee or vise is prohibited.

F. Conductors shall not be installed until conduit system is complete. Bending radius of insulated wire or cable shall not be less than the minimum recommended by wire or cable manufacturer. Maximum pulling tension of any wire or cable shall not exceed manufacturer's recommended values. Do not injure insulation while installing wire in conduits.

G. Use temporary raceway caps to prevent foreign matter from entering. During construction, after the building has been dried in and prior to any wire being pulled, all conduit shall be cleaned so that it is free of foreign material and water.

H. Provide an equipment grounding conductor which shall be separate from the electrical system neutral conductor. See corresponding specification section.

I. Make conduit bends and offsets so inside diameter is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

J. Make bends in exposed parallel or banked runs from the same centerline.

K. Use raceway fittings compatible with raceways and suitable for use and location.

L. For slabs located above grade in multistory buildings (second floor and above), embed raceways in slabs in middle third of slab thickness where practical, and leave at least 1-inch (25-mm) concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
2. Space raceways laterally to prevent voids in concrete.
3. Install conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit or rigid steel conduit before rising above floor.
5. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.

M. For slabs on grade level, conduit shall be buried below grade by a minimum of 12”. Conduits may not be installed in grade level slabs.

N. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

O. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch (1830-mm) flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.

P. Set floor boxes level and trim after installation to fit flush to finished floor surface. Seal box to prevent entrance of moisture or dirt.

Q. Boxes: Attach boxes to concrete formwork, or to other surrounding building material. Provide additional junction and pull boxes where injury to insulation or deformation of wire would occur due to excessive pulling resistance. When several feeders pass through a common pull box, tag each feeder separately, indicating electrical characteristics and destination.

1. Boxes shall be accurately located. Consult Architectural plans for dimensions.
2. Mount boxes in the course nearest to the height specified when installed in finished block, brick or tile walls.
3. Boxes for use with raceway systems shall be minimum 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 4 inches square, except 4-by-2 inch boxes may be used where only one raceway enters outlet.
4. Pull boxes shall be at least the minimum size required by NFPA 70 and of code-gauge galvanized sheet steel, or compatible with nonmetallic raceway systems, except where cast-metal boxes are required in locations specified herein. Furnish boxes with screw-fastened covers. Where several feeders pass through a common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.
5. Extension rings shall not be used in new construction. Size all boxes according to fill. Any extension rings found shall be removed at the contractor's expense, unless specifically approved by the Engineer.
6. Recessed Installation: Boxes and covers shall be installed so that the covers are flush with the finished surfaces. Boxes in masonry or tile construction shall have masonry boxes or boxes with square cut tile covers. Do not cut concrete block through its entirety in order to accommodate any type box. "Handy" boxes shall not be used.
7. Boxes in Partitions: Through type boxes are not permitted except where shown on electrical drawings. Recessed outlet boxes, cabinets, consoles, etc., when shown located back-to-back shall be provided with 1/2" fiberglass insulation between the boxes.
8. Verify box/enclosure placement in rated assemblies and comply with UL spacing/opening requirements. Fire stop as required.

R. For all conduits entering junction boxes in interior spaces, seal spare conduits with approved conduit plugs. Seal conduits containing fiber-optic communications cable with conduit sealer.

S. Wet or Damp Locations:

1. Use rigid steel or IMC unless noted otherwise.

2. Provide sealing fittings, to prevent passage of water vapor, where conduits pass from warm to cold locations, i.e., (refrigerated spaces, constant temperature rooms, air conditioned spaces building exterior walls, roofs) or similar spaces.
3. Use rigid steel or IMC conduit within five feet of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Cover conduit on the outside with factory coating of 20 mil bonded PVC or field coat with asphaltum before installation. After installation, completely coat damaged areas of coating.
4. Wireways and fittings shall be used for exposed work and when installed outdoors or in wet locations shall be approved weatherproof construction.

T. Bushings shall be provided at the end of all conduits to protect the insulation of the conductor. Provide grounding bushings for metal raceways, boxes, and cabinets to insure that all metallic surfaces are effectively grounded. Metallic raceway may be bonded to cabinets, boxes and panelboards by double locknut and bushing to ensure the metallic parts are all effectively grounded.

U. Install pull boxes in conduit at intervals of 200 feet or less except when these intervals will place the pull box cover in a finished floor area or non-accessible place, the interval may be extended to a maximum distance of 300 feet. Request for each deviation or extension of interval shall be made and approval granted by the Engineer before proceeding with the installation. If any conduit run is found to be greater than 300 feet and the contractor has not secured prior approval from the engineer, a new raceway shall be installed to replace the deficient one at the contractor's expense.

V. Conduit Installed in Concrete:

1. Conform to applicable portion of Section 703 of ACI Standard Code for reinforced concrete.
2. Conduit: Rigid Steel, IMC or EMT; except do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
3. Align and run conduit in direct lines.
4. Locate conduits in center third of concrete slab thickness. Outside conduit diameter not to exceed 1/3 concrete slab thickness. Install no conduit in concrete slabs of less than 3" thick.
5. Conduits in concrete slabs shall not cross at an angle of less than 45 degrees.
6. Conduits shall not pass through beams except when shown on the Drawings.
7. Space vertical installation of conduit through concrete slabs not closer than three diameters on center.
8. Space between conduit in slabs not closer than six diameters apart, except one conduit diameter at conduit crossings.
9. Where conduits rise through floor slabs, curved portion of bends shall not be visible above finish floor.

3.4 Special PVC Requirements

A. Floor Penetrations:

1. Rigid metallic conduit for all exposed conduits, regardless of size and concealed conduits greater than 1 ½". Schedule 40 PVC for conduits less than 1 ½" concealed in walls. All conduit concealed by floor mounted equipment may be schedule 40 PVC (if less than 1 ½" and less than 50 feet and length) or rigid metallic conduit (if 1 ½" or greater and

greater than 50 feet in length). Concealed PVC conduit (less than 1 ½") shall transition to metal conduit as soon as practical above slab.

B. Bends:

1. Conduits less than 1 ½": Conduit elbows may be either rigid non-metallic or non-corrosive rigid metallic conduit. In circuit runs exceeding 50', all bends shall be non-corrosive rigid metallic conduit. Bends may be factory or field fabricated using manufacturer approved heat boxes. Field fabricated bends using blowtorch are not acceptable.
2. Conduits 1 ½" and larger: Conduit elbows shall be rigid non-corrosive metallic conduit only, unless specifically allowed otherwise by the Engineer. Schedule 40 PVC elbows shall not be used.
3. A cable pulling plan may be requested by the Engineer on long pulls.
4. The Engineer may allow special provisions for the installation of PVC elbows.

C. Minimum Size:

1. Minimum size of PVC conduit to be installed below slab shall be 3/4".

D. Jointing:

1. Pipe and fittings shall be cement welded or threaded (only for Schedule 80 conduit) and made watertight. All joints shall be cleaned with solvent or sanded smooth prior to application of cement.

3.5 Raceway Methods For Voice, Data And CATV

A. Cable tray: A conduit shall be stubbed up above ceiling from each data outlet and each CATV outlet to the nearest cable tray. Each conduit shall serve one CO outlet only. Conduit shall be 1" trade size for data outlets and 1" trade size for CATV outlets. Conduit shall terminate at cable tray.

B. Conduit bodies such as 'LB' fittings are not allowable.

C. Pull boxes for 1" data conduits and ¾" CATV conduits shall be 4" wide x 4" long x 2-1/8" deep NEMA 1 galvanized steel with screw cover. Where 1" data or ¾" CATV conduits are tightly racked with uniform spacing, wider pull boxes may be provided to serve multiple conduits. Terminate conduits at opposite ends of pullboxes. Do not terminate conduits at right angles to each other except as specifically indicated.

D. Provide pullboxes for each run of conduit at every 100 feet on center and at each end of conduit runs containing a total of two 90 deg bends or a combination of lesser bends totaling 180 deg (minimum requirements - provide whether specifically indicated or not). Conduit runs containing more than two 90 deg bend without a pullbox are not acceptable. Factory conduit elbows and all other bends shall have a minimum radius of six times the internal conduit diameter. Conduit offsets and pullboxes required to suit field conditions and to conform to these requirements shall be provided at no additional cost to the owner.

E. Conduits that extend outside the building shall be metallic, no exceptions.

F. For existing facilities: NEMA 3R metallic enclosures shall be provided where the conduit exits the building. The box shall be sided to terminate all circuits and provide proper TVSS and grounding. A separate driven ¾" by 20' ground rod shall be driven at each junction box location. Grounding shall also be bonded to the building electrical ground. Metallic conduit shall be properly bonded to the metallic junction box.

3.6 Wiring Methods For Power, Lighting, And Control Circuits

A. Feeders: Type THHN/THWN insulated conductors in raceway.

B. Underground Feeders and Branch Circuits: Type THWN insulated conductors in raceway.

C. Branch Circuits: Type THHN/THWN insulated conductors in raceway.

D. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

E. Except for control wiring, the minimum size of wire shall be No. 12 AWG.

F. For all lighting and power receptacle circuits (20 ampere), the minimum wire size is #12 AWG. The total distance for the travelers on three-way circuits shall calculated and distance limitations applied. Wire sizes that are installed and do not meet the size/distance criteria, shall be removed and replaced at the contractor's expense. The larger wire size applies to the home run. Minimum wire size for 120V and 277V, 20 ampere circuits to limit voltage drop to 3% or less is as follows:

1. Less than 50' - #12 AWG (120V).
2. Circuits greater than 50' but less than 100' - #10 AWG (120V).
3. Circuits greater than 100' but less than 150' - #8 AWG (120V).
4. Circuits greater than 150' but less than 270' - #6 AWG (120V).
5. Circuits greater than 270' but less than 420' - #4 AWG (120V).

3.7 Wiring Installation

A. General: Conductors shall not be installed until conduit system is complete. Bending radius of insulated wire or cable shall not be less than the minimum recommended by wire or cable manufacturer. Maximum pulling tension of any wire or cable shall not exceed manufacturer's recommended values. Do not injure insulation while installing wire in conduits.

B. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Splices: Splices shall be permitted in junction boxes, outlet boxes of other permanently accessible locations. Conductors No. 6 or smaller shall be spliced with devices approved by Underwriters Laboratories, Inc., as splicing connectors. Splices in conductors larger than No. 6 shall be accomplished with devices approved by Underwriters Laboratories as pressure cable connectors.
2. Splices made in underground boxes or wet locations shall be made with commercial, UL approved cast resin splicing kit (120 volt circuits or greater). Splices for low voltage circuits may not be made below grade or in wet/damp locations.

C. Wire Pulling Lubrication: Shall be used when any wire is pulled by mechanical means. Wire and cable shall be carefully handled during installation. Soap flakes or vegetable soaps shall not be used for lubrication.

D. Install wiring at outlets with at least 12 inches (300 mm) of slack conductor at each outlet.

E. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 468B.

F. Provide dedicated neutrals for all 120V circuits.

G. Conductors in Parallel: Conductors connected in parallel (electrically joined at both ends to form a single conductor) shall be of the same length, of the same conductor material, the same circular-mil area, the same insulation types and terminate in the same manner. Where installed in separate raceways or cables, the raceways or cables shall have the same physical characteristics.

H. Wiring in switchboards, panelboards, junction cabinets, etc., shall be neatly formed to present a neat and orderly appearance.

I. Interconnections of control wiring shall be on identified numbered terminal strips.

3.8 Expansion Joints

A. Conduits three inches and larger that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install couplings in accordance with the manufacturers' recommendations.

B. Provide conduits smaller than three inches with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5" vertical drop midway between end. Flexible conduit shall have a green copper ground-bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for three inches and larger conduits are acceptable.

C. Expansion fittings shall be provided for raceways to compensate for thermal expansion and contraction in conduit runs 200 feet or greater and at building expansion joints. Bonding jumpers shall be provided for electrical continuity of the raceway system at the expansion fittings.

3.9 Caulking And Seals:

A. Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases. Fire stop shall be rock wool fiber, silicone foam sealant or approved equal. Completely fill and seal clearances between raceways and openings with the fire stop material. Adhere to manufacturer's installation instructions.

B. At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight.

3.10 Electrical Supporting Device Application

A. Damp Locations and Outdoors: Hot-dip galvanized materials.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply with manufacturer's written instructions.

E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.11 Support Installation

A. Install support devices to securely and permanently fasten and support electrical components.

B. Support no electrical work from piping, ductwork, etc. Where metal decking is used, provide supports independent of decking so that loads will not be transferred to decking. Drill through decking and secure supports to concrete slab.

C. Conduit through Slab Supports: Conduit supports for conduits routed from below grade up through concrete slabs shall be solid, metallic type. Metallic conduit shall not be used to support conduits through slab. After concrete slab has been poured and set, supports shall be cut flush with slab.

D. Support conduit within one foot of changes of direction, and within one foot of each enclosure to which it is connected.

E. Electrical devices in lay-in and gypsum board ceilings: Coordinate location of electrical outlets with architectural features of the building and with the equipment of other trades. Boxes or devices mounted between bar joists or "T" bars shall be supported from two bars or joists. Devices and associated boxes shall not be supported by the lay-in tiles.

F. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

G. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

H. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

I. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

J. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.

K. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

L. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals. Vertical conduit inside building shall be supported at each floor level and at 10'0" intervals. Simultaneously install vertical conductor supports with conductors.

M. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.

N. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

O. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

P. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Steel: Welded threaded studs or spring-tension clamps on steel.
   a. Field Welding: Comply with AWS D1.1.
6. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
7. Light Steel: Sheet-metal screws.
8. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

Q. Equipment Supports: Concrete bases and structural steel to support this Division's equipment and raceways, and not specifically shown on Structural or Architectural Drawings shall be furnished by Contractor whose equipment or raceways is to be supported. Provide a raised reinforced 4" concrete base for all floor supported equipment. Equipment installed outdoors on concrete slabs shall be provided with a 4" raised concrete base. If equipment is being installed on grade, concrete base shall be provided that will allow a minimum of 3” above finished grade and sod.

3.12 Firestopping

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Comply with UL assembly rating requirements.

B. Space junction boxes, receptacles and panels installed in rated assemblies to comply with UL listings. Verify prior to installation.

C. Cracks, voids, or holes up to 4" diameter shall be filled with putty, caulking, or one-piece intumescent elastomer which is non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat.

D. For openings 4" or greater use a sealing system capable of passing 3-hour fire test in accordance with ASTM E-814. Sealing system shall consist of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350°F.

3.13 Concrete Bases

A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement.

3.14 Cutting And Patching

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

C. Sleeves Through Roof: Coordinate setting with Division 7. Contractor setting sleeves for his electrical conduit is responsible for filling sleeve pockets with roof bitumen and insuring there is no moisture leakage during roof guarantee period.

3.15 Field Quality Control

A. Inspect installed components for damage and faulty work, including the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Concrete bases.
6. Cutting and patching for electrical construction.
7. Touchup painting.

3.16 Refinishing And Touchup Painting

A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.
5. Finishes in areas not listed or otherwise noted shall be black enamel.
6. Hangers, supports, structural steel and equipment that are not factory finished shall be prime coated and finished coated with color to match the area in which it will be located.
7. Electric cabinets, switchboards, panelboards and equipment that is factory finished and has damaged finish shall be touched up to match the factory finish.
8. All surfaces that are to be painted shall be free of rust, scale, oil and grease before prime coat is applied.
9. Paint all junction boxes and conduit as described herein.

3.17 Grounding

A. Ground and bond in accordance with NEC Article 250 and other applicable articles.

B. Provide an equipment grounding conductor which shall be separate from the electrical system neutral conductor. The equipment grounding conductor shall be colored green. It shall be continuous from a connection at the Service Entrance Equipment Ground to all switchboards, distribution and branch panelboards. Equipment grounding conductors shall be provided in all branch circuits serving convenience outlets, receptacles, portable and permanently installed electrical appliances, equipment apparatus and other miscellaneous metal enclosing bodies including light switch boxes normally within contact of personnel. Branch circuit grounding conductors shall be sized in accordance with the National Electrical Code. Connections at panelboards, outlets, equipment and apparatus shall be made in an approved and permanent manner. Resistance to ground shall not exceed 15 ohms.

C. Bond bushings of the raceway system to ground lugs in boxes, cabinets, motors and equipment to assure electrical continuity of all metallic components of the electrical systems. Comply with the requirements of NEC Articles 250D, 250E, 250F, 250G, 250J and 250K. Where equipment is not provided with a grounding lug, provide ground lugs suitable for wire being installed.

3.18 Cleaning And Protection

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

3.19 General Tests And Inspections

A. Prepare systems, equipment, and components for tests and inspections, and perform preliminary tests to ensure that systems, equipment, and components are ready for testing. Include the following minimum preparations as appropriate:

1. Perform insulation-resistance tests.
2. Perform continuity tests.
3. Perform rotation test (for motors to be tested).

B. Test Equipment Suitability: Comply with NETA ATS, Section 5.2.

C. Test Equipment Calibration: Comply with NETA ATS, Section 5.3.

D. Test and Inspection Reports: In addition to requirements specified elsewhere, report the following:

1. Manufacturer's written testing and inspecting instructions.
2. Calibration and adjustment settings of adjustable and interchangeable devices involved in tests.
3. Tabulation of expected measurement results made before measurements.
4. Tabulation of "as-found" and "as-left" measurement and observation results.

END OF SECTION

SECTION 260550 – EXCAVATION AND BACKFILL

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. Review all project Drawings to be aware of conditions affecting work herein.

PART 2 - PRODUCTS

2.1 Sand: Clean, hard, uncoated grains free from organic matter or other deleterious substances. Sand for backfill shall be of a grade equal to mortar sand, with 95% passing a No. 8 sieve, and not more than 8% passing a No. 100 sieve.

2.2 Gravel: Clean, well-graded hard stone or lime rock gravel, free from organic material. Size range to be from No. 4 screen retentions to 1".

2.3 Earth: Must be free of stones, wood, roots or rubbish.

2.4 Underground-Line Warning Tape: See Specifications Section 26 05 53/Electrical Identification

PART 3 - EXECUTION

3.1 Ditching and Excavation: Shall be performed by hand wherever the possibility of encountering obstacles or any existing utility lines. The Contractor will be totally responsible to insure that no utility or service interruptions shall be caused and that no existing utilities or obstructions will prohibit installations of service under this Contract at proper grade and location. Where clear and unobstructed areas are to be excavated, appropriate machine excavation methods may be employed. Avoid use of machine excavations within the limits of the building lines except when machine weights and operation will not damage sub-surface structural components or piping.

A. Install longitudinal runs of conduit a minimum of one foot from back of curb or 6 feet from edge of pavement in the absence of curb. If ditches are present, install conduit a minimum of 4 feet from the bottom of the ditch line.

B. Maintain a minimum trench depth of 30 inches (or 12 inches below areas blocked by rock or impenetrable obstructions) below finished grade. Upon completion, restore surface to like-original condition within 7 calendar days of occurrence of damage. Remove all rock and debris

from backfill material. Remove excess material from site and compact area according to NEC Article 300-7. Backfill with excavated material and compact to 95% of original density.

3.2 Bedding: Excavate to bottom grade of raceway to be installed, and shape bed of undisturbed earth to contour of conduit for a width of at least 5% of the conduit diameter. If earth conditions necessitate excavation below raceway grade, bring the bed up to the proper elevation with clean, dry sand deposited in 6" layers and firmly tamped by mechanical means. If sub-cut exceeds 12" or if bed is of an unstable nature, a 6" minimum layer of rock will be required before sand bedding begins.

3.3 Placing: Conduit shall be carefully handled into place in the excavation. Avoid knocking loose soil from the banks of the trench into the conduit bed. Coated conduit shall have special handling slings to prevent damage to the coating. All holidays in the conduit coating shall be touched in before beginning back filling.

A. If one or more conduit is required between the same points, install conduit in one common trench.

3.4 Backfilling: Deposit earth or sand carefully in 6" layers, maintaining adequate side support. Compact fill in 6" layers, using mechanical means up to the top elevation of the conduit and 12" layers to finish grade.

A. Backfill trench at locations along the trench path where non-movable objects, such as rocks and boulders, cannot be avoided. The purpose of the backfill is to provide a gradual change in elevation of the trench, so that excessive bending and stress will not be transferred to conduits once underground conduit system is installed.

3.5 Identification: Provide identifying metalized plastic warning tape above non-metallic conduit and standard plastic warning tape above metal conduit. Warning tape shall be placed approximately 12" above the conduit. Replace surface to the original condition, i.e., sodding, sprigging, and fine grading.

3.6 Excavation shall be maintained in satisfactory condition during the progress of the work. Sub-surface structures shall be constructed in adequately sized excavations and dewatering equipment shall be installed and properly maintained. Shoring shall be employed in the event of unstable soil conditions and in all cases to protect materials and personnel from injury.

3.7 Conduits to be installed below the footings or foundations shall be installed prior to the installation of the footings. All soil shall be compacted to meet the structural requirements for the footings. If it is not possible to install the conduit prior to pouring of the footings, it shall be necessary for the contractor to provide a bridge footing to span the excavation plus 2 feet on either side of the excavation. The footing modifications shall be approved prior to installation by the Structural Engineer.

3.8 After installation of conduits and upon completion of tamping and backfilling, perform a mandrel test on each conduit to ensure no conduit has been damaged. Furnish a non-metallic mandrel having a diameter of approximately 50% of the inside diameter of the conduit through which it is to be pulled. If damage has occurred, replace the entire length of conduit. Ensure pull cord is re-installed.

3.9 Directional Drilling:

A. Maintain a minimum depth of 4 feet under roadways, driveways, sidewalks, etc.

B. Guarantee the drill rig operator and digital walkover locating system operator are factory-trained to operate the make and model of equipment provided and have at least one-year experience operating the make and model of drill rig. Submit documentation of the operator's training and experience for review at least 2 weeks before start of directional drilling.

C. Provide a means of collecting and containing drilling fluid/slurry that returns to the surface such as a slurry pit. Provide measurements to prevent drilling fluids from entering drainage ditches and storm sewer systems. Prevent drilling fluid/slurry from accumulating on or flowing onto pedestrian walkways, driveways and streets. Immediately remove all drilling fluids/slurry that are accidentally spilled.

3.10 Paved trenching: All conduit installation under existing paved surfaces shall be directional bored. Trenching shall only be permitted with prior approval from the Engineer and Owner. On concrete surfaces, replace the entire joint of concrete unless otherwise specified. On all other surfaces, neatly cut and replace the width of trench with like material.

A. Finish paved areas with materials matching damaged areas. For conduit installed under roadways, cut neatly and replace the width of paved area damaged by trenching. For conduit installed under sidewalks and walkways, remove entire section of slab from joint to joint and replace. Place graded stone material to temporarily maintain traffic where repairs cannot be performed immediately.

3.11 Reconditioning Surfaces:

A. Restore, to their original elevation and condition, unpaved surfaces disturbed during installation of duct, handholes, etc. Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged with sod of quality equal to that which was removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding and provide top soiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.

3.12 Paving Repairs:

A. Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists, restore such surface treatment or pavement to the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces.

END OF SECTION

SECTION 260553 - ELECTRICAL IDENTIFICATION

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. This Section includes the following:

1. Identification for raceway.
2. Identification for conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 Submittals

A. Product Data: For each electrical identification product indicated.

1.4 Quality Assurance

A. Comply with NFPA 70.

B. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 Raceway Identification:

A. Paint: Semi-gloss acrylic-enamel.

B. Marker for circuit identification on box covers: Permanent, waterproof, black ink marker (exception: brown and black painted covers which shall use permanent, waterproof, white paint based marker).

2.2 Conductor and Cable Identification Materials:

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Insulation shall be factory-colored in accordance with paragraph “Installation.”

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.

E. Write-On Tags: Polyester tag, 0.01 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 Floor Marking Paint:

A. Semi-gloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.

1. Primer: Interior concrete and masonry primer.
2. Finish Coats: Interior semi-gloss alkyd enamel.

2.4 Underground-line Warning Tape:

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches wide by 5.5 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core 3.5 mils thick.
4. Printed legend shall indicate type of underground line.

2.5 Warning Labels and Signs:

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

F. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2.6 Instruction Signs:

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

B. Engraved legend with black letters on white face.

C. Punched or drilled for mechanical fasteners.

D. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 Equipment Identification Labels:

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white background. White letters on a red background for Emergency and Optional Standby systems.

2.8 Miscellaneous Identification Products:

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 Accessible Raceways More Than 600 V:

A. Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches high, with self-adhesive vinyl labels. Repeat legend at 10-foot maximum intervals.

3.2 Accessible Raceways 600 V or Less, for Service, Feeder, and Branch Circuits:

A. Identify interior raceway systems with paint as follows:

1. Conduits: paint all couplings per the color coding below.

2. Junction Boxes:
   a. Paint all junction and pull box covers per the color coding below.
   b. For covers containing branch circuits: after painting the cover the appropriate color, hand write the panelboard/circuit number contained in the box (i.e. 2P1-15,17,19).
   c. For covers containing feeder circuits: after painting the cover the appropriate color, hand write the feeding panel and load panel (i.e. 4D1 to 2P1A).

B. Coupling and box cover colors as follows:

1. 120/208 Volt Systems: Black.

3.3 Auxiliary Systems:

A. Identify interior raceway systems with paint as follows:

1. Conduits: paint all couplings per the color coding below.
2. Junction Boxes: Paint all junction and pull box covers per the color coding below.

B. Coupling and box cover colors as follows:

1. Fire Alarm System: Red.
2. Access Control & Security System: Yellow.
3. Telecommunication System: Blue.
4. Other Systems: Paint a unique color (do not use any of the above colors or green or white).

3.4 Conductors:

A. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

B. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

C. Power-Circuit Conductor Identification: For conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.

E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

3.5 Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

3.6 Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

3.7 Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

A. Power transfer switches.

B. Controls with external control power connections.

3.8 Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

3.9 Instruction Signs:

A. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

B. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/3inch high letters for emergency instructions at equipment.

3.10 Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

3.11 Labeling Instructions:

A. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a with 1/4-inch high letters on 1-inch high label.

B. Outdoor Equipment: Engraved, laminated acrylic or melamine label.

C. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

D. Equipment to Be Labeled:

1. Panelboards, electrical cabinets, and enclosures.
2. Access doors and panels for concealed electrical items.
3. Electrical switchgear and switchboards.
4. Transformers.

5. Electrical substations.
6. Emergency system boxes and enclosures.
7. Motor-control centers.
8. Disconnect switches.
9. Enclosed circuit breakers.
10. Motor starters.
11. Push-button stations.
12. Power transfer equipment.
13. Contactors.
14. Remote-controlled switches, dimmer modules, and control devices.
15. Battery inverter units.
16. Battery racks.
17. Power-generating units.
18. Voice and data cable terminal equipment.
19. Master clock and program equipment.
20. Intercommunication and call system master and staff stations.
21. Television/audio components, racks, and controls.
22. Fire-alarm control panel and annunciators.
23. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
24. Monitoring and control equipment.
25. Uninterruptible power supply equipment.
26. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

3.12 Installation:

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

Phase	**208/120-V Circuits**
A	Black
B	Red
C	Blue
Neutral	White

Ground	Green

G. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 18" to 30" above the line and not less than 6" below grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

K. Identification Schedule: Prior to Substantial Completion Inspection provide one framed and under glass 11" x 17" color copy of the approved Identification Schedule in each electrical room.

END OF SECTION

SECTION 262420 - PANELBOARDS

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. This Section includes the following:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 Definitions

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RFI: Radio-frequency interference.

D. RMS: Root mean square.

E. SPD: Surge protection device.

F. SPDT: Single pole, double throw.

1.4 Submittals

A. Approval Submittals:

B. Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of:

1. Panelboard
2. Overcurrent protective device
3. Surge protection device
4. Metering device

C. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
   a. Enclosure types and details for types other than NEMA 250, Type 1.
   b. Bus configuration, current, and voltage ratings.
   c. Short-circuit current rating of panelboards and overcurrent protective devices.
   d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   e. Time-current curves, including selectable ranges for each type of overcurrent protective device.
2. Wiring Diagrams: Power, signal, and control wiring.

D. Panelboard Schedules: For installation in panelboards.

E. Electrical Room Layouts: For each electrical room, provide ¼" scale drawing showing equipment layouts for clearance verification. Show all equipment including equipment in other specification sections.

F. Operation and Maintenance Data: include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 Quality Assurance

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

F. Panelboards shall be listed and labeled by Underwriters' Laboratories, Inc. in accordance with UL Standard 67.

G. Panelboards for use as service disconnecting means shall additionally conform to UL 869.

1.6 Project Conditions

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not exceeding 104 deg F (40 deg C).

2. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

1.7 Coordination

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, duct work piping, and encumbrances to workspace clearance requirements.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

C. Provide recommended settings for all circuit breakers with selectable settings to coordinate with downstream devices.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards and Accessories:
   a. Siemens
   b. Eaton Corporation; Cutler-Hammer Products.
   c. Square D.
   d. General Electric Co.; Electrical Distribution & Protection Div.

2.2 Panelboards

A. Enclosures: Galvanized surface-mounted cabinets. NEMA PB 1, Type 1.

1. Rated for environmental conditions at installed location.
   a. Outdoor Locations: NEMA 250, Type 3R.
2. Hinged Front Cover (Indoor units only): Entire front trim hinged to box and with standard door within hinged trim cover.
3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
4. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
5. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
6. Directory Card: Type written with transparent protective cover, mounted in welded metal frame, inside panelboard door.

7. Provide an engraved laminated phenolic or micarta nameplate 1" high by 3" wide with minimum 1/4" letters indicating the panelboard identification, voltage and upstream protective device. The panelboard shall also have a nameplate affixed to the panelboard with the following information stamped therein: Nameplate: Manufacturer, Voltage, Ampacity, Type of Panelboard, Manufacturer's Order No. and Date, Interrupting Rating - RMS Sym.

B. Phase and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box. Ground bus shall have the same rating as the panelboard.
3. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads as indicated on drawings.

C. Conductor Connectors: Suitable for use with conductor material.

1. Main and Neutral Lugs: Compression type.
2. Ground Lugs and Bus Configured Terminators: Compression type.

D. Service Equipment Label (where indicated): UL labeled for use as service equipment for panelboards with main service disconnect switches.

E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 Panelboard Short-Circuit Rating

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 Distribution Panelboards

A. Doors: Concealed hinges, secured with vault-type latch with tumbler lock; keyed alike.

B. Main Overcurrent Protective Devices: Circuit breaker.

C. Branch Overcurrent Protective Devices:

1. For Circuit-Breakers: Bolt-on circuit breakers.

2.5 Lighting And Appliance Branch-Circuit Panelboards

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.6 SPD - Service Entrance Devices

A. Surge Protective Device Description: Modular design, UL 1449 latest Edition Listed, mounted integral to panel enclosure with field-replaceable modules and the following features and accessories:

1. Fuses, rated at 200-kA interrupting capacity.
2. Fabrication using bolted compression lugs for internal wiring.
3. Integral disconnect switch.
4. Arrangement with copper busbars and for direct bolted connections to phase buses, neutral bus, and ground bus.
5. Red and green LED indicator lights for power and protection status.
6. Audible alarm, with silencing switch, to indicate when protection has failed.
7. One set of dry contacts rated at 2A and 24-V dc, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
8. Surge-event operations counter.
9. The SPD system shall be duty life cycle tested to survive a minimum of 1,000 surges per phase of 10kV, 10 kA, IEEE C62.45 Category C3 surge current with less than 10% degradation of clamping voltage.
10. The SPD system shall have EMI/RFI filtering, UL1283 listed and per MIL-STD-220A.
11. Per NEC Article 285.6, SPD shall be marked by a Short Circuit Current Rating (SCCR), equal to or greater than the available fault current where connected (as noted on drawings).

B. Peak Single-Impulse Surge Current Rating: 200kA per phase (L-N + L-G), 100kA per mode.

C. Protection modes and UL1449 clamping voltage for grounded wye circuits with voltage of 208Y/120; 3-phase, 4-wire circuits, shall be as follows:

1. Line to Neutral: 400V for 208Y/120.
2. Line to Ground: 400V for 208Y/120.
3. Neutral to Ground: 400V for 208Y/120.

2.7 SPD - Panelboard Devices

A. Surge Protective Device Description: Modular design, UL 1449 2nd Edition Listed, mounted integral to panel enclosure with field-replaceable modules and the following features and accessories:

1. Fuses, rated at 200-kA interrupting capacity.
2. Fabrication using bolted compression lugs for internal wiring.
3. Integral disconnect switch.
4. Arrangement with direct bus connections to phase buses, neutral bus, and ground bus.
5. Red and green LED indicator lights for power and protection status.
6. Audible alarm, with silencing switch, to indicate when protection has failed.
7. One set of dry contacts rated at 2A, 24-V dc, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
8. Surge-event operations counter.
9. The SPD system shall be duty life cycle tested to survive a minimum of 2,500 surges per phase of 20kV, 10 kA, IEEE C62.41 Category C3 surge current with less than 5% degradation of clamping voltage.
10. The SPD system shall have EMI/RFI filtering, UL1283 listed and per MIL-STD-220A.

11. Per NEC Article 285.6, SPD shall be marked by a Short Circuit Current Rating (SCCR), equal to or greater than the available fault current where connected (as noted on drawings).

B. Peak Single-Impulse Surge Current Rating: 100kA per phase (L-N + L-G), 50kA per mode.

C. Protection modes and UL 1449 clamping voltage for grounded wye circuits with voltages of 480Y/277 or 208Y/120; 3-phase, 4-wire circuits, shall be as follows:

1. Line to Neutral: 800V for 480Y/277, 400V for 208Y/120.
2. Line to Ground: 800V for 480Y/277, 400V for 208Y/120.
3. Neutral to Ground: 800V for 480Y/277, 400V for 208Y/120.

2.8 Overcurrent Protective Devices

A. Circuit breakers shall be molded case with trip units of size, type and quantity shown on the drawings. The circuit breakers shall be bolt-on type, equipped with individually insulated, braced, and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Paper stickers are not acceptable for individual circuit numbers. Individual circuit numbers shall be phenolic. Trip indication shall be clearly shown by the breaker handle. Provisions for additional breakers shall be such that no additional connectors will be required to add circuit breakers. Breaker terminals shall be UL listed as suitable for type and size of conductor provided for.

B. The following are general/minimum requirements. Provide features trip units, etc. per the selective coordination study as required to achieve coordination.

1. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
2. Current-Limiting Circuit Breakers: Frame sizes 400A and smaller; let-through ratings less than NEMA FU 1, RK.
3. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Unless indicated otherwise, breakers smaller than 250A frame shall be thermal-magnetic.
4. Adjustable Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting. Unless indicated otherwise, breakers smaller than 800A frame and at least 250A frame shall be adjustable thermal-magnetic.
5. Electronic Trip-Unit Circuit Breakers: Unless indicated otherwise, breakers 800A frame and larger shall be electronic trip type. RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

C. Multipole Breakers: Provide common trip-type with single operating handle. Breaker design shall be such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.9 Accessory Components and Features

A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 Installation

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Install overcurrent protective devices and controllers.

1. Set field-adjustable switches and circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

G. Provide four ¾” conduits from all recessed panelboards to above accessible ceiling for future use.

3.2 Identification

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."

B. Create a directory to indicate installed circuit loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Verify room numbers with Owner prior to creating directory. All room and building numbers/names shall reflect the final labels assigned for occupancy.

C. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic nameplate mounted with corrosion-resistant screws. Nameplate shall comply with the requirements listed in Section 2.2.A.7 above.

3.3 Connections

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section "Basic Electrical Materials and Methods."

3.4 Field Quality Control

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 Cleaning

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 262705 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 Related Documents

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

1.2 Summary

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
   1. Nonfusible switches.
   2. Enclosures.

1.3 Definitions

A. GFCI: Ground-fault circuit interrupter.

B. HD: Heavy duty.

C. RMS: Root mean square.

D. SPDT: Single pole, double throw.

1.4 Submittals

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
   1. Enclosure types and details for types other than NEMA 250, Type 1.
   2. Time-current curves, including selectable ranges for each type of circuit breaker.
   3. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
   4. Current and voltage ratings.
   5. Short-circuit current rating.
   6. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.5 O & M Submittals:

A. Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approved submittals (product data and shop drawings) in O & M manual.

1.6 Quality Assurance

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. All products shall be UL listed.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.7 Project Conditions

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

1.8 Coordination

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

1. Siemens
2. Square D Co.
3. Eaton Corp.; Cutler-Hammer Products.
4. General Electric Co.; Electrical Distribution & Control Division.

2.2 Fusible And Nonfusible Switches

A. Fusible Switch: NEMA KS 1, Type Heavy Duty, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position. All fusible switches rated 100 thru 600 amperes at 240 volts, and 30 thru 600 amperes at 600 volts, shall have the capability of field conversion from standard Class H fuse spacing to Class J fuse spacing without affecting the UL listing. The switch also must accept Class R fuses and have field installable UL listed rejection feature to reject all fuses except Class R. UL listed short circuit ratings, when equipped with Class R fuses shall be 200,000 ampere RMS symmetrical. 800 and 1200 ampere switches shall have provisions for Class L fuses.

B. Nonfusible Switch: NEMA KS 1, Type Heavy Duty, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Copper material internally mounted and labeled for copper ground conductors. Provide with each switch. Attach to enclosure with stainless steel, self-tapping screws.
2. For switches serving elevator equipment power, provide an auxiliary set of contacts and connect to the elevator equipment as required to signal the elevator controller to disconnect the emergency battery for the lowering system when the circuit is intentionally and de-energized at the fused safety switch.

D. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
4. Shall have overcenter, trip free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle indication. All breakers shall be bolt-on type.
5. Circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
6. Provide with shunt trip features where indicated on the Drawings.

2.3 Enclosures

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location and shall be dead front type.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
3. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

PART 3 - EXECUTION

3.1 Examination

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

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

3.2 Installation

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.3 Identification

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Basic Electrical Materials and Methods."

3.4 Adjusting

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.5 Cleaning

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION

SECTION 262710 - ENCLOSED CONTROLLERS

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. This Section includes ac general-purpose controllers rated 600 V and less that are supplied as enclosed units.

1.3 Submittals

A. Product Data: Submit manufacturer’s technical product data, specifications and installation instructions for each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each enclosed controller.
   1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
      a. Enclosure types and details.
      b. Nameplate legends.
      c. Short-circuit current rating of integrated unit.
      d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.
   2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

C. Field Test Reports: Written reports specified in Part 3.

D. Manufacturer's field service report.

E. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

1.4 O & M Data Submittals:

For enclosed controllers and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Closeout Procedures," include the following:

1. Routine maintenance requirements for enclosed controllers and all installed components.

2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Approval submittals, product data and shop drawings.

1.5 Quality Assurance

A. Manufacturer Qualifications: Maintain, within 100 miles (160 km) of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. All products shall be UL listed.

F. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed controllers, including clearances between enclosed controllers, and for adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 Delivery, Storage, And Handling

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subjected to weather, cover enclosed controllers to protect from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

1.7 Coordination

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

C. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.

D. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Enclosed Controllers:
   a. Siemens
   b. Square D Co.
   c. Eaton Corp.; Cutler-Hammer Products.
   d. General Electrical Distribution & Control.
   e. Rockwell Automation Allen-Bradley Co.; Industrial Control Group.

2.2 Relays

A. Relays shall be electrically held DPDT unless specifically noted on drawings, with contacts rated for the load connected and with NEMA 1 enclosures. Minimum contact rating for lighting controllers shall be 30 amps.

2.3 Manual Enclosed Controllers

A. Description: NEMA ICS 2, general purpose, Class A, with toggle action and overload element.

2.4 Magnetic Enclosed Controllers

A. Description: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, Starters through NEMA size seven shall be equipped with double break silver-alloy contacts. Contacts shall be replaceable without removing power wiring or removing the starter from the enclosure. The starters shall have straight-through wiring, Starter coils shall be molded construction through NEMA size seven, coils shall be replaceable from the front without removing the starter from the enclosure. Operating voltage shall be as indicated on the Drawings, unless otherwise indicated. Magnetic motor controllers shall have "Hand-Off-Auto" selector switch on cover unless noted otherwise. Magnetic motor controllers shall have red "run" and green "stop" LED pilot lights on the cover.

B. Control Circuit: Voltage per drawings; obtained from integral fused control power transformer with sufficient capacity to operate coil plus 50VA.

C. Combination Controller (where specified on the drawings): Factory-assembled combination controller and disconnect switch.

1. Circuit-Breaker Disconnecting Means: NEMA AB 1, motor-circuit protector with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

D. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.

E. Phase-Failure and Undervoltage Relays: Magnetic motor controllers shall have solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting.

F. Multispeed Enclosed Controller (where specified on the drawings): Match controller to motor type, application, and number of speeds; include the following accessories:

1. Compelling relay to ensure motor will start only at low speed.
2. Accelerating relay to ensure properly timed acceleration through speeds lower than that selected.
3. Decelerating relay to ensure automatically timed deceleration through each speed.

2.5 Multipole Contactors

A. Manufacturers:

1. Allen-Bradley/Rockwell Automation.
2. Cutler-Hammer; Eaton Corporation.
3. GE Industrial Systems; Total Lighting Control.
4. Square D Co.

B. Description: Electrically operated and electrically held, complying with NEMA ICS 2 and UL 508.

1. Current Rating: As indicated on drawings.
2. Control-Coil Voltage: Match control power source.

2.6 Enclosures

A. Description: Flush- or surface-mounted cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
3. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

2.7 Accessories

A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type. Magnetic motor controllers shall have "Hand-Off-Auto" selector switch on cover unless noted otherwise. Magnetic motor controllers shall have red "run" and green "stop" pilot lights on the cover. Pilot lights shall be LED type.

C. Stop and Lockout Push-Button Station: Magnetic motor controllers shall have momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

D. Phase-Failure and Undervoltage Relays: Magnetic motor controllers shall have solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting.

2.8 Factory Finishes

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosed controllers before shipping.

PART 3 - EXECUTION

3.1 Examination

A. Examine area and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance.

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

3.2 Applications

A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.

B. Select horsepower rating of controllers to suit motor controlled.

3.3 Installation

A. See Division 26 Section "Basic Electrical Materials and Methods" for general installation requirements.

B. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Basic Electrical Materials and Methods."

C. Install freestanding equipment on concrete bases.

3.4 Identification

A. Identify enclosed controller components and control wiring according to Division 26 Section "Basic Electrical Materials and Methods."

3.5 Control Wiring Installation

A. Install wiring between enclosed controllers according to Division 26 Section "Conductors and Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect hand-off-automatic switch and other automatic-control devices where applicable.

1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.6 Connections

A. Conduit installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.

B. Ground equipment.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.7 Field Quality Control

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed controller bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including pretesting and adjusting solid-state controllers.

3.8 Adjusting

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.9 Cleaning

A. Clean enclosed controllers internally, on completion of installation, according to manufacturer's written instructions. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.10 Startup Service

A. Engage a factory-authorized service representative to perform startup service.

B. Verify that enclosed controllers are installed and connected according to the Contract Documents.

C. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections.

D. Complete installation and startup checks according to manufacturer's written instructions.

3.11 Demonstration – for soft start motor starters only

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Review data in maintenance manuals. Refer to Division 1 Section "Closeout Procedures."
3. Schedule training with Owner, through Engineer, with at least seven days' advance notice.

END OF SECTION

SECTION 262726 - GENERAL WIRING DEVICES

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. This Section includes the following:

1. Single and duplex receptacles, ground-fault circuit interrupters, integral surge suppression units, and isolated-ground receptacles.
2. Single- and double-pole snap switches and dimmer switches.
3. Device wall plates.
4. Pin and sleeve connectors and receptacles.
5. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 Definitions

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. PVC: Polyvinyl chloride.

D. RFI: Radio-frequency interference.

E. SPD: Surge protection device.

F. SPR : Surge protection receptacle.

G. UTP: Unshielded twisted pair.

1.4 Submittals

A. Product Data: Submit manufacturer’s technical product data, specifications and installation instructions. For each type of product indicated.

1.5 Quality Assurance

A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. UL Listed.

1.6 Coordination

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Mfg. Company Inc.
   c. Pass & Seymour/Legrand; Wiring Devices Div.
2. Wiring Devices for Hazardous (Classified) Locations:
   a. Crouse-Hinds/Cooper Industries, Inc.; Arrow Hart Wiring Devices.
   b. EGS/Appleton Electric Company.
   c. Killark Electric Manufacturing Co./Hubbell Incorporated.
3. Multioutlet Assemblies:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Wiremold Company (The).
4. Poke-Through, Floor Service Outlets and Telephone/Power Poles:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Pass & Seymour/Legrand; Wiring Devices Div.
   c. Square D/Groupe Schneider NA.
   d. Thomas & Betts Corporation.
   e. Wiremold Company (The).

2.2 Receptacles

A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498. Devices shall be heavy duty, Federal Specification grade.

B. Single Receptacle Devices:

20 amp, 2 pole, 3 wire, 125V, NEMA 5-20R Hubbell HBL5361
30 amp, 2 pole, 3 wire, 125V, NEMA 5-30R Hubbell HBL9308
50 amp, 2 pole, 3 wire, 125V, NEMA 5-50R Hubbell HBL9360

20 amp, 3 pole, 4 wire, 125/250V, NEMA 14-20R Hubbell HBL8410
30 amp, 3 pole, 4 wire, 125/250V, NEMA 14-30R Hubbell HBL9430A
50 amp, 3 pole, 4 wire, 125/250V, NEMA 14-50R Hubbell HBL9450A
60 amp, 3 pole, 4 wire, 125/250V, NEMA 14-60R Hubbell HBL9460A

C. Duplex Receptacle Devices: The receptacle shall be heavy duty specification grade and have the following features: back and side wiring, 0.032 inches thick brass triple wipe power contacts, brass center inset, all brass grounding system, impact resistant nylon face, thick wall thermoset base. 15 amp, 2 pole, 3 wire, 125V, NEMA 5-15R Hubbell HBL5252. 20 amp, 2 pole, 3 wire, 125V, NEMA 5-20R Hubbell HBL5352.

D. GFCI Receptacles: Straight blade devices shall be heavy duty specification grade. Integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter. Hubbell GFR 5362 or approved equal.

E. SPR Receptacles: Straight blade, NEMA WD 6, Configuration 5-20R, with integral SPD in line to ground, line to neutral, and neutral to ground. Hubbell HBL 8362 or approved equal.

1. SPD Components: Multiple metal-oxide varistors; with a nominal clamp level rating of 500 volts and minimum single transient pulse energy dissipation of 140 J line to neutral, and 70 J line to ground and neutral to ground.
2. Active SPD Indication: Visual and audible with light visible in face of device to indicate device is "active" or "no longer in service."
3. Identification: Distinctive marking on face of device to denote SPD-type unit.

F. Combination USB Charger Receptacles:

1. Standard AC Duplex receptacle with two USB charging ports rated at 2.1 A, UL listed to UL 498 and UL 1310.

a. Device shall have one AC outlet and two USB charging ports (2.1 A @ 5 V DC).
b. USB ports shall be work with USB 2.0 and 3.0 compatible devices.
c. Device shall have auto grounding feature.
d. Where shown on Drawings as ground-fault protected, device shall be wired from load-side of a GFCI receptacle.
e. Device shall be compatible with standard wall plates.

2.3 Pendant Cord/Connector Devices

A. Description: Matching, locking-type plug and receptacle body connector, NEMA WD 6, Heavy-Duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.4 Cord And Plug Sets

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.5 Switches

A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.

1. Single Pole, 20 amp, 120/277 shall be Hubbell HBL1221 or approved equal.
2. Double Pole, 20 amp, 120/277V shall be Hubbell HBL1222 or approved equal.
3. Three-Way, 20 amp, 120/277V shall be Hubbell HBL1223 or approved equal.
4. Four-Way, 20 amp, 120/277V shall be Hubbell HBL1224 or approved equal.

B. Snap Switches: Federal Specification grade, quiet type, abuse resistant nylon toggle, color coded base, one-piece rivetless copper alloy spring contact arm & terminal plate, one piece integral grounding terminal with #8 brass screw, stainless steel automatic grounding clip, back wiring, one piece rivetless copper alloy spring contact arm and terminal plate. Provide 15-amp switch for circuits controlling up to but not exceeding 15 amperes. Provide 20-amp switch for circuit exceeding 15 amperes but less than or equal to 20 amperes. Provide 30 ampere switches for circuits exceeding 20 amperes but less than 30 amperes.

2.6 Wall Plates

A. Single and combination types to match corresponding wiring devices.

1. Material for Finished Spaces: Provide UL listed one-piece device plates for outlets to suit the devices installed. Except as noted below, all wiring device plates shall be 302 stainless steel, 0.032 in. thick. Jumbo device plates shall be used on all walls, Hubbell ‘SJ’ series, 302 stainless steel or approved equal. Sectional type device plates will not be permitted. Screws shall be machine-type with countersunk heads in color to match finish of plate.
2. Material for Unfinished Spaces: Provide UL listed one-piece device plates for outlets to suit the devices installed. Except as noted below, all wiring device plates shall be 302, stainless steel 0.032 in. thick. Jumbo device plates shall be used on all walls, Hubbell ‘SJ’ series, 302 stainless steel or approved equal. Sectional type device plates will not be permitted. Screws shall be machine-type with countersunk heads in color to match finish of plate.
3. Material for Wet Locations: Plates installed in wet locations shall be cast, gasketed and UL listed for "wet locations."

2.7 Floor Service Fittings

A. Type: Modular, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Power Receptacle: NEMA WD 6, Configuration 5-20R, unless otherwise indicated.

2.8 Finishes

1. Wiring Devices Connected to Normal Power System: Gray, unless otherwise indicated or required by NFPA 70.
2. Wiring Devices Connected to Emergency Power System: Red.
3. SPR Devices: Blue.

2.9 Finishes

1. Wiring devices: Grey.
2. SPR Devices: Blue.

PART 3 - EXECUTION

3.1 Installation

A. Install devices and assemblies level, plumb, and square with building lines.

B. Mounting Heights: Mounting heights for receptacle outlets shall be 18" above finished floor or as indicated on the Drawings. Mounting heights for receptacles over casework shall be 7" above countertop. Verify all receptacle heights prior to rough-in. Provide a written description to the Engineer, prior to rough-in, any conflicts. The Contractor shall at his expense, be responsible for the relocation of any receptacle not installed according to these specifications.

C. Prior to roughing-in wall outlet boxes, the Contractor shall verify from general construction drawings; door swings, type of wall finishes and locations for counters and work benches. Do not scale the plans; location of devices is shown on plans in desired vicinity. The Contractor shall carefully locate devices symmetrically and in coordination with architectural features.

D. Switches that control remote outlets, fans, etc., shall have engraved plastic name tags indicating the outlets, fans, etc. that are controlled.

E. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.

F. Install unshared neutral conductors online and load side of dimmers according to manufacturers' written instructions.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Remove wall plates and protect devices and assemblies during painting.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 Connections

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section "Basic Electrical Materials & Methods."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 Field Quality Control

A. Perform the following field tests and inspections:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION

SECTION 262730 - CORD REELS

PART 1 - GENERAL

1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this Section.

1.2 Division-26 Basic Electrical Materials and Methods Sections apply to work of this Section.

1.3 Submittals: Submit the producer's standard descriptive data sheets for each type of product being provided. Mark the data sheet for the product being provided with an identifying mark or arrow.

PART 2 - PRODUCTS

2.1 Acceptable Producers: Appleton Electric Company and Hubbell.

2.2 Cord reels shall be UL listed and shall be enclosed steel construction.

2.3 Mount on ceiling or wall using 4" octagonal outlet box or ceiling or wall mounting base. If mounting base is used provide cord and plug to receptacle outlet near base.

2.4 Cord reels shall be 20A and have 3#12AWG conductors. Minimum cord length shall be 25 feet.

2.5 Cords shall have a positive - stop cord locking ratchet with adjustable ball stop.

2.6 Housing for cord reels shall be baked enamel finish in producer's standard color.

2.7 Multi-position guide arm.

2.8 Hubbell Industrial Cord Reel or equal.

PART 3 - EXECUTION

3.1 Provide the type cord reel as indicated on the Drawings. Reels shall be handlamp or receptacle only type.

3.2 With all overhead mounted reels, provide secondary safety chain or cable to attach reels to ceiling to prevent the possibility of the reel accidently failing.

3.3 Testing: After all wiring and cord reels are in place, test to determine that:

A. System is free from short circuits and other faults.

B. Cord reel cable extends and retracts as specified.

END OF SECTION

SECTION 263200 - STANDBY ELECTRICAL SYSTEM

PART 1 - GENERAL

1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this Section.

1.2 Division-26 Basic Electrical Materials and Methods Sections apply to work of this Section.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.1 The building electrical system shall have two sources of power as follows:

A. Normal system to be comprised of normal utility power.

B. Standby system to be comprised of a stand-by generator system.

1. The standby system shall provide power to the following systems:
   a. Optional Standby System
      1) Optional Standby system shall comply with NEC Article 702.

END OF SECTION

SECTION 263210 - DIESEL GENERATOR

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. This Section includes packaged diesel engine generator sets with the following features and accessories:

1. Battery charger.
2. Base mounted fuel tank.
3. Engine-generator set.
4. Muffler.
5. Exhaust piping external to set.
6. Outdoor enclosure.
7. Remote annunciator.
8. Remote stop switch.
9. Starting battery.
10. Battery heater.
11. Block heater.
12. Exhaust insulation.

B. Related Sections include the following:

1. Division 26 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 Definitions

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

B. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hertz or cycles per second.

1.4 Submittals

A. Product Data: Include the following:

1. Data on features, components, accessories ratings, and performance.
2. Thermal damage curve for generator.

3. Time-current characteristic curves for generator protective device.
4. Recommended circuit breaker setting.
5. Load calculations showing maximum voltage drop for each step.
6. Exhaust system insulation.
7. Rain cap.
8. Equipment enclosure with wind rating.
9. Fuel tank with required fuel containment and safeguards.
10. Day tank (if required).
11. Remote annunciator and wiring requirements.
12. Emergency kill switch and wiring requirements.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
4. Wiring Diagrams: Power, signal, and control wiring.

C. Qualification Data: For manufacturer.

D. Certified summary of prototype-unit test report.

E. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.

F. Certified Summary of Performance Tests: Demonstrate compliance with specified requirement to meet performance criteria for sensitive loads.

G. Test Reports:

1. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
2. Report of sound generation.
3. Field quality-control test reports.

H. Certification of Torsional Vibration Compatibility: Comply with NFPA 110.

I. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition, include the following:

1. List of tools and replacement items recommended to be stored at the Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

J. Warranty: Special warranty specified in this Section.

1.5 Quality Assurance

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than 4 hours' normal travel time from Installer's place of business to Project site.
2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer’s Distributor Qualifications: A qualified supplier. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs. Service cannot be sublet to another service organization.

C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

D. Comply with NFPA 30 and 37A.

E. Comply with NFPA 70.

F. Comply with NFPA 110 requirements for emergency power supply system.

G. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

H. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

I. Fuel containment. Comply with applicable state requirements.

1.6 Coordination

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.7 Warranty

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.8 Maintenance Service

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Maintenance agreements shall include parts and supplies as used in manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Kohler Co; Generator Division
2. Caterpillar; Engine Div.
3. Onan Corp./Cummins Power Generation; Industrial Business Group.

2.2 Engine-Generator Set

A. Packaged engine-generator set shall be a coordinated assembly of compatible components.

B. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.

C. Output Connections: Three phase, four wire.

D. Safety Standard: Comply with ASME B15.1.

E. Nameplates: Each major system component shall be equipped with a nameplate to identify manufacturer's name and address, and model and serial number of components.

F. Mounting Frame: Adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Mounting frame shall be free from sharp edges and corners and shall have lifting attachments arranged for lifting with slings without damaging components.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

2.3 Generator-Set Performance

A. Over sizing generator compared with the rated power output of the engine is permissible to meet specified performance.

1. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.
2. Generator temperature shall be Class F or Class B. Minimum ratings shall be 90 degree C Lloyds, 95 degree C ABS, 105 degree C continuous, 130 degree C standby (Rise by resistance method, Mil-Std-705, Method 680.1b).

B. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.

C. Steady-State Voltage Modulation Frequency: Less than 1 Hz.

D. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 second.

E. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.

F. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

G. Transient Frequency Performance: Less than 2-Hz variation for a 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.

H. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. The telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.

I. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, the system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components and without a current boost system.

J. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.

K. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.4 Service Conditions

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 15 to plus 40 deg C.
2. Altitude: Sea level to 500 feet.

2.5 Engine

A. Fuel: Fuel oil, Grade DF-2.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Engine Fuel System:

1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

G. Governor: Adjustable isochronous, with speed sensing.

2.6 Engine Cooling System

A. Description: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

B. Radiator: Rated for specified coolant.

C. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

D. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

E. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

1. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

2.7 Fuel Supply System

A. Comply with NFPA 30.

B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with all local, state and federal guidelines and with UL 142 fuel oil tank. Features include the following:

1. Tank level indicator.
2. Dual wall construction with leak detection.
3. Capacity: Fuel for 48 hours continuous operation at 100 percent rated power output.
4. Vandal-resistant fill cap.
5. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.8 Engine Exhaust System

A. Muffler: Critical type, sized as recommended by engine manufacturer; sound level measured at a distance of 10 feet (3 m) from exhaust discharge shall be 85 dBA or less. Muffler shall be mounted inside generator weatherproof housing. Shall be mounted such that generator housing can be fully opened for maintenance.

B. Condensate Drain for Muffler: Schedule 40, black steel pipe connected to muffler drain outlet through a petcock.

C. Connection from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe.

D. Connection from Exhaust Pipe to Muffler: Stainless-steel expansion joint with liner.

E. Exhaust Piping External to Engine: ASTM A 53/A 53M, Schedule 40, welded, black steel, with welded joints and fittings and exterior insulation.

F. Rain Cap: Rain cap shall be aluminum or stainless steel and shall penetrate the top of the housing and contain no elbows outside housing.

G. Insulation: For all installations, the exhaust system shall be fully insulated as recommended by the generator manufacturer.

2.9 Combustion-Air Intake

A. Description: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

2.10 Starting System

A. Description: 24-V electric, with negative ground and including the following items:

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Environmental Conditions" Paragraph in "Service Conditions" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.

3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article to provide specified cranking cycle at least twice without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article. Include accessories required to support and fasten batteries in place.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Heater: Provide where generator is installed outdoors. Provide automatic disconnect for when generator is running.
9. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
    a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.11 Control And Monitoring

A. Functional Description: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of the generator set. When mode-selector switch is switched to the on position, the generator set starts. The off position of the same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set. Control system shall be microprocessor based.

B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

C. Indicating and protective devices and controls shall include those required by NFPA 110, and the following:

D. Indicating and Protective Devices and Controls:

1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
8. Ammeter-voltmeter, phase-selector switch(es).
9. Generator-voltage adjusting rheostat.
10. Start-stop switch.
11. Overspeed shutdown device.
12. Coolant high-temperature shutdown device.
13. Coolant low-level shutdown device.
14. Oil low-pressure shutdown device.
15. Fuel tank derangement alarm.
16. Fuel tank high-level shutdown of fuel supply alarm.

E. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

F. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals. Data system connections to terminals are covered in Division 26 Section "Electrical Power Monitoring and Control."

G. Common Remote Audible Alarm: Signal the occurrence of any events listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.

1. Engine high-temperature shutdown.
2. Lube-oil low-pressure shutdown.
3. Over speed shutdown.
4. Remote emergency-stop shutdown.
5. Engine high-temperature prealarm.
6. Lube-oil low-pressure prealarm.
7. Fuel tank, low-fuel level.
8. Low coolant level.
9. Over crank shutdown.
10. Coolant low-temperature alarm.
11. Control switch not in auto position.
12. Battery-charger malfunction alarm.
13. Battery low-voltage alarm.

H. Remote Alarm Annunciator: Comply with NFPA 99. Labeled LED shall identify each alarm event. Common audible signal shall sound for alarm conditions. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is

silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

I. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation. Install as indicated on the Drawings or Engineer approved location.

J. Provide TVSS on all circuits exiting genset.

2.12 Generator Overcurrent And Fault Protection

A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.

1. Tripping Characteristic: Designed specifically for generator protection. Provide circuit breaker settings to coordinate with generator damage characteristics.
2. Trip Rating: Matched to generator rating.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

B. Ground-Fault Indication (where indicated on drawings): Comply with NFPA 70, Article 700-7(d). Integrate ground-fault alarm indication with other generator-set alarm indications.

2.13 Generator, Exciter, And Voltage Regulator

A. Comply with NEMA MG 1 and specified performance requirements.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over speed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Excitation shall use no slip or collector rings, or brushes, and shall be arranged to sustain generator output under short-circuit conditions as specified.

G. Enclosure: Drip proof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band. Isolated from load to prevent tracking.

J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding. Dipped and baked, harmonic distortion not to exceed 5% total RMS line to line.

L. Subtransient Reactance: 12 percent, maximum.

2.14 Outdoor Generator-Set Enclosure

A. Description: Vandal-resistant, weatherproof painted marine-grade aluminum Level 2 sound attenuated enclosure.

1. The enclosure shall be UL2200 listed, providing a sound level of 75.2 dB(A) while the generator is operating at 100% load at 23 feet (7 meters) using acoustic insulation and acoustic-lined inlet hoods, constructed from a minimum of 0.125-inch-thick formed heavy duty aluminum panels. The acoustic insulation used shall meet UL 94 HF1 flammability classification. The enclosure shall be manufactured from bolted panels to facilitate service, future modifications, or field replacement. The enclosure shall use a vertically louvered air inlet and outlet hood with 90-degree angle to discharge air up and reduce noise. The enclosure shall have an integral rodent guard and skid end caps. The enclosure shall be certified to 186 mph (299 kph) wind load rating. The snow load rating shall be 70 lbs./ sq. ft. or greater.
2. The generator set enclosure shall be furnished with separate set of DC LED lights powered by the starting battery on a fused circuit with a 0-60 minute “No-Lock-On” timer.
3. The enclosure shall allow the generator set to operate at full load based on the cooling capability of the genset. The enclosure will account for no more than a 5°C derating of the ambient cooling capability of the generator.
4. Enclosures shall be equipped with sufficient side and end doors to allow access for operation, inspection, and service of the unit. A minimum of two doors per side shall be provided. Access to the genset controller and main line circuit breaker(s) shall through a door and shall meet the minimum working clearance requirements of the National Electric Code.
5. The enclosure shall be furnished with stainless steel latches, hinges, and hardware on the external panels of the enclosure. Access doors shall be rubber sealed to prevent water intrusion and to minimize noise.
6. Doors shall be equipped with lockable latches. Locks shall be keyed alike. Door locks shall be recessed to minimize potential of damage to door/enclosure.
7. A duct between the radiator and air outlet shall be provided to prevent recirculation of hot air.
8. The complete exhaust system shall be internal to the enclosure.
9. The critical silencer shall be fitted with a tailpipe and rain cap.

B. HVHZ Enclosure Requirements:

1. Enclosure shall conform to the Florida Building Code for High-Velocity Hurricane Zones.
2. Enclosure shall be third-party tested and certified to meet the following standards:
   a. Large Missile Impact Level E (FBC TAS 201-94)
   b. Uniform Static Air Pressure (FBC TAS 202-94)

c. Cyclic Wind Pressure Loading (FBC TAS 203-9)
d. Ultimate Design Pressure – Wall Panels +/- 65PSF
e. Ultimate Design Pressure – Roof Panels +/- 100PSF

3. Louvers:
   a. Inlet louvers: aluminum, motorized.
   b. Outlet louvers: galvanneal steel, gravity activated 90° louvers to prevent entry of rain and snow.

2.15 Finishes

A. Indoor Components: Manufacturer's electrostatically applied powder coat over corrosion-resistant pretreatment and compatible standard primer.

B. Outdoor Enclosures and Components: Cleaned with two-stage alkaline cleaning process, manufacturer’s electrostatically applied powder coat over corrosion-resistant pretreatment and primer and finish coated with powder baked fade-, scratch-, and corrosion resistant Power Armor heavy-duty industrial finish.
   1. The enclosure shall surpass a 3,000-hour salt spray corrosion test per ASTM B-1117.

C. Enclosure finish shall be manufacturer’s standard color.

2.16 Source Quality Control

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components, and equipped with identical or equivalent accessories.
   1. Tests: Comply with NFPA 110, Level 1 energy converters in Paragraphs 3.2.1, 3.2.1.1, and 3.2.1.2.
   2. Generator Tests: Comply with IEEE 115.
   3. Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype shall have been factory tested to demonstrate compatibility and reliability.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
   1. Full load run.
   2. Maximum power.
   3. Voltage regulation.
   4. Transient and steady-state governing.
   5. Single-step load pickup.
   6. Safety shutdown.

C. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 Examination

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

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

3.2 Concrete Bases

A. Coordinate size and location of concrete bases. Shall be 8” thick, exceeding genset footprint by 12” on all sides and be 4” higher than grade level. Provide as defined in 26 05 11. Provide rebar reinforcement, #6 on 12” centers on top and bottom. Provide a ground strap from rebar, 4/0 copper.

B. Provide a counterpoise ground loop around the concrete pad. Ground loop shall be 4/0 copper, 12” below grade. Provide two driven ground rods on opposite corners of the counterpoise loop. Ground rods shall be copper clad ¾” x 30’. Bond pad rebar with counterpoise loop. Provide a 4/0 copper lead to the generator grounding pad.

3.3 Installation

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generators level on concrete base.

1. Vibration Isolation: Mount packaged engine generators on restrained spring isolators or internal vibration isolators.

C. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.4 Connections

A. Ground equipment according to Division 26 Section "Grounding and Bonding." Generator shall be configured as a “separately derived electrical system” by bonding the neutral and ground at the generator.

B. Connect wiring according to Division 26 Section "Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.5 Identification

A. Identify system components according to Division 26 Section "Basic Electrical Materials and Methods."

3.6 System Integration

A. Fire Alarm System Integration: The generator controller shall be integrated into the existing fire alarm system to annunciate the following conditions:
   1. Generator running.
   2. Generator fault.
   3. Emergency power system Automatic transfer switch in non-automatic position.

3.7 Field Quality Control

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Sections 7.15.2.1 and 7.22.1 (except for vibration baseline test). Certify compliance with test parameters.
   2. Perform tests recommended by manufacturer.
   3. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, the following:
      a. Single-step full-load pickup test.
   4. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
      a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
      b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
      c. Verify acceptance of charge for each element of the battery after discharge.
      d. Verify that measurements are within manufacturer's specifications.
   5. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
   6. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the last 12 months, traceable to standards of the National Institute for Standards and Technology, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

G. Perform resistive load bank test for a minimum of 4 hours.

H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

I. Remove and replace malfunctioning units and retest as specified above.

J. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

K. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.8 Startup Service

A. Engage a factory-authorized service representative to perform startup service.

B. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

C. Complete installation and startup checks according to manufacturer's written instructions. Provide test documentation to Engineer.

D. Provide a full fuel tank at final acceptance. Fuel shall be new and receipt shall be provided in close out documents. Provide suitable fuel additive, as recommended by manufacturer, to preserve fuel. Include information on fuel additive in close out documents.

3.9 Demonstration

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

1. Coordinate this training with that for transfer switches.
2. Fully demonstrate operation, maintenance, and emergency procedures with Owner’s representative.

END OF SECTION

SECTION 263220 - TRANSFER SWITCHES

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. This Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.
2. Bypass/isolation switches.

1.3 Submittals

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, sections, and elevations showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition, include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.4 Quality Assurance

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Source Limitations: Obtain automatic transfer switches, bypass/isolation switches, nonautomatic transfer switches, remote annunciators, and remote annunciator and control panels through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for emergency service under UL 1008, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NEMA ICS 1.

E. Comply with NFPA 70.

F. Comply with NFPA 99.

G. Comply with NFPA 110.

H. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Contactor Transfer Switches:
   a. Emerson; ASCO Power Technologies, LP.
   b. Kohler Co.; Generator Division.
   c. Onan Corp./Cummins Power Generation; Industrial Business Group.
   d. Russelectric, Inc.

2.2 General Transfer-Switch Product Requirements

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including 100% tungsten filament lamp loads.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

C. Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels have communication capability matched with remote device.

D. Solid-State Controls: Repetitive accuracy of all settings is plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

F. Neutral Terminal: Switched, solid and fully rated.

G. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

H. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color code or by numbered or lettered wire and cable tape markers at terminations.

1. Designated Terminals: Pressure type suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

I. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

J. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Switch Action: Double throw; mechanically held in both directions.
2. Contacts: Fully rated silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

2.3 Automatic Transfer Switches

A. Comply with Level 1 equipment according to NFPA 110.

B. Microprocessor based.

C. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

D. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

F. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

2.4 Automatic Transfer-Switch Features

A. Undervoltage Sensing for Each Phase of Normal Source: Senses low phase-to-ground voltage on each phase. Pickup voltage is adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

B. Time delay for override of normal-source voltage sensing delays transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.

C. Voltage/Frequency Lockout Relay: Prevents premature transfer to generator. Pickup voltage is adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency is adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.

D. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes. Provides automatic defeat of delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

E. Test Switch: Simulates normal-source failure.

F. Switch-Position Pilot Lights: Indicate source to which load is connected.

G. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
2. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

H. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.

I. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

J. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.

K. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

L. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

1. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
2. Push-button programming control with digital display of settings.
3. Integral battery operation of time switch when normal control power is not available.

2.5 Bypass/Isolation Switches

A. Comply with requirements for Level 1 equipment according to NFPA 110.

B. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Include the following features for each combined automatic transfer switch and bypass/isolation switch:

1. Means to lock the bypass/isolation switch in the position that isolates the transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. While isolated, interlocks prevent transfer-switch operation, except for testing or maintenance.
2. Draw out Arrangement for Transfer Switch: Provides physical separation from live parts and accessibility for testing and maintenance operations.
3. Bypass/Isolation Switch Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of associated automatic transfer switch, and with same phase arrangement and number of poles.
4. Contact temperatures of bypass/isolation switches do not exceed those of automatic transfer-switch contacts when they are carrying rated load.
5. Operability: Constructed so load bypass and transfer-switch isolation can be performed by 1 person in no more than 2 operations in 15 seconds or less.
6. Legend: Manufacturer's standard legend for control labels and instruction signs give detailed operating instructions.
7. Maintainability: Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors.

C. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

2.6 Nonautomatic Transfer Switches

A. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." Switch is capable of transferring load in either direction with either or both sources energized.

B. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." In addition, removable manual handle provides quick-make, quick-break manual-switching action. Switch is capable of electrically or manually transferring load in either direction with either or both sources energized. Control circuit disconnects from electrical operator during manual operation.

C. Double-Throw Switching Arrangement: Incapable of pauses or intermediate position stops during switching sequence.

2.7 Remote Annunciator System

A. Functional Description: Remote annunciator panel annunciates conditions for indicated transfer switches. Annunciation includes the following:

1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Switch position.
3. Switch in test mode.

4. Failure of communication link.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.

1. Indicating Lights: Grouped for each transfer switch monitored.
2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
4. Lamp Test: Push-to-test or lamp-test switch on front panel.

2.8 Remote Annunciator and Control System

A. Functional Description: Include the following functions for indicated transfer switches:

1. Indication of sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Indication of switch position.
3. Indication of switch in test mode.
4. Indication of failure of digital communication link.
5. Key-switch or user-code access to control functions of panel.
6. Control of switch-test initiation.
7. Control of switch operation in either direction.
8. Control of time-delay bypass for transfer to normal source.

B. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation.

C. Remote Annunciation and Control Panel: Solid-state components. Include the following features:

1. Controls and indicating lights grouped together for each transfer switch.
2. Label each indicating light control group. Indicate the transfer switch it controls, location of switch, and load it serves.
3. Digital Communication Capability: Matched to that of transfer switches supervised.
4. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.

2.9 Finishes

A. Enclosures: Manufacturer's polyester powder coat over corrosion-resistant pretreatment and primer.

2.10 Source Quality Control

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 Application

A. Four-Pole Switches: install neutral switching.

3.2 Installation

A. Floor-Mounted Switch: Anchor to floor by bolting.

1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 2 inches (50 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated. Cast anchor-bolt inserts into bases. Comply with Division 3 Section "Cast-in-Place Concrete."

B. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

C. Identify components according to Division 26 Section "Basic Electrical Materials and Methods."

3.3 Wiring To Remote Components

A. Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

3.4 Connections

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section "Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.5 Field Quality Control

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.22.3. Certify compliance with test parameters.

3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.
4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
    f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Remove and replace malfunctioning units and retest as specified above.

3.6 Demonstration

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.
    1. Coordinate this training with that for generator equipment.

END OF SECTION

SECTION 264113 - LIGHTNING PROTECTION SYSTEM - CLASS I MATERIALS

PART 1 - GENERAL

1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this Section.

1.2 Division-26 Basic Electrical Materials and Methods Sections apply to work of this Section.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product to be installed.

B. Samples: Submit samples of the following:
   1. Air terminal.
   2. Base plates (each type to be used).
   3. Lightning protection conductor (6").

C. Roof Suitability Letter: Provide statement from manufacturer that system being provided is suitable for surface mounting on the roof material being supplied on this project.

D. Shop Drawings:
   1. Submit complete shop drawings showing the type, size, mounting requirements and locations for all equipment, grounds, and cable routings, etc. Drawings shall be no smaller than 1/16"=1'-0". CAD based roof plans may be obtained from the Architect or Engineer.

1.4 Test Reports and Verification Submittals:

A. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
   1. Ground Resistance Testing: Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81. Document results.
   2. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. UL Letter of Certification:

1. The lightning protection installer shall secure and deliver the UL Letter of Certification to the Architect for the Owner upon completion of the installation. The Contractor shall also submit copies of as-built shop drawings with LPI Form LPI-R88 to finalize the LPI Certified System Application. Provide the original UL certificate to the Owner with a copy in each O&M Manual.
2. UL does not allow for certification for partial installations or building additions, they only certify entire buildings. The lightning protection contractor after successful bid and contract award, shall be required to survey the remainder of the building to determine if the building conforms to current UL96a Standards for lightning protections systems (LPS). If the existing LPS is deficient, the lightning protection contractor is to provide the owner with a scope of work and quotation for upgrading the existing system to current standards so that a new UL Letter of Certification can be provided for the complete structure.

1.5 O&M Data Submittals:

A. Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approval submittals (product data & shop drawings) in O&M manual.

1.6 Labels: Label A for lightning conductors, Label B for air terminals and Label C for Master Label attached to the building all in compliance with the Underwriter's Laboratories, Inc. Master Label Service, UL 96A.

1.7 Scope: The work covered by this section of the specifications consists of furnishing all labor, materials and items of service required for the completion of a functional and unobtrusive lightning protection system as approved by the Engineer, and in strict accordance with this section of the specifications and the applicable contract drawings. If any departure from the contract drawings or submittal drawings, covered below are deemed necessary by the Contractor, details of such departures and reasons therefore shall be submitted as soon as practical to the Engineer for approval. No such departures shall be made without the prior written approval of the Engineer.

1.8 Standards: The installation shall conform with the latest following codes and standards:

A. Lightning Protection Institute Installation Code LPI 175.

B. National Fire Protection Code NFPA 780

C. UL96 Lightning Protection Components

D. UL96A Installation Requirements for Lightning Protection Systems

1.9 Quality Assurance: The lightning protection system shall conform to the requirements of the Lightning Protection Institute and NFPA Standards for Lightning Protection Systems. The LPI System Certification, including Form LPI-1-R88 shall be furnished and submitted.

A. The system to be furnished under these specifications shall be the standard product of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer's latest approved design. The equipment manufacturer shall also be a U.L. listed and approved manufacturer and a fully certified manufacturer member in good standing of the Lightning Protection Institute.

B. The lightning protection system shall be installed by a qualified UL or LPI installer.

PART 2 - PRODUCTS

2.1 Acceptable Producers: Robbins Lightning Protection, Thompson Lightning Protection, Harger Lightning Protection, Heary Lightning Protection.

2.2 Standards: All equipment used in this installation shall be factory inspected, approved, and properly labeled in accordance with LPI requirements. All equipment shall be new, the product of a single manufacturer as outlined above, and of a design and construction to suit the application where it is used in accordance with accepted industry standards and LPI and NFPA Codes requirements.

2.3 Air Terminals: Shall be solid, round copper bar of ½" minimum diameter. The air terminals shall have blunt terminal and extend a minimum of 10 inches above object to be protected or as required. Locate and space according to LPI and NFPA requirements. Thompson 52, 662, etc. Air terminals for use on aluminum roof systems shall be aluminum, Thompson A55, A56, A572, A660.

2.4 Conductors: Shall be copper, of 29 strands 17 gauge minimum. Ties to major metal masses shall be same size as main conductor. Miscellaneous ties to sheet metal and flashing shall be minimum size of #6 AWG stranded or equivalent braid. Thompson 29X. Conductors for use on metal roofs shall be aluminum of equal current carrying capacity as the copper conductor. The contractor shall transition to copper after exiting roof with approved connectors.

2.5 Air Terminal Bases:

A. For Built-up Roofs and Concealed Type: Shall be of cast bronze with bolt pressure cable connections and shall be securely mounted with adhesive type bases and shall have proper adhesive base to support terminal. Crimp type connectors are not acceptable. Thompson Cat. numbers 680, 678, 78, 611, etc., as required. Bases on single ply roofs shall be secured with a proper adhesive and shall have a minimum surface contact area of 18.5 sq. inches, Cat. number 688.

B. For Metal Roof Systems: Air terminal based for use on metal roofs shall be aluminum adhesive base type, Thompson A688. On sloped metal roofs use angle adapter so that air terminals are vertical, Thompson A27. The cable shall be tied down every 3’ between air terminals and other bonding points with an adhesive tie-down base, Thompson A730. The roof ridge bases shall be Thompson A71A.

2.6 Ground Connections: Provide one (1) for each down conductor preference being given to metal water pipes or other large underground metallic structures. Driven grounds shall be located a minimum of two feet from building foundation. Place conductors connecting to grounds 30" below finished grade. The building electrical system ground shall be bonded to the lightning protection system ground,

A. Ground Lead Spacing: The spacing for driven ground leads shall not exceed 100’ and shall be equally spaced around the building being protected.

B. New Construction: The down lead shall be concealed after exiting roof with a through wall connection. Two methods are acceptable for down leads. If building steel is used for down leads, the spacing of the down leads shall not exceed 60’. The driven grounds must still be used and be bonded to the building steel.

2.7 Ground Rods: Shall be coper-clad steel sectional type and minimum 3/4" in diameter and 10' long. Where indicated on the Drawings, provide ¾” by 20’ ground rods. They shall connect to the system with an exothermic connection.

2.8 Cable Fasteners: Shall be substantial in construction, electrolytically compatible with the conductor and mounting surface and shall be spaced according to LPI and NFPA Code requirements. Thompson 174, 730, 166, etc.

2.9 Bonding Devices: Bonding devices, cable splicers and miscellaneous connectors shall be of cast bronze with bolt pressure connections to cable. Cast or stamped crimp fittings are not acceptable. Splicers similar to 433B, 705, 706, etc., bonding devices similar to 702, 704, 551, 142, 561, 142X, etc. On metal roof systems use bonding devices and cable splicers compatible with the conductors and roof system.

2.10 Miscellaneous Hardware: Bolts, nuts and screws shall be brass, bronze, or stainless steel. On metal roof systems, provide hardware compatible with the roof system.

2.11 Metal Roof System Adhesive: Use adhesives that are approved by the roof system manufacturer. Contractor shall submit the roof manufacturer and system being supplied to the lightning protection contractor so that the proper adhesive may be used. Thompson 731 or approved alternate.

PART 3 - EXECUTION

3.1 Installation: The installation shall be accomplished by an experienced installer who is a Certified Master Installer of the LPI or working under the direct supervision of an LPI manufacturer as listed above or his authorized LPI Certified Master Installer representative.

A. All equipment shall be installed in a neat workmanlike manner in the most inconspicuous manner possible. The system shall consist of a complete cable network on the roof involving all air terminals, splices, and bonds with cable downleads routed concealed either directly in the building construction (new construction) or in conduit to ground (existing construction).

B. Metal Roof Systems: Downlead cables shall not be brought directly through the roof. All lighting protection equipment and conductors shall be surface mounted. Thru-roof connectors shall not be used on this project.

C. Copper equipment shall not be connected to aluminum surfaces except by means of an LPI approved bimetal transition fitting. Lead coating is not to be accepted as a bimetal transition.

D. Bond all metal masses within six feet of the main conductors. Bond all metal equipment and plumbing stacks with proper bonding techniques. Bond water piping system to conductors preferably at or near ground level. Conceal down conductors within the building structure unless indicated otherwise. Install in 1" conduit. Secure conduit on one-foot centers.

E. Joints, Bends and Supports in Conductors: Joints shall be as few in number as possible, mechanically strong and shall provide contact area not less than double the cross-sectional area of conductor. Make all joints with corrosion-resistant materials. Joints above grade may be bolted, pressure type, or thermite welding. Bends shall be gradual with minimum angle not less than 90 degrees. Radii of bends at eaves, etc., shall be not less than 8". Place supports a maximum of 4 feet apart. Roof supports shall be a maximum of 3 feet apart.

3.2 Coordination: The lightning protection installer will work with other trades to insure a correct, neat and unobtrusive installation. It shall be the responsibility of the lightning protection installer to assure a sound bond to the main water service and to assure interconnection with other building ground systems, including both telephone and electrical.

3.3 Ground Rods: Install sufficient length or number of grounds to give maximum resistance of 5 OHMS at each down conductor location. Bond different three-point grounding systems together if necessary to achieve a lower impedance.

END OF SECTION

SECTION 265025 – DISTRIBUTED LOW VOLTAGE LIGHTING CONTROL SYSTEM

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. This Section includes the following lighting controls:

1. Low voltage relay-based lighting control system.

1.3 Definitions

A. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

B. PC: Personal computer; sometimes plural as "PCs."

C. Power Line Carrier: Use of radio-frequency energy to transmit information over transmission lines whose primary purpose is the transmission of power.

D. RS-485: A serial network protocol, similar to RS-232, complying with TIA/EIA-485-A.

1.4 Submittals:

A. Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each device provided.

B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.

1. Floor Plans: submit a “point-to-point” wiring diagram showing power, signal, and control wiring to all lighting control equipment and devices, room numbers, device descriptions, etc. Include connections to AV systems where applicable. The submittal shall be made for approval prior to the installation of any devices or cabling.
2. System riser diagram with all devices, components, cable and wire types and sizes.

C. Software Upgrade Kit: For Owner to use in modifying software to upgrade and to allow system expansion.

D. Field quality-control test reports.

1.5 Test Reports and Verification Submittals:

A. Training: Submit letter verifying that Owner training has been received by factory representative.

1.6 O&M Data Submittals:

A. Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approval submittals (product data & shop drawings) in O&M manual.

1.7 Quality Assurance

A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.

B. Manufacturer Qualifications: Company specializing manufacturing of centralized and distributed lighting control systems with a minimum of 25 years documented experience.

C. Installer Qualifications: Company certified by the manufacturer and specializing in the installation of networked lighting control products with minimum three years documented experience or a company with five years of experience specializing in installation of networked lighting control.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

F. Comply with NFPA 70.

1.8 Coordination

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

1. Match components and interconnections for optimum performance of lighting control functions.

1.9 Warranty

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Software: Failure of input/output to execute switching or dimming commands.
   b. Failure of modular relays to operate under manual or software commands.
   c. Damage of electronic components due to transient voltage surges.

2. Warranty Period: Cost to repair or replace malfunctioning parts for one year after the date of Substantial Completion.

1.10 Extra Materials

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Electrically Held Relays: Equal to 5 percent of amount installed for each size indicated, but no fewer than one relay.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. SensorSwitch nLight Network Control System or approved equal.

2.2 System Requirements

A. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.

B. Where provided, system must interface directly with intelligent LED luminaires such that only CAT-6 cabling is required to interconnect luminaires with control components such as sensors and switches (see Networked LED Luminaire section)

C. Intelligent lighting control devices shall communicate digitally, require <4 mA of current to function (Graphic wall stations excluded), and possess RJ-45 style connectors.

D. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher-level network backbone.

E. Devices within a lighting control zone shall be connected with CAT-6 low voltage cabling in any order.

F. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.

G. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.

H. Power for devices within a lighting control zone shall come from either resident device already present for switching (relay device) or dimming purposes, or from the network backbone. Standalone “bus power supplies” shall not be required in all cases.

I. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself. Specific applications that require centralized or remote switching shall be capable of being accommodated.

J. System shall have one or more primary wall mounted network control “gateway” devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.

K. System shall use “bridge” devices that route communication and distribute power for up to 8 directly connected lighting zones together for purposes of decreasing system wiring requirements.

L. System shall be capable of wirelessly connecting a lighting zone to a WiFi (802.11n) wireless data network for purposes of eliminating the “bridge” devices and all cabling that connects zones to bridge devices.

M. WiFi enabled devices shall detect when WiFi network is down and revert to a user directed default state.

N. WiFi-enabled devices shall be capable of current monitoring.

O. WiFi-enabled devices shall utilize WPA2 AES encryption.

P. WiFi-enabled devices shall be able to connect to 802.11b/g/n WiFi networks.

Q. WiFi-enabled devices shall have at least one local RJ-45 port for communicating with non-WiFi-enabled system devices.

R. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control profiles.

S. Individual lighting zones shall be capable of being segmented into several “local” channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.

T. Devices located in different lighting zones shall be able to communicate occupancy, photocell, and switch information via either the wired or WiFi backbone.

U. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of a space. Note operating modes should be utilized only in manners consistent with local energy codes.

V. Auto-On / Auto-Off (via occupancy sensors)

1. Zones with occupancy sensors automatically turn lights on when occupant is detected.
2. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

3. Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.

W. Manual-On / Auto-Off (also called Semi-Automatic)

1. Pushing a switch will turn lights on.
2. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

X. Manual-On to Auto-On/Auto-Off

1. Pushing a switch will turn lights on.
2. After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.
3. Sequence can be reset via scheduled (ex. daily each morning) events.

Y. Auto-to-Override On

1. Zones with occupancy sensors automatically turn lights on when occupant is detected.
2. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
3. Sequence can be reset via scheduled (ex. daily each morning) events.

Z. Manual-to-Override On

1. Pushing a switch will turn lights on.
2. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
3. Sequence can be reset via scheduled (ex. daily each morning) events.

AA. Auto On / Predictive Off

1. Zones with occupancy sensors automatically turn lights on when occupant is detected.
2. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
3. If switch is pressed, lights turn off and a short “exit timer” begins. After timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lights must be turned on via the switch.

BB. Multi-Level Operation (multiple lighting levels per manual button press)

1. Operating mode designed specifically for bi-level applications.
2. Enables the user to cycle through the up to four potential on/off lighting states using only a single button.
3. Eliminates user confusion as to which of two buttons controls which load.
4. Three different transition sequences are available in order to comply with energy codes or user preference).
5. Mode available as a setting on all nLight devices that have single manual on/off switch (ex. nWSX, nPODM, nPODM-DX).
6. Depending on the sequence selected, every button push steps through relays states according to below table.

7. In addition to achieving bi-level lighting control by switching loads with relays, the ability to command dimming outputs to “step” in a sequence that achieves bi-level operation is present.

CC. A taskbar style desktop application shall be available for personal lighting control.

DD. An application that runs on “smart” handheld devices (such as an Apple® IPhone®) shall be available for personal lighting control.

EE. Control software shall enable logging of system performance data and presenting useful information in a web-based graphical format and downloadable to .CSV files.

FF. Control software shall enable integration with a BMS via BACnet IP.

GG. System shall provide the option of having pre-terminated plenum rated CAT-5 cabling supplied with hardware.

HH. Expansion Capability: Adequate to increase the number of control functions in the future by 25 percent more than those indicated. This expansion capability applies to equipment ratings, housing volumes, spare relays, terminals, number of conductors in control cables, and control software.

II. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels.

JJ. FCC Compliance: The programmable controllers shall comply with FCC emission standards specified in Part 15, sub-part J for commercial applications. In addition the controllers must meet the higher FCC standards for residential applications. Equipment that cannot meet both commercial & residential FCC certification shall not be acceptable.

2.3 Functional System Description

A. Manual switch, an internal timing and control unit, or an external sensor or other control signal source sends a signal to programmable-system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits for groups of lighting fixtures or other loads. Equivalent to ILC QuantaElite Series.

2.4 Control Module (Gateway)

A. Control module shall be a device that facilitates communication and time-based control of downstream network devices and linking into an Ethernet. Each control device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to lighting control devices.

B. Devices shall have a user interface that is capable of wall mounting, powered by low voltage, and have a touch screen.

C. Device shall automatically detect all devices downstream of it.

D. Device shall have a standard and astronomical internal time clock.

E. Device shall have one RJ-45 10/100 BaseT Ethernet connection.

F. Device shall have a USB port.

G. Each control gateway device shall be capable of linking 1500 devices to the management software.

H. Device shall be capable of using a dedicated or DHCP assigned IP address.

2.5 Communications Bridges

A. Device shall surface mount to a standard 4” x 4” square junction box.

B. Device shall have 8 RJ-45 ports.

C. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.

D. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.

E. Device shall be careful of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.

2.6 Networked System Vacancy Sensors

A. Dual-Technology Type: Ceiling mounted; detect occupancy by using a combination of PIR and microphonic detection methods in area of coverage. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation. Sensors shall be equipped with an automatic override for 100-hour burn-in of lamps. This feature must be available at any time for lamp replacements.

B. Sensors shall be available with zero, one, or two integrated Class 1 switching relays, and up to one 0-10 VDC dimming output. Sensors shall be capable of switching 120 / 277 / 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor. Relays shall be dry contacts.

C. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.

D. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue.

E. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.

2.7 Network System Daylight (Photocell and Or Dimming) Sensors

A. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.

B. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.

C. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

D. Dimming sensors shall control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).

E. Photocell and dimming sensors shall be equipped with an automatic override for 100-hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set point" setting.)

F. Combination units that have all features of on/off photocell and dimming sensors shall also be available.

G. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.

H. Line voltage versions of the above-described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC, 277 VAC, and 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load. Relays shall be dry contacts.

2.8 Relays And Modules

A. Networked System Power (Relay) Packs

1. Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2nd relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
2. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.
3. All devices shall have two RJ-45 ports.

4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
5. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. 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.
6. Power Packs and Power Supplies shall be WiFi enabled.

B. 0-10V Dimming Networked System Power (Relay) Packs

1. Power pack with 16A relay with an integral 0-10V dimming module. Secondary Packs shall be capable of providing up to 16 Amps of 0-10 VDC dimming of fluorescent ballasts/LED drivers.

2.9 Networked System Relay & Dimming Panels

A. Panel shall incorporate up to 4 normally closed latching relays capable of switching 120/277 VAC or up to 2 Dual Phase relays capable of switching 208/240/480 VAC loads. Relays shall be rated to switch up to a 30A ballast load at 277V. Each relay shall be provided with one 0-10VDC dimming output.

2.10 Networked Auxiliary Input/Output (I/O) Devices

A. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.

B. Devices shall have two RJ-45 ports. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.

C. I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current (typically 40 or more ballasts).

2.11 Manual Switches And Plates

A. Switches: Addressable switches. Provide and install custom faceplates and switches where shown on the drawings and/or schedules. Switch and plate assembly shall be single gang, double gang or custom configuration with switches installed as scheduled. Switches shall be capable of connection via Cat 6 cable. Switches shall be SensorSwitch nPodM series or approved equal.

B. Low voltage master switches shall have a 3.5" full color touch screen for selecting up to 8 programmable lighting control presets or acting as up to 16 on/off/dim control switches. Each device shall enable configuration of lighting presets, switched and dimers via password protected setup screens.

C. Faceplate: Finish in accordance with Division 26 Section "General Wiring Devices," type to match switch.

D. Switches and/or faceplate shall be custom engraved to indicate each switch zone. Verify exact zone names with engineer prior to engraving.

E. Configurations that are not standard catalog items shall be factory fabricated.

2.12 Conductors And Cables

A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Division 26 Section "Basic Electrical Materials and Methods."

B. Switch Cable: Category 6, lime green jacket color.

C. Digital and Multiplexed Signal Wire: Shielded, twisted-pair cable.

PART 3 - EXECUTION

3.1 Sensor Installation

A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer’s written instructions.

3.2 Relay Installation

A. Install relays, concealed above ceiling. In finished spaces with open ceilings, install relays in nearest ceiling cavity or electrical room.

3.3 Headend Equipment Installation

A. Install gateway(s), bridge(s), power supplies, etc. serving as the lighting headend control system or remote-control system in NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

3.4 Wiring Installation

A. Wiring Method: Install wiring in raceways. Comply with Division 26 Section "Basic Electrical Materials and Methods." Minimum conduit size shall be 3/4 inch (13 mm).

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

C. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

G. Verify control wiring requirement prior to installing conduit. Coordinate wiring and conduit with control system shop drawings.

H. Category 6 Cabling:

1. Comply with NECA 1.
2. General Requirements for Cabling:
    a. Comply with TIA/EIA 568 B.1.
    b. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
    c. Install 110 style IDC termination hardware unless otherwise indicated.
    d. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
    e. Cold Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
    f. Support all cable not installed in conduit or cable tray using j-hook supports installed on 5’ centers.
    g. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
    h. Do not untwist UTP cables more than 2 inches from the point of termination to maintain cable geometry.
3. Separation from EMI Sources:
    a. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
    b. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
        1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
        2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
        3) Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
    c. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
        1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
        2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
        3) Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

d. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   1) Electrical Equipment Rating Less Than 2 kVA: No requirement.
   2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   3) Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

e. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

f. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.5 Identification

A. Identify components and power and control wiring according to Division 26 Section "Basic Electrical Materials and Methods."

3.6 Field Quality Control

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and assist in field testing. Report results in writing.

B. Custom Programming Engage a factory-authorized service representative to program the system with custom presets, zones, scenes, etc., as directed by engineer and owner. This session shall take place on site after the system is fully operational and at a time convenient for the engineer and owner.

C. Perform the following field tests and inspections and prepare test reports:

1. Visually inspect UTP jacket materials for NRTL certification markings. Inspect cabling terminations in equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding, and bonding, and labeling of all components.
3. Verify that the control module features are operational.
4. Check operation of local override controls.
5. Test system diagnostics by simulating improper operation of several components selected by Engineer.

D. UTP Performance Field Tests:

1. Test for each device. Perform the following tests according to TIA/EIA-568-C.1 and TIA/EIA-568-C.2:
   a. Wire map.
   b. Length (Physical vs. electrical, and length requirements).
   c. Insertion loss.
   d. Near-end crosstalk (NEXT) loss.
   e. Power sum near-end crosstalk (PSNEXT) loss.
   f. Equal-level far-end crosstalk (ELFEXT).

g. Power sum equal-level far-end crosstalk (PSELFEXT).
h. Return loss.
i. Propagation delay.
j. Delay skew.

2. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in the BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
3. Remove and replace cabling where test results indicate they do not comply with specified requirements.
4. End-to-end cabling will be considered defective if it does not pass test and inspections.

E. Prepare test and inspection reports.

3.7 Adjusting

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

3.8 Demonstration

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting controls.

B. Coordinate demonstration of products specified in this section with demonstration requirements for dimming control systems specified in Division 26 Section “Dimming Controls”.

END OF SECTION

SECTION 265119 - LED INTERIOR LIGHTING

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. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixtures mounted on exterior building surfaces.
3. Lighting fixture supports.
4. Emergency lighting units.
5. Exit signs.

1.3 Definitions

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 Submittals

A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following: Physical description of fixture, including dimensions and verification of indicated parameters.

1. Emergency lighting unit battery and charger.
2. LED drivers.
3. LED life, output (lumens, CCT, and CRI), and energy efficiency data.

4. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project IES LM-79 and IES LM-80.
   a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
   b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include location and size of each field connection.

C. Wiring Diagrams: Power, signal, and control wiring.

D. Samples for Verification: For each type of luminaire.

1. Accessories: Cords and plugs.
2. Fixtures.

E. Field quality-control test reports.

F. Warranties: Special warranties specified in this section.

1.5 O&M Submittals

A. Submit manufacturer’s maintenance data including parts lists. Include in these data, a copy of approval submittals (product data and shop drawings) in O & M manual.

1.6 Extra Materials:

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: **Ten for every 100** of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: **One for every 100**of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: **One for every 20**of each type and rating installed. Furnish at least one of each type.

1.7 Quality Assurance

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Comply with NFPA 70.

E. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.8 Delivery, Storage, And Handling

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 Warranty

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: **Five** year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 Manufacturers

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include the products specified.

2.2 Fixtures and Components, General

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures

E. Bulb shape complying with ANSI C79.1.

F. Lamp base complying with ANSI C81.61.

G. CRI of minimum 80 unless specified otherwise in the Lighting Fixture Schedule.

H. Minimum rated lamp life of 50,000 hours.

I. Integral driver.

J. Metal Parts: Free of burrs and sharp corners and edges.

K. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

L. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit access without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

M. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

N. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   a. Lens Thickness: At least 0.156 inch (3.175 mm) minimum unless different thickness is scheduled.
   b. UV stabilized.
2. Glass: Tempered glass, unless otherwise indicated.

O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:
   a. "USE ONLY" and include specific lamp type.
   b. Lamp diameter, shape, size, wattage, and coating.
   c. CCT and CRI for all luminaires.

2.3 Exit Signs

A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum of rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Shall have Self Verification and Test capability installed.

2.4 LED Emergency Lighting Fixtures

A. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.

1. Emergency Connection: Operate fixture continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture driver.
2. Night Light Connection: Operate fixture at 50% output continuously.
3. Test Switch and Light-Emitting-Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
4. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum seven-year nominal life.
5. Charger: Fully automatic, solid-state, constant-current type.
6. 1400 lumen ouput for a minimum of 90 minutes depending upon fixture type and quantity.
7. Approved manufacturers are Bodine, Beghelli and Emergi-Lite.
8. In exterior locations, provide equipment capable of operating at temperatures from 0° F to 130° F.

2.5 Metal Finishes

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.6 Luminaire Fixture Support Components

A. Comply with Division 26 Section “Basic Electrical Materials and Methods” for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, **12 gage (2.68 mm)**.

E. Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

H. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.7 Finishes

A. Fixtures: Manufacturers' standard, unless otherwise indicated.

1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects. Paint shall be applied after fabrication.
2. Metallic Finish: Corrosion resistant.

2.8 Source Quality Control

A. Provide services of a qualified, independent testing and inspecting agency to factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.

B. Factory test fixtures with driver at rated lumen output; certify results for electrical ratings and photometric data.

PART 3 - EXECUTION

3.1 Installation

A. Fixtures:

1. Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings.
2. The installation shall meet with the requirements of NFPA 70.

3. Mounting heights specified or indicated shall be to bottom of fixture for ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures on the job before installation is commenced and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed.
4. 1' x 4', 2' x 4' and 2' x 4' Recessed and semi-recessed fixtures may be supported from suspended ceiling support system ceiling tees if the ceiling system support wires are provided at a minimum of four wires per fixture and located not more than 6 inches from each corner of the fixture. Additionally, for recessed fixtures, provide support clips securely fastened to ceiling grid members, a minimum of one at or near each corner of each fixture.
5. For round fixtures or fixtures smaller in size than the ceiling grid, provide a minimum of four wires per fixture and locate at each corner of the ceiling grid in which the fixture is located.
6. Do not support fixtures by ceiling acoustical panels. Where fixtures of sizes less than the ceiling grid are indicted to be centered in the acoustical panel, support such fixtures independently or with at least two 3/4-inch metal channels spanning, and secured to the ceiling tees.
7. Provide wires for lighting fixture support in this section. There are many type of ceiling systems available on the market and any number of these ceiling systems may be used as part of this work. Verify the types of ceiling construction before ordering fixture fabrication. Determine that suspension methods and flange arrangements for fixtures coordinate with ceiling types and their suspension systems.
8. For flush mounted luminaires, secure fixture to outlet box. Attach to ceiling structural members at four points equally spaced around the circumference of the fixture. Provide trim ring flush with surface.
9. For wall mounted luminairs, attach fixture to structural members in walls. Where a structural member is not available, attach to a minimum 20 guage backplate attached to wall structural members. Do not attach fixtures directly to gypsum board.

3.2 Connections

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 Field Quality Control

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Verify normal operation of each fixture after installation.

C. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal. Test every fixture and provide written documentation of results.

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

E. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

F. Clean all fixtures. Wipe down and remove finger prints, dust, dirt, grime, etc.

3.4 Adjusting

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace drivers or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 265600 - SITE LIGHTING

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. This Section includes the following:

1. Site lighting fixtures with lamps and ballasts.

1.3 Submittals

A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of fixture, including dimensions and verification of indicated parameters.
2. Fluorescent and high-intensity-discharge ballasts.
3. Lamps.

B. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Warranties: Special warranties specified in this Section.

1.4 O & M Data Submittals

A. Submit manufacturer’s maintenance data including parts lists. Include in these data, a copy of approval submittals (product data and shop drawings) in O & M manual.

1.5 Quality Assurance

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicted, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. Site lighting shall be per plans and specifications in base bid. It is the contractor's responsibility to insure that all items supplied for use on this project comply with the specifications. Any alternate to the base bid specifications must be reviewed and approved by the Engineer in writing at least 10 days prior to the bid. Information sufficient to determine conformance to the specifications must be submitted to the engineer at least two weeks prior to bid date to be considered for approval. No substitutions will be considered without compliance with the requirements listed herein. Contractor shall be responsible for all cost (engineering time, manufacturer's cost, distributor cost, etc.) incurred to replace equipment not approved if substitutions are made by the distributor, manufacturer representative, or contractor. For an alternate to the base bid specifications to be reviewed, the following samples and technical information must be supplied:

1. A working sample of the alternate luminaire complete with lamps, ballast, and optical system that will be supplied for the bid installation. For convenience, the Engineer may require a sample, which operates at 120 volts.
2. A complete photometric report of the submitted sample with the specified lamp type must list the actual candela values for the luminaire's distribution in at least three planes. Candela curves, footcandle and lumen tables in iso-footcandle contours are not acceptable. Prorated data is not acceptable. Data will be supplied both in written form and in the form of a data file on CD in IES format for use in recognized computer lighting applications.
3. A current original catalog data sheet with luminaire catalog numbers. Modified data sheets are unacceptable.
4. A factory generated point-by-point computer printout of the entire site on one plan verifying the illumination criteria for the entire site plan based on using the alternate luminaires. The spacing increment of points on the verification printouts shall not exceed one half the scale of the original site plan or the luminaire mounting height, whichever is less. The printouts shall be based on the footcandle levels based on the criteria set by the Engineer for this specific project with a summary table showing the maximum, minimum, and average horizontal footcandle levels on the entire site. Footcandle values shall be in decimal value. Values shall not be rounded up or down. Values shall be shown with no less than two decimal points. At a minimum, two printouts must be supplied, one showing initial footcandles, and one showing maintained footcandle values based on a .72 light loss for metal halide luminaires and a .80 light loss factor for high pressure sodium luminaires. The report must show that the alternate fixtures provides performance equal to or better than the lighting levels of the specified product.
5. The engineer reserves the right to verify the lighting performance of the fixtures following installation on the site. Should the luminaire performance fail to meet the criteria set forth for this specific job, or fail to meet the performance specification set forth for the specific fixture, the contractor shall be responsible for acquiring and installing any additional equipment necessary to bring the lighting levels up to the required values. All cost related to purchase and installation of such additional equipment shall be the responsibility of the contractor. Verification of the site by the engineer may take place anytime following the completion of the site and the initial 100-hour burning of the lamps in the fixtures, up to 180 days following the initial 100-hour burning period.

PART 2 - PRODUCTS

2.1 Manufacturers

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified on the drawings.

2.2 Fixtures And Components, General

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

D. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

2.3 Lighting Fixtures

A. Construction

1. All housings and arms shall feature an Aluminum Association Architectural Class I anodized finish. The fixture will be anodized after fabrication with an electrolytic process that does not use dyes or organic chemicals.
2. Housing shall be square or rectilinear design with die formed (or die cast) aluminum housing sides with integral reinforcing spline and no welded corners.
3. All fixtures shall provide for segmented, electro-chemically brightened, anodized aluminum sheet reflectors set in facets to produce the specified light distribution patterns. The assembly shall be easily to rotate in the field in 90 degree increments without rotating the luminaire.
4. Complete installation and wiring of the fixture must be accomplished without opening the fixture housing except to install the lamp.
5. The fixture shall permit access without tools into the reflector assembly and ballast compartments for ease of maintenance and safety.
6. Ballast assemblies shall be provided on a unitized tray permitting removal of the ballast tray form the fixture without the necessity to cut any wires. Additional ballast trays pre-assembled and including all ballast components must be available from the manufacturer of the fixture.

2.4 Finishes

A. Fixtures: Manufacturers' standard, unless otherwise indicated.

1. Paint Finish: Polyester powder coat applied over corrosion-resistant treatment or primer, free of defects.
2. Metallic Finish: Corrosion resistant.

2.5 Source Quality Control

A. Provide services of a qualified, independent testing and inspecting agency to factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.

B. Factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.

PART 3 - EXECUTION

3.1 Installation

A. Fixtures: Set lighting fixtures plumb, square, and level and secure in accordance with manufacturers' directions and approved drawings. The installation shall meet with the requirements of NFPA 70.

B. Adjust aimable fixtures to provide required light intensities.

C. Provide ground rod at base of pole per section 26 56 28.

D. Provide fusing for each pole mounted fixture inside handhole in pole.

3.2 Connections

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 Field Quality Control

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Verify normal operation of each fixture after installation.

C. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal. Test every fixture and provide written documentation of results.

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

E. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

END OF SECTION

SECTION 265628 - LIGHT POLES AND STANDARDS

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. This Section includes the following poles for support of luminaires:

1. Steel poles.
2. Aluminum poles.
3. Prestressed concrete poles.

B. Related Sections include the following:

1. Division 26 Section "Site Lighting" for lighting fixtures, lamps, ballasts, and accessories.

1.3 Definitions

A. Luminaire: Complete lighting fixture, including ballast housing if provided.

B. Pole: Luminaire support structure, including foundation, standard, pole top and high pole, and tower used to illuminate large area.

C. Standard: Same definition as "Pole" above.

1.4 Performance Requirements

A. Wind Load: Pressure of wind on standard and luminaire, calculated and applied as stated in AASHTO LTS-3.

1. The actual wind speed for the required loading shall not be less than that referenced in ASCE 7-98, Minimum Design Loads for Buildings and Other Structures, 1998. Linear interpolation between contours is permitted.

1.5 Submittals

A. Product Data: For each type of pole indicated, arranged in order of lighting unit designation. Include data on accessories, finishes, and the following:

1. Materials and dimensions of poles
2. Means of attaching luminaires and indication that attachment is suitable for it

3. Concrete bases (for anchor base poles)
4. Overall pole dimensions
5. Working moment capacity
6. Total moment resulting from applied loads
7. Total axial load
8. Anticipated pole top deflection due to applied loads
9. Total weight of each pole
10. Bolt hole locations (for anchor base poles)
11. Description and location of steel reinforcement (for direct burial concrete poles)
12. Twenty-eight day strength of concrete and detention strength (for direct burial concrete poles)
13. Ultimate moment
14. Cracking moment
15. Minimum clear concrete cover over spiral steel (for direct burial concrete poles)
16. Wind loading calculations.
17. Structural foundation requirements, signed by a registered structural engineer.

B. Shop Drawings: Include anchor-bolt templates keyed to specific poles and certified by manufacturer.

1. Design calculations, certified by a qualified professional engineer, indicating strength of the foundation.

C. Product Certificates: Signed by manufacturer of poles, certifying that products are designed for load requirements in AASHTO LTS-3 and that load imposed by luminaire has been included in design.

1. Design calculations, certified and signed by a qualified professional engineer, indicating strength of the foundation.

1.6 Delivery, Storage, And Handling

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on metal poles until just before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ameron Pole Products; Division of Ameron International Corp.
2. Lyte Poles.
3. Gardco.

2.2 Poles, General

A. Description: Comply with AASHTO LTS-3 in structural design of poles.

B. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Performance Requirements" Article, with a gust factor of 1.3.

1. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

C. Luminaire Attachment: Structural supports to comply with luminaire mounting requirements.

D. Finish: Match finish of pole and support structure on arm, bracket, and tenon mount materials.

E. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Mountings: Correctly position luminaire attachment to provide indicated light distribution.
3. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless stainless-steel items are indicated.
4. Anchor-Bolt Template: Plywood or steel.
5. Concrete Bases: Cast-in-place concrete.

F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and having strength, mounting bolt, and top-plate dimensions required to support pole, luminaire, and accessories.

2.3 Aluminum Poles

A. Poles: Seamless, extruded structural tube complying with ASTM B 429, 6063-T6 alloy with access handhole in pole wall.

B. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

C. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

D. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.

E. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Engineerural and Metal Products" for recommendations for applying and designating finishes.

1. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Engineerural Class I,

integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
a. Color: per drawings.
b. Shape: per drawings.

PART 3 - EXECUTION

3.1 Erection, General

A. Set reinforcement for anchor bolts, nuts, and washers according to anchor-bolt templates furnished by pole manufacturer.

1. Concrete Finish: Trowel and rub smooth.

B. Install poles as follows:

1. Use web fabric slings (not chain or cable) to raise and set poles.
2. Mount pole to foundation with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
3. Secure poles level, plumb, and square.
4. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
5. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

3.2 Corrosion Prevention

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

3.3 Grounding

A. Ground poles/support structures according to Division 26 Section "Grounding and Bonding."

1. Install grounding electrode (minimum size is ¾” by 10’ long) for each pole.
2. Nonmetallic Poles: Ground metallic components of pole accessories and foundations.
3. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

END OF SECTION

SECTION 270000 - TELECOMMUNICATIONS GENERAL

PART 1 - GENERAL

1.1 The work covered by this division consists of providing all labor, equipment and materials and performing all operations necessary for the installation of the structured cabling system work as herein called for and shown on the Drawings.

1.2 Related Documents

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

B. This is a Basic Telecommunications Requirements Section. Provisions of this Section apply to work of all Division 27 Sections.

C. Comply with all requirements of Division 26 Sections, Basic Electrical Materials and Methods and Electrical Grounding.

D. Review all project Drawings to be aware of conditions affecting work herein.

1.3 Definitions

A. Provide: Furnish, install, and test, complete and ready for intended use.

B. Furnish: Supply and deliver to project site, ready for subsequent requirements.

C. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, test complete ready for intended use, and similar requirements.

D. Other definitions used throughout these Division 27 specifications:

1. BICSI: Building Industry Consulting Service International.
2. CO: Communications Outlet.
3. CP: Consolidation Point.
4. EMI: Electromagnetic Interference
5. FUT: Fiber under test.
6. LAN: Local area network.
7. MCE: Main Communications Equipment Room.
8. M/M: Multimode.
9. OFOI: Owner furnished; owner installed.
10. OFCI: Owner furnished; contractor installed.
11. RCDD: Registered Communications Distribution Designer.
12. SCSC: Structured Cabling System Contractor.
13. S/M: Single mode.

14. TR: Telecommunications Room
15. UTP: Unshielded twisted pair.
16. VOIP: Voice Over Internet Protocol
17. WAO: Work Area Outlet.
18. Horizontal Cabling: The portion of the communications cabling system that extends from the work area outlet (WAO) to the horizontal cross-connect in the TR.
19. Intrabuilding Backbone: The portion of the communications cabling system within a building that connects each TR to the MCE.
20. Interbuilding Backbone: The portion of the communications cabling system exterior to a building that connects one buildings MCE to another's.
21. Active Equipment: The active data network and telephone system equipment will not be included as a part of this contract. The wiring infrastructure to support connectivity will be installed under this contract. The contractor shall assist providers of these systems to integrate and install as required to interface to the cabling systems installed under this contract.

1.4 Permits and Fees: Contractor shall obtain all necessary permits, meters, and inspections required for his work and pay all fees and charges incidental thereto.

1.5 Verification of Owner's Data: Prior to commencing work the Contractor shall satisfy himself as to the accuracy of all data indicated on the Drawings and/or provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Engineer. Commencement of work by the Contractor shall be held as an acceptance of the data by him after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions, or inaccuracies of the said data.

1.6 Delivery and Storage of Materials: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. All material shall be stored to provide protection from the weather and damage.

1.7 Extent of work is indicated in the Drawings, Schedules, and Specification. Singular references shall not be construed as requiring only one device if multiple devices are shown on the Drawings or are required for proper system operation.

1.8 Field Measurements and Coordination

A. The intent of the Drawings and Specifications is to obtain a complete and satisfactory installation. Separate divisional Drawings and Specifications shall not relieve the Contractor or Subcontractors from full compliance of work of his trade indicated on any of the Drawings or in any Section of the Specifications. Report conflicts prior to start of work.

B. Verify all field dimensions and locations of equipment to ensure close, neat fit with other trades' work. Make use of all Contract Documents and approved shop drawings to verify exact dimension and locations. Do not scale structured cabling system drawings; rely on dimensions shown on architectural or structural drawings.

C. Coordinate work in this Division with all other trades in proper sequence to ensure that the total work is completed within Contract time schedule and with minimum cutting and patching.

D. Locate all equipment, materials, and apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on structured cabling system drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others.

E. Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings, and passageways. Cut no structural members without written approval from Engineer or Architect.

F. Carefully examine any existing conditions, piping, and premises. Compare Drawings with existing conditions. Report any observed discrepancies. Written instructions will be issued by the Engineer to resolve discrepancies.

G. Because of the small scale of the Drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members, wall and partition locations, trusses, and room dimensions and take actual measurements on the job. Locate material, equipment, and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment or material cannot be fitted, the Engineer shall be consulted. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

1.9 Guarantee And Service:

A. Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving Contractor of his responsibilities during guarantee period.

B. The Contractor shall guarantee labor, materials, and equipment for a period of one (1) year from Substantial Completion, or from Owner's occupancy, whichever is earlier. Contractor shall make good any defects and shall include all necessary adjustments to and replacement of defective items without expense to the Owner.

C. Special Structured Cabling System Warranty:

1. See sections 27 13 00 and 27 15 00 for special structured cabling system warranty.

1.10 Approval Submittals

A. When approved, the submittal control log and submittals shall be an addition to the specifications herewith and shall be of equal force in that no deviation will be permitted except with the approval of the Architect/Engineer.

B. Shop drawings, product literature, and other approval submittals will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions and Division 1 Specification sections and the following:

1. Submittals shall be properly organized in accordance with the approved submittal control log.
2. Submittals shall include all applicable items referenced in each specification section, and not include items from more than one specification section in the same submittal.
3. Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control number, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approval stamps. A sample cover sheet is included at the end of this section.
4. Submittals shall have been reviewed and approved by the General Contractor (or Prime Contractor). Evidence of this review and approval shall be an "Approved" stamp with a signature and date on the cover sheet.
5. Submittals shall be combined into a single submittal package with a table of contents. Submittals shall not be issued as multiple individual submittal packages.
6. Submittals that include a series of devices shall be organized by device and be marked accordingly.

C. If the shop drawings show variation from the requirements of contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variation in writing in his letter of transmittal and on the submittal cover sheet in order that, if acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the contract.

D. Review of shop drawings, product literature, catalog data, or schedules shall not relieve the Contractor from responsibility for deviations from contract drawings or specifications, unless he has in writing called to the attention of the Architect/Engineer each such deviation in writing at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings, product literature, catalog data, or schedules. Any feature or function specified but not mentioned in the submittal shall be assumed to be included per the specification.

E. Submit shop drawings as called for in other sections after award of the contract and before any material is ordered or fabricated. Shop drawings shall consist of plans, sections, elevations and details to scale (not smaller than □" per foot), with dimensions clearly showing the installation. Direct copies of small-scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other sections and shall show space allotted for it. Include construction details and materials.

1.11 Test Reports and Verification Submittals: Submit test reports, certifications and verification letters as called for in other sections. Contractor shall coordinate the required testing and documentation of system performance such that sufficient time exists to prepare the reports, submit the reports, review the reports, and take corrective action within the scheduled contract time. Where testing by an independent testing agency is required or selected by the Contractor, the requirements below shall be met.

A. The testing firm shall be regularly engaged in the testing of structured cabling system equipment devices, installations, and systems.

B. The testing firm shall utilize technicians who are regularly employed by the firm for testing services.

1.12 O&M Data Submittals: Submit Operation and Maintenance data as called for in other sections. When a copy of approval submittals is included in the O&M Manual, only the final "Furnish as Submitted" or "Furnish as Corrected" copy shall be used. Contractor shall organize these data in the O&M Manuals tabbed by specification number. Prepare O&M Manuals as required by Division 1 and as described herein. Submit manuals at the Substantial Completion inspection.

PART 2 - PRODUCTS

2.1 All materials shall be new or Owner-supplied reused as shown on the drawings, the best of their respective kinds, suitable for the conditions and duties imposed on them at the building and shall be of reputable manufacturers. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following sections.

2.2 Equipment and Materials

A. Shall be new and the most suitable grade for the purpose intended. Equipment furnished under this division shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of three years. Where practical, all of the components shall be products of a single manufacturer in order to provide proper coordination and responsibility. Where required, Contractor shall furnish proof of installation of similar units or equipment.

B. Each item of equipment shall bear a name plate showing the manufacturer's name, trade name, model number, serial number, ratings, and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated or painted.

C. The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be a product of the manufacturer's latest design.

D. A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

E. Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.

F. Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material, and type of construction desired. Manufacturer's products shown on the Drawings have been used as basis for design; it shall be the Contractor's responsibility to ascertain that alternate manufacturer's products meet detailed specifications, and that size and arrangement of equipment are suitable for installation.

G. Model Numbers: Catalog numbers and model numbers indicated in the Drawings and Specifications are used as a guide in the selection of the equipment and are only listed for the Contractor's convenience. The Contractor shall determine the actual model numbers for

ordering equipment and materials in accordance with the written description of each item and with the intent of the Drawings and Specifications.

H. All equipment and material shall be manufactured and assembled in the United States.

2.3 Requests For Substitution

A. Where a particular system, product or material is specified by name, consider it as standard basis for bidding, and base proposal on the particular system, product or material specified.

B. Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

C. Required product cannot be supplied in time for compliance with Contract time requirements.

D. Required product is not acceptable to governing authority, or determined to be non-compatible, or cannot be properly coordinated, warranted or insured, or has other recognized disability as certified by Contractor.

E. Substantial cost advantage is offered Owner after deducting offsetting disadvantages including delays, additional compensation for redesign, investigation, evaluation and other necessary services and similar considerations.

F. All requests for substitution shall contain a "Comparison Schedule" and clearly and specifically indicate any and all differences or omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include but shall not be limited to data as follows for both the specified and substituted products:

1. Principal of operation.
2. Materials of construction or finishes.
3. Thickness of gauge of materials.
4. Weight of item.
5. Deleted features or items.
6. Added features or items.
7. Changes in other work caused by the substitution.
8. Performance curves.

G. If the approved substitution contains differences or omissions not specifically called to the attention of the Architect/Engineer, the Owner reserves the right to require equal or similar features to be added to the substituted products (or to have the substituted products replaced) at the Contractor's expense.

PART 3 - EXECUTION

3.1 Workmanship: All materials and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat and/or workmanlike appearance, or do not allow adequate space for maintenance, shall be removed and replaced when so directed by the Architect/Engineer.

3.2 Coordination

A. The Contractor shall be responsible for full coordination of the structured cabling system with shop drawings of the building construction so the proper openings and sleeves or supports etc., are provided for conduit, devices, or other equipment passing through slabs or walls.

B. Any additional steel supports required for the installation of any structured cabling system equipment, devices or conduit shall be provided by the Contractor.

C. It shall be the Contractor's responsibility to see that all equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the Drawings.

D. All connections to devices and equipment shown on the Drawings shall be considered diagrammatic unless otherwise indicated by a specific detail on the Drawings. The actual connections shall be made to fully suit the requirements of each case and adequately provide for servicing.

E. The Contractor shall protect equipment and devices at all times during storage and construction. He shall replace all equipment and devices which are damaged as a result of inadequate protection.

F. Prior to starting and during progress of work, examine work and materials installed by others as they apply to work in this division. Report conditions which will prevent satisfactory installation.

G. Start of work will be construed as acceptance of suitability of work of others.

3.3 Interruption of Service: Before any equipment is shut down for disconnecting or tie-ins, arrangements shall be made with the Architect/Engineer and this work shall be done at the time best suited to the Owner. This will typically be on weekends and/or holidays and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this work shall be included in the base bid.

3.4 Cutting and Patching: Notify General Contractor to do all cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under this section. Utilize experienced trades for cutting and patching. Obtain permission from Architect/Engineer before cutting any structural items.

3.5 Equipment Setting: Bolt equipment directly to concrete pads or foundations, using hot-dipped galvanized anchor bolts, nuts, and washers. Level equipment.

3.6 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 27. Obtain matched color coatings from the manufacturer and apply as directed by manufacturer. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.

3.7 Clean-Up: Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials and remove all oil and grease spots. Repaint or touch up as required to look like new. During progress of work, Contractor is to carefully clean and leave premises free from debris and in a safe condition.

3.8 Service Coordination: Prior to commencing any work, coordinate with utility/service provider to ensure proper services are available to project when needed.

3.9 All equipment which cannot be repaired on-site shall be transported at the contractor's expense.

3.10 Operation and Maintenance Manuals: Furnish four complete manuals bound in ring binders with Table of Contents, organized, and tabbed by specification section.

3.11 Start-Up and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, start-up shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety, and operating control shall be included in start-up check.

3.12 Record Drawings

A. During the progress of the work the Contractor shall record on their field set of Drawings the corrections, variations, and deviations for systems which are not installed exactly as shown on the Contract Drawings.

B. Upon completion of the work, record drawings shall be prepared as described in the General Conditions, Supplementary Conditions, and Division 1 Sections.

3.13 Acceptance

A. Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.

B. Instructions: At completion of the work, provide a competent and experienced person who is thoroughly familiar with the project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems.

C. Operation and Maintenance Manuals: Furnish complete manuals bound in ring binders and organized by system or section.

D. Record Drawings: Submit "Record Drawings".

E. Acceptance will be on the basis of tests and inspections of the work. A representative of the firm which performed the testing shall be in attendance to assist during inspection. Contractor shall furnish necessary electricians to operate system, make any necessary adjustments and assist with final inspection.

END OF SECTION

SECTION 270010 - CODES AND STANDARDS

PART 1 - GENERAL

1.1 All work under Division 27 shall be constructed in accordance with the codes and standards listed herein. The design has been based on the requirements of these codes and standards. While it is not the responsibility of the Contractor to verify that all work called for complies with these codes and standards, he shall be responsible for calling to the Engineer's attention any details on the Drawings and/or Specifications that are not in conformance with these or other codes and standards. Current issue of code applies unless specifically noted otherwise.

1.2 Comply with regulations and codes of suppliers of utilities.

1.3 Where no specific method or form of construction is called for in the Contract Documents, the Contractor shall comply with code requirements when carrying out such work.

1.4 Where code conflict exists, generally the most stringent requirement applies.

1.5 Codes or standards applying to a specific part of the work may be included in that section.

PART 2 - CODES AND STANDARDS

2.1 Codes:

A. Florida Building Code – Building – 2023

B. Florida Building Code – Test – Protocols for High Velocity Hurricane Zones – 2023

C. National Electrical Code (NFPA-70) – 2020

D. National Fire Alarm Code (NFPA-72) – 2019

E. Uniform Fire Code (NFPA 1) – 2021 Florida Edition

F. National Electrical Safety Code (NESC)

G. Life Safety Code (NFPA 101) – 2021 Florida Edition

2.2 Standards:

A. All electrical materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments:

1. American National Standard Institutes (ANSI)
2. Illuminating Engineering Society (IES)
3. Institute of Electrical and Electronics Engineers (IEEE)
4. National Electrical Manufacturer's Associations (NEMA)
5. National Fire Protection Association (NFPA)
6. Occupational Safety and Health Act (OSHA)
7. Underwriter's Laboratories, Inc. (UL)
8. TIA/EIA-568.1-E Commercial Building Telecommunications Infrastructure Standard
9. ANSI/EIA/TIA-569-E Commercial Building Standard for Telecommunications Pathways and Spaces
10. ANSI/EIA/TIA-606-C Administration Standard for the Telecommunications Infrastructure
11. ANSI/J-STD-607-D Generic Telecommunications Bonding and Grounding for Customer Premises
12. BICSI - Telecommunications Distribution Methods Manual (TDMM) – 14th Edition
13. SCTE - Society of Cable Television Engineers

PART 3 - EXECUTION

3.1 Not Used

END OF SECTION

SECTION 270020 - CONTRACTOR QUALIFICATIONS

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. This Section includes:

1. Structured Cabling System Contractor qualifications.

1.3 Quality Assurance

A. Structured Cabling System Contractor Installer Qualifications:

1. The Structured Cabling System Contractor (SCSC) shall be regularly engaged in the layout and installation of structured cabling systems of similar size and complexity as required for this installation. The Structured Cabling System Contractor shall have successfully completed the layout, installation, testing and warranty of not less than five Structured Cabling Systems of the scope of the largest system on this project for a minimum period of five years prior to the bid date, and shall have been regularly engaged in the business of Structured Cabling Systems contracting continuously since. The Contractor shall have an existing permanent office located within 100 miles of the job site from which installation and warranty service operations will be performed.
2. The SCSC shall present the name and certification number of a BICSI certified Registered Communications Distribution Designer (RCDD) who is a permanent employee of the Contractor. The Contractor shall maintain this RCDD, in his permanent employment throughout this project. The RCDD shall have overall responsibility for certifying that the installed structured cabling system conforms to these contract documents.
3. The Structured Cabling System Subcontractor's present on site Project Manager, Fore Person, Lead Techs, and all Technicians shall be Factory Certified to install this building's Structured Cabling system. The Structured Cabling System Subcontractor shall provide copies of all on site personnel's Factory Certifications for the Structured Cabling System to installed in this building.

1.4 Proof Of Contractor Qualifications

A. The SCSC shall provide the following documentation, as evidence that the requirements for SCSC qualifications listed above are satisfied.

1. A list of not less than five (5) references for jobs of similar size and complexity including project name, location, contact person and phone number.
2. RCDD name, BICSI certification number, and qualifications.
3. Factory Certifications of all onsite personnel.
4. Location of permanent existing office from which installation and warranty work will be performed.

1.5 Approval Submittals

A. Qualification Data: For Installer.

PART 2 - PRODUCTS

A. NOT APPLICABLE

PART 3 - EXECUTION

A. NOT APPLICABLE

END OF SECTION

SECTION 270500 - COMMUNICATIONS RELATED WORK

PART 1 - DIVISION 1 - GENERAL REQUIREMENTS

1.1 All Division 1 Sections apply to all Division 27 Sections.

1.2 Coordinate for all cutting and patching. Contractor shall review all cutting and patching required prior to bidding and shall coordinate installation.

PART 2 - DIVISION 2 - SITEWORK

2.1 Specific requirements for excavation and backfill for underground conduit are contained in Section 260543.

2.2 The following is part of Division 27 work.

A. Underground communications utilities.

PART 3 - DIVISION 3 - CONCRETE

3.1 Perform the following as part of Division 27 work, complying with the requirements of Division 3, Concrete.

A. Curbs, foundations, and pads for communications equipment.

B. Encasement of communications work.

C. Underground structural concrete to accommodate communications work.

D. Rough grouting in and around communications work.

E. Patching concrete cut to accommodate communications work.

PART 4 - DIVISION 4 – MASONRY

4.1 Refer to Division 4, Masonry for:

A. Patching openings to accommodate communications work.

PART 5 - DIVISION 5 – METALS

5.1 Refer to Division 5, Metals for:

A. Supports for communications work.

B. Framing openings for communications equipment.

PART 6 - DIVISION 6 – WOOD

6.1 Refer to Division 6, Wood for:

A. Supports for communications work.

B. Framing openings for communications equipment.

PART 7 - DIVISION 7 - THERMAL & MOISTURE PROTECTION

7.1 Refer to Division 7, Thermal and Moisture Protection for:

A. Installation of all supports for communications work.

B. Caulking and waterproofing of all wall and roof mounted communications work.

7.2 Perform the following as part of Division 27 work, complying with Division 7 requirements.

A. Fire barrier penetration seals.

B. Caulking and related shielding around ducts and pipes for sound isolation and attenuation.

PART 8 - DIVISION 8 - DOORS AND WINDOWS

8.1 Refer to Division 8, Doors & Windows for:

A. Installation of all access doors for communications work.

PART 9 - DIVISION 9 - FINISHES

9.1 Refer to Division 9, Finishes for:

A. Painting exposed conduit and equipment.

B. Painting structural metal and concrete for communications work.

C. Painting access panels.

9.2 Colors shall be selected by the Architect for all painting of exposed communications work unless specified herein.

9.3 Perform the following as part of Division 27 work.

A. Touch up painting of factory finishes.

PART 10 - DIVISION 26 – ELECTRICAL

10.1 All cabling and raceways for communications as indicated on the communications drawings shall be furnished and installed by the communications contractor, complying with the requirements of Division 27 specifications.

10.2 See “Contractor Coordination and Responsibilities Note” on the Drawings.

END OF SECTION

SECTION 271300 - BACKBONE CABLING SYSTEM

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. This Section includes:

1. Pathways.
2. Optical fiber cabling.
3. Cable connecting hardware, patch panels, and cross-connects.
4. Grounding products.
5. Fire-stopping products.
6. Racks and cable management.
7. Identification products.
8. Cable testing.

1.3 System Description:

A. The work consists of all labor, materials, equipment, and services necessary to provide, install, test and certify a new backbone cabling system as described in the contract documents.

B. The installation shall include all accessories and appurtenances required to provide a complete and operational system. Any materials not specifically mentioned in these specifications or not shown on the drawings, but required for a complete and finished installation shall be furnished and installed at no additional cost to the Owner.

C. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

D. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling except as specifically noted in coaxial video systems.

1.4 Performance Requirements:

A. The installation shall be in compliance with the requirements of the National Electrical Code, Florida Building Code and OSHA recommendations, and the rules, regulations and requirements of Federal Communications Commission.

B. The installation shall comply fully with all counties, city, and state laws and ordinances, regulations and codes applicable to the installation.

C. Local electrical and building codes may differ with national codes. Follow the most stringent code or recommendations. Where there are instances of ambiguity, refer to the Owner/Engineer for interpretation.

D. All equipment shall be equal to or exceed the minimum requirements of NEMA, IEEE, ASME, ANSI, TIA/EIA and Underwriters Laboratories.

E. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

F. Should any change in plans or specifications be required to comply with governmental regulations, the Contractor shall notify the Owner at the time of submitting the construction schedule.

G. All work done under this contract shall be performed in accordance with the most recent issue of the codes, standards and guidelines stated in section 27 00 00. Where there is a perceived conflict between a standard or guideline and the Contract Documents, the Contractor shall perform the work as directed by the Engineer.

1.5 Special Backbone Cabling System Warranty:

A. The Contractor shall warrant the entire backbone cabling system (End-to-End Certification) under the manufacturers systems warranty for a minimum period of 15 years. The warranty will begin on the first day after final acceptance. The warranty shall include cable and connectivity components and have one point of contact for all cabling system issues. The warranty shall include materials, parts and labor. If any failure or defect occurs within the warranty period, the contractor and/or manufacturers shall remedy it within 48 hours at no cost to the owner, or any owner representative or consultant. Structured cabling systems warranty shall cover cable, connecting hardware and the labor cost for the repair or replacement.

1.6 Approval Submittals:

A. Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product indicated.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. Telecommunications Drawings:

a. Provide RCDD approved shop drawings in accordance with TIA-606. The identifier for each termination and cable shall appear on the drawings. The drawings shall depict final installed wiring system infrastructure in accordance with TIA-606. The drawings shall provide details required to prove that the distribution system shall properly support connectivity from the serving telecommunications space to the work area outlets. Provide a plastic laminated schematic of the as-installed point-to-point wiring diagram. Mount the laminated schematic in the main telecommunications room. At a minimum, the following shall be provided:
   1) T1 – Layout of the complete building, per floor including, but not limited to, Building Area/Serving Zone boundaries, backbone systems, and horizontal pathways. The drawings shall indicate the location of building areas, serving zones, vertical backbone diagrams, telecommunications rooms, access points, pathways, grounding systems, etc.
   2) T2 – Serving Zones/Building Area Drawings including, but not limited to, drop locations and cable identification (ID's). Drawings shall show a building area or serving zone and shall identify drop locations, telecommunications rooms, access points and detail callouts for common equipment rooms and other congested areas.
   3) T-3 – Telecommunications space drawings – Provide T3 drawings in accordance with TIA-606 that include telecommunications rooms plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and cabinet/rack, backboard, and wall elevations. Drawings shall show the layout of applicable equipment, including incoming cable stub or connector blocks, building protector assemblies, outgoing cable connector blocks, new or existing conduit/pathway entrances, patch panels, and equipment spaces and cabinet/racks. Drawings shall include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances and the equipment relationship to other parts of the work, including clearances for maintenance and operation. T-3 drawings may also include enlarged plans of congested areas of T-1 or T-2 drawings.
   4) T-4 – Typical detail drawings including, but not limited to, faceplate labeling, firestopping, ADA compliant devices, etc. Detail drawings shall also include details of symbols and typicals such as faceplate labeling, faceplate types, faceplate population installation procedures, detail racking, and raceways.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and testing supervisor.

D. Test Reports and Verification Submittals:

1. Pre-installation Testing: Test cables upon receipt at Project site.
   a. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
2. Cable Field Testing: Submit as described in these specifications.

3. Training: Submit letter verifying that Owner training has been received as described in these specifications.

E. O&M Data Submittals:

1. Submit as described in these specifications.

1.7 Quality Assurance:

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of a Level 2 Installer who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

D. Grounding: Comply with ANSI-J-STD-607-A.

1.8 Project Conditions:

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.9 Coordination:

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 Pathways:

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

C. Inside TRs:

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, and D-rings.
3. Velcro straps and other devices.
4. Cable trays.
5. Ladder trays.

D. Outside TRs:

1. Backbone cabling shall be routed in conduit. Conduit materials shall be as specified in section 26 05 30.

E. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cablofil Inc.
   b. Cooper B-Line, Inc.
   c. Flex tray.
   d. Wiremold.
   e. Chatsworth Products, Inc.
2. Cable Tray Material: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1.
3. Basket Cable Trays: 12 inches wide and 4 inches deep. Wire mesh spacing shall not exceed 2 inches by 4 inches.
   a. Provide all necessary transitions at 90-degree angles, tees and change of cable tray size so that the cable tray is continuous. The drawings do not reflect these requirements due to the small scale. Transitions shall also be provided at all change of elevations.
   b. Supports: Cable tray shall be supported by trapeze style hanging clips on threaded rods on both sides of the tray. Center supports are prohibited. Exception: cable tray in TRs which shall be supported by wall brackets.
   c. Coordinate installation with other trades to avoid conflicts prior to installation. Install as required to transition around, above or below other trades work.
4. UTP Cable Tray Accessories:
   a. Fittings: Tees, crosses, risers, and other fittings as necessary as recommended by cable tray manufacturer.
   b. Supports: supports and connectors, including bonding jumpers, as recommended by cable tray manufacturers.
5. Warning Signs:
   a. Lettering: 1-1/2 inch (40-mm) high black letters on yellow background with legend "Warning! not to be used as walkway, ladder or support for ladders or personnel."

2.2 Optical Fiber Cable Hardware:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ortronics, Inc., or Ortronics approved system partner.
2. Panduit Corp., or Panduit approved system partner.
3. Comm Scope, or Comm Scope approved system partner.

B. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
2. Quick-connect, [duplex], 3M Hot Melt, Type [SC] [ST] [LC] connectors.
3. Insertion loss: < 0.5dB per pair.

C. Fiber Patch Panels:

1. Rack mount fiber enclosures shall be designed to manage and organize fiber optic cable to and from equipment or cross-connects that support data, voice, video and audio. Enclosures shall accommodate up to 36 fibers per rack space. Enclosures shall have bend radius control for transition to front vertical cabling. Fiber optic enclosures shall be constructed of steel material. Molded ABS front and back covers shall be removable for wiring installation. Enclosures shall have pass-through holes in the top and bottom for use with splice enclosures.
2. Includes fiber optic cable routing kits (grommets, cable ties, saddle clips, spools, strain relief and ID/caution labels) for various cable management solutions.
3. Multiple cable entry locations provided in rear of enclosure on top, bottom, and side.
4. Durable molded hinged front and rear lockable doors.
5. Slide-out, tilt-down drawer for access to cables.
6. Holds up to 6 adapter panels with color coding connectors.
7. Provide in all fiber optic patch panels yellow-colored caps over unused S/M ports, red colored caps over unused M/M ports and black colored caps over unterminated ports.
8. Manufacturer: Superior Modular Fiber LIU.

2.3 Patch Cords:

A. M/M Duplex Fiber Optic Patch Cable:

1. Duplex, two strand, 62.5/125 micron, FDDI rated, with heavy duty outer PVC jacket (orange).
2. Assembly shall meet TIA/EIA-568-B.3 performance requirements, factory assembled and tested.
3. End connectors shall be SC with duplex clips to maintain polarity.
4. Unit shall be factory assembled and tested.
5. Unit shall be marked with overall loss value and coded for test result comparisons.
6. Test results from manufacturer shall be shipped with assembly.
7. End connector to be color coded with white and red boots.

B. S/M Duplex Fiber Optic Patch Cable:

1. Duplex, two strand, 9/125 micron, FDDI rated, with heavy duty outer PVC jacket (yellow).
2. Assembly shall meet TIA/EIA-568-B.3 performance requirements, factory assembled and tested.
3. End connectors shall be SC with duplex clips to maintain polarity.
4. Unit shall be factory assembled and tested.
5. Unit shall be marked with overall loss value and coded for test result comparisons.
6. Test results from manufacturer shall be shipped with assembly.
7. End connector to be color coded with white and red boots.

2.4 Other Equipment:

A. Equipment shall be of the same manufacturer, unless noted otherwise on drawings.

B. 19" Floor Racks:

1. 7' tall.
2. 2 post.
3. 45 rack spaces.
4. Black aluminum construction.
5. Double-sided #12-24 EIA universal mounting hole spacing.
6. 800lbs. load rating.
7. Provide with concrete floor mounting kit.
    a. Provide with floor isolation kit.
    b. Provide rack to runway hit.
    c. Rack base dust cover.
    d. Floor rack mounting hits.
8. Support off wall using 12" wide black aluminum ladder tray and all required hardware.
9. Chatsworth Model 46383-503, or approved equal.

C. 19” Wall-Mounted Rack:

1. 38.5”
2. Wall-mount, hinged.
3. 19 rack spaces.
4. Black steel construction.
5. Double-sided #12-24 EIA universal mounting hole spacing.
6. 85lbs. load rating.
1. Chatsworth Model 11348-523, or approved equal.

D. Cabinets, freestanding modular type:

1. 7’ tall.
2. 45 rack spaces
3. Black aluminum construction.
4. Removable and lockable side panels, front and rear doors. All cabinets shall be keyed alike.
5. Adjustable feet for leveling
6. 19” double-sided #12-24 EIA universal mounting hole spacing.
7. Integral ground bar
8. Roof mounted 550 CFM fan with filter.

E. Cabinets, wall-mounted modular type:

1. Height and rack space as indicated on drawings.
2. Black aluminum construction.
3. Lockable front and rear doors and louvered side panels. All cabinets shall be keyed alike.
4. Hinged front and rear.
5. 19” double-sided #12-24 EIA universal mounting hole spacing.
6. Integral ground bar
7. Roof mounted 250 CFM fan with filter.

F. Rack Mounted Vertical Slotted Ducts:

1. For 7' floor racks.
2. Rear mount.
3. Duct on front and rear.
4. Hinged covers on front and rear.
5. 4"W x 5"D x 83"H for duct on end of rack.
6. 6"W x 8"D x 83"H for duct between racks.

G. Rack Mounted Horizontal Cable Managers:

1. 19" wide 2 RU.
2. Duct on front and rear.
3. Hinged covers on front and rear.
4. Chatsworth Model 30130-719, or approved equal.

H. Manufacturers

1. Panduit Corporation
2. Siemon Network Cabling
3. Chatsworth.
4. Middle Atlantic

2.5 Grounding:

A. Comply with ANSI-J-STD-607-A.

1. TGB: shall be 1/4" thick, 4" wide and length shall be 12" minimum. A minimum of twelve 5/16" hole sets at 5/8" spacing and six 7/16" hole sets at 1" spacing shall be provided. Pre-assembled with brackets and insulators.
2. TMGB: shall be 1/4" thick, 4" wide and length shall be 24" minimum. A minimum of twenty-four 5/16" hole sets at 5/8" spacing and six 7/16" hole sets at 1" spacing shall be provided. Pre-assembled with brackets and insulators.
3. All grounding busbar lugs shall be copper compression, 2-hole (spacing to match busbar hole spacings), long barrel with window lug. Use stainless steel hex head screws and stainless steel lock nuts to secure lugs to busbars.
4. Cables shall be insulated (green) with stranded copper conductors.

2.6 Plywood Backboards:

A. Shall be 3/4" thick AC exterior grade plywood with two coats of fire retardant grey paint on all six sides.

B. Provide plywood backboards on all walls in TRs from 12" AFF to 9' AFF including above doors.

C. Ready-Spec is also acceptable.

2.7 Fire-stopping Products:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. S.T.I.
2. 3M.
3. Wiremold.

2.8 Cable Ties:

A. Provide hook and loop cable ties. Provide plenum rated where required.

2.9 Identification Products:

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 Entrance Facilities:

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

B. Entrance Protectors: Provide where shown on drawings. Protect all terminated pairs.

3.2 Wiring Methods:

A. Wiring Method: Install cables in raceways except within TRs. Conceal raceway and cables except in unfinished spaces.

B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 Installation of Pathways:

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.

B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius elbows whenever possible.

D. Pathway Installation in TRs:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays around perimeter of room.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 Installation of Cables:

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 12 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In TRs, install a 10 foot long service loop on each end of cable.
11. Support all cable not installed in conduit or cable tray using cable support brackets and D-rings installed on 12” centers minimum.
12. All cables shall be bundled and cable tie wrapped together. Cables shall be separately bundled with like cables (e.g., multimode fiber, single mode fiber, voice backbone, horizontal cables). Velcro tie wrapping shall occur on 12 inch (6 inch for vertical cable runs) intervals throughout the TRs unless noted otherwise. Tie wraps should not bite into the cable insulation, but should form securely around the cables so as not to depress the cable.
13. All cables shall be neatly bundled and cable tie wrapped down to the racks and patch panels. Group horizontal cables with not more than 24 cables per bundle.
14. Route cables along cable rack trays in a neat and straight order in 24 cable bundles. Use drop out shields to protect cables as they drop out of cable trays or cable rack trays. Use rear of vertical cable management rails at racks to support and manage cables terminated to rear of patch panels. Maintain a neat and straight order of the cables inside the cable management rails. Adjust length of cables terminating on the rear of patch panels so that

cables exit out of vertical cable management rail, fan into the proper port and are punched down in the proper order.

15. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.5 Firestopping:

A. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 Grounding:

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors.

D. Size of grounding backbone cable shall be as per drawings or BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter, Table 10.1, whichever is larger.

E. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor. Do not loop grounds. Ground all racks, punchdown block towers, etc individually from busbar. Route along rack rear across runway and to busbar.

3.7 Identification:

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.

1. Administration Class: 3.
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. See Division 27 Section Horizontal Cabling System for additional identification requirements. See Evaluations for discussion about TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 3 level of administration including optional identification requirements of this standard.

C. Comply with requirements in Division 27 Section Horizontal Cabling System.

D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

F. Labels shall have an adhesive backing for permanent attachment where required.

G. All labels shall be of sufficient size. All labels shall be easily readable from floor level when viewing a backboard, panel, or communications outlet from the front.

H. Labels attached to riser cable bundles shall be installed on a label holder of sufficient size. Label holder to be plastic and have tie wrapping provisions.

I. All labels shall be installed straight.

J. Text shall be as large and as bold as possible.

K. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

L. The following items shall receive labeling:

1. Raceways (both ends).
2. Backbone cables.

3. Fiber strands.
4. Patch panels.
5. Patch panel ports.
6. Equipment racks and cabinets.
7. Voice blocks.
8. Ground backbone cables (both ends).
9. Ground busbars.
10. Telecommunications spaces.
11. Firestop locations

M. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
5. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
6. Label each unit and field within distribution racks and frames.
7. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

3.8 Constructing Names:

A. Example name for backbone cables and pathways (label both ends within 12" of termination):

1. 0053-1A/0053-3B, FSM1
2. This element starts in building 0053 TR1A and ends in building 0053 TR3B. This element is a fiber optic cable single mode and is index 1.

B. The following is a list of backbone cable and pathway elements:

1. FMM = fiber multimode.
2. FSM = fiber single mode.
3. FCM = fiber composite.
4. CUT = copper unshielded twisted pair.
5. CVI = copper voice panel interconnect cable.
6. PCO = pathway conduit.
7. TBB = telecommunications bonding backbone.

C. Example name for equipment:

1. 0053-2C-PRK1
2. This element starts in building 0053 TR2C and is a pathway rack and is index 1.

D. The following is a list of equipment elements:

1. PRK = pathway rack.
2. TGB = telecommunications grounding busbar.
3. TMGB = telecommunications main grounding busbar.
4. FPL = fiber panel.
5. CPL = copper twisted pair panel.
6. WCPL = wall-mounted copper twisted pair panel.

3.9 Field Quality Control:

A. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

B. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 Patch Cord Delivery:

A. Deliver all patch cords to the Owner along with a typed inventory of the patch cords broken down by type and length as scheduled on the drawings. The Contractor shall provide a copy of the inventory, signed by the Owner, in the O&M Manuals.

3.11 Owner Personnel Training:

A. After Substantial Completion but before Final Completion, provide on-site training to Owner personnel on the operation and use of the system. Provide one copy of the training material.

B. The Engineer shall be notified prior to training and may participate in training at their discretion.

C. The instruction shall be presented in an organized and professional manner by personnel who are thoroughly familiar with the structured cabling system installation and who have demonstrated knowledge in the data equipment specified for installation under the project.

D. Training shall include a "walk-through" of the systems to identify and locate closets, panels, and important system components, a discussion of overall system concepts and configuration, specific instruction in labeling, a review of the as-built drawings, a review of the system verification and acceptance documentation, and guidelines for basic trouble-shooting and operation of the structured cabling system.

E. The Contractor shall provide documentation of training (including names of personnel present at each training session) to the Engineer at the Final Completion Inspection. The

documentation shall be signed-off by the Owner. The documentation shall be three-hole punched and ready for insertion in the O&M manuals.

END OF SECTION

SECTION 271500 - HORIZONTAL CABLING SYSTEM

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. This Section includes:

1. Pathways.
2. UTP cabling.
3. Coaxial cable
4. Cable connecting hardware, patch panels, and cross-connects.
5. Telecommunications outlet/connectors.
6. Fire-stopping products.
7. Identification products.
8. Cable management system.
9. Cable testing.

1.3 System Description:

A. The work consists of all labor, materials, equipment, and services necessary to provide, install, test and certify a new horizontal cabling system as described in the contract documents.

B. The installation shall include all accessories and appurtenances required to provide a complete and operational system. Any materials not specifically mentioned in these specifications or not shown on the drawings, but required for a complete and finished installation shall be furnished and installed at no additional cost to the Owner.

C. The installed system shall be a complete and warranted Category 6 horizontal cabling system solution with all outlet and termination hardware and cable assemblies provided by one single manufacturer. Cabling shall be by the same manufacturer or by a cable manufacturer approved by the connectivity manufacturer for that particular system solution.

D. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the TR. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

E. A work area is approximately 100 sq. ft. and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

F. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.

1.4 System Solution:

A. Provide one of the following solutions:

1. Panduit, TX 6000.
2. General Cable Genspeed 6000 Enhanced.
3. Or by connective device approved cabling.
4. Berk-tek / Ortronics, Netclear GT2
5. Comm Scope, Uniprise.

1.5 Performance Requirements:

A. The installation shall be in compliance with the requirements of the National Electrical Code, Standard Building Code and OSHA recommendations, and the rules, regulations and requirements of Federal Communications Commission.

B. The installation shall comply fully with all counties, city, and state laws and ordinances, regulations and codes applicable to the installation.

C. Local electrical and building codes may differ with national codes. Follow the most stringent code or recommendations. Where there are instances of ambiguity, refer to the Owner/Engineer for interpretation.

D. All equipment shall be equal to or exceed the minimum requirements of NEMA, IEEE, ASME, ANSI, TIA/EIA, and Underwriters' Laboratories.

E. Should any change in plans or specifications be required to comply with governmental regulations, the Contractor shall notify the Owner at the time of submitting the construction schedule.

F. All work done under this contract shall be performed in accordance with the most recent issue of the codes, standards and guidelines stated in section 270000. Where there is a perceived conflict between a standard or guideline and the contract documents, the Contractor shall perform the work as directed by the Engineer.

G. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 Special Structured Cabling System Warranty

A. The Contractor shall warrant the entire structured cabling system (End-to-End Certification) under the manufacturer's systems warranty for a minimum period of 15 years. The warranty will begin on the first day after final acceptance. The warranty shall include cable and connectivity components and have one point of contact for all cabling system issues. The warranty shall include materials, parts, and labor. If any failure or defect occurs within the warranty period, the contractor and/or manufacturers shall remedy it within 48 hours at no cost to the owner, or any owner representative or consultant. Structured cabling systems warranty shall cover cable, connecting hardware and the labor cost for the repair or replacement.

1.7 Approval Submittals:

A. Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product indicated.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. Telecommunications Drawings:
   a. Provide RCDD approved shop drawings in accordance with TIA-606. The identifier for each termination and cable shall appear on the drawings. The drawings shall depict final installed wiring system infrastructure in accordance with TIA-606. The drawings shall provide details required to prove that the distribution system shall properly support connectivity from the serving telecommunications space to the work area outlets. Provide a plastic laminated schematic of the as-installed point-to-point wiring diagram. Mount the laminated schematic in the main telecommunications room. At a minimum, the following shall be provided:
      1) T1 – Layout of the complete building, per floor including, but not limited to, Building Area/Serving Zone boundaries, backbone systems, and horizontal pathways. The drawings shall indicate the location of building areas, serving zones, vertical backbone diagrams, telecommunications rooms, access points, pathways, grounding systems, etc.
      2) T2 – Serving Zones/Building Area Drawings including, but not limited to, drop locations and cable identification (ID's). Drawings shall show a building area or serving zone and shall identify drop locations, telecommunications rooms, access points and detail callouts for common equipment rooms and other congested areas.
      3) T-3 – Telecommunications space drawings – Provide T3 drawings in accordance with TIA-606 that include telecommunications rooms plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and cabinet/rack, backboard, and wall elevations. Drawings shall show the layout of applicable equipment, including incoming cable stub or connector blocks, building protector assemblies, outgoing cable connector blocks, new or existing conduit/pathway entrances, patch panels, and equipment spaces and cabinet/racks. Drawings shall include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances and the equipment relationship to other parts

of the work, including clearances for maintenance and operation. T-3 drawings may also include enlarged plans of congested areas of T-1 or T-2 drawings.

4) T-4 – Typical detail drawings including, but not limited to, faceplate labeling, firestopping, ADA compliant devices, etc. Detail drawings shall also include details of symbols and typicals such as faceplate labeling, faceplate types, faceplate population installation procedures, detail racking, and raceways.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and testing supervisor.

D. Samples: For workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration and faceplates for color selection and evaluation of technical features.

E. Test Reports and Verification Submittals:

1. Cable Field Testing: Submit as described in these specifications.
2. Training: Submit letter verifying that Owner training has been received as described in these specifications.

F. O&M Data Submittals:

1. Submit as described in these specifications.

1.8 Quality Assurance:

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of a Level 2 Installer who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

D. Grounding: Comply with ANSI-J-STD-607-A.

1.9 Project Conditions:

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 Coordination:

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 Pathways:

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

C. Inside TRs:

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, and D-rings.
3. Straps and other devices.
4. Cable trays.
5. Ladder trays.

D. Outside TRs:

EDIT FOR HORIZONTAL RACEWAY METHOD.

1. Horizontal cabling shall be routed in 1 inch or larger EMT conduit from outlet boxes to jhooks and/or cable trays, then in cable trays to the serving TR. Outlet boxes shall be a minimum of 4 inches by 4 inches by 2 1/8 inches. Conduit materials shall be as specified in section 26 05 30.

E. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cablofil Inc.
   b. Cooper B-Line, Inc.
   c. Flextray.
   d. Wiremold.
   e. Chatsworth Products, Inc.
2. Cable Tray Material: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1.
3. Basket Cable Trays: 12 inches wide and 4 inches deep. Wire mesh spacing shall not exceed 2 inches by 4 inches.
   a. Provide all necessary transitions at 90-degree angles, tees and change of cable tray size so that the cable tray is continuous. The drawings do not reflect these requirements due to the small scale. Transitions shall also be provided at all change of elevations.

b. Supports: Cable tray shall be supported by trapeze style hanging clips on threaded rods on both sides of the tray. Center supports are prohibited. Exception: cable tray in TRs which shall be supported by wall brackets.
c. Coordinate installation with other trades to avoid conflicts prior to installation. Install as required to transition around, above, or below other trades work.

2.2 UTP Cable:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ortronics, Inc., or Ortronics approved system partner.
2. General Cable Corporation or approved system partner.
3. PAN-NET Panduit Corp., or Panduit approved system partner.
4. Amp/Netconnect or Amp/Netconnect approved system partner.
5. Or approved system partner.

B. Category 6 Horizontal Cable:
1. 100-ohm, four unshielded twisted pairs of 23 or 24 AWG copper, insulated solid conductors enclosed by an overall jacket.
2. The cable shall exceed the requirements of ANSI/TIA/EIA-568-B.2-1.
3. Plenum (CMP) rated.
4. Cable jacket color shall be blue unless noted otherwise.
5. Supports the following applications: Ethernet 10Base-T, 100Base-T (Fast Ethernet), 1000Base-T (Gigabit Ethernet); 1.2 Gb/s ATM; Token Ring 4/16; digital video; and broadband/baseband analog video.
6. Performance tested to 650 MHz.
    a. Gel filled cable to be used for all underground cabling requirements between buildings. Use Mohawk M57622 or equal to all slab on grade floor boxes.

C. Category 6A Horizontal Cable:

1. 100-ohm, four unshielded twisted pairs of 23 AWG copper, insulated solid conductors enclosed by an overall jacket.
2. Cable outside diameter shall not exceed 0.250 inches.
3. The cable shall exceed the requirements of ANSI/TIA/EIA-568-C.2.
4. Plenum (CMP) rated.
5. Cable jacket color shall be blue unless noted otherwise.
6. Supports the following applications: Ethernet 10Base-T, 100Base-T (Fast Ethernet), 1000Base-T (Gigabit Ethernet), 10G BASE-T; POE+, POE++; 1.2 Gb/s ATM; Token Ring 4/16; digital video; and broadband/baseband analog video.
7. Performance tested to 650 MHz.
    a. Gel filled cable to be used for all underground cabling requirements between buildings and cabling serving in-grade floor boxes.

2.3 UTP Cable Hardware:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ortronics, Inc., or Ortronics approved system partner.

2. Panduit Corp., or Panduit approved system partner.
3. Comm Scope or Comm Scope approved system partner.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Work Area Outlets (WAOs):

1. Accommodate up to 6-ports per gang.
2. Have labels for circuit identification with a clear plastic cover and tool-less removal.
3. Have stainless steel and gravity feed versions available.
4. Have surface mount boxes and standoff rings available for both single and double gang faceplates.
5. Have rear protective strain relief caps with side or rear entry, which can be installed onto cable before or after termination.
6. Support T568A or T568B wiring.
7. Allow jack installation from the front or rear of the faceplate and allow for the jack to pass through the faceplate without re-termination.

D. Copper Patch Panels:

1. Use the same modular jacks used in the WAOs.
2. Black aluminum construction.
3. 24 (1 RU), 48 (2 RU) and 72 (3 RU) port configurations.
4. Allow terminated jacks to pass through panel for easy rearrangement without re-termination.
5. Have a rear wire management bar.
6. Provided with labels and self-adhesive clear label holders.

2.4 Coaxial Cable:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company.
2. Belden CDT Inc.; Electronics Division.
3. Coleman Cable, Inc.
4. CommScope, Inc.
5. Draka USA.
6. Times Warner Cable.
7. General Cable.

B. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

C. RG-6:

1. No. 18 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Quad shield foil braid construction with 100 percent aluminum tape, 60 percent aluminum braid, 100 percent aluminum tape, 40 percent aluminum braid.

3. Jacketed with black PVC or PE.
4. Suitable for indoor installations.

D. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

E. CATV Cable: Type CATV.

1. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
2. CATV Riser Rated: Type CATVR, complying with UL 1666.

F. CATV SYSTEM TESTING

1. The contractor shall furnish all equipment and personnel required for the test as follows:
   a. Test each cable for continuity and attenuation. Check each cable for correct termination – remake all connectors that are not properly terminated. Verify proper grounding at service entrance and at all surge suppression devices. Provide signal testing as specified on the drawings and below and complete outlet tuning chart with all test results. See sample “Outlet Tuning Log Form” below.
   b. A full system and cable plant test shall be performed after the installation of the cabling and headend is fully complete. The system shall be tested complete from the service entrance/headend to the outlets. Contractor shall invite the Owners designated representative and engineer to be present for all testing procedures. Contractor shall furnish all equipment and personnel required for the system testing.
   c. Perform a "burn-in" of the headend system by leaving all active components powered and operational for at least three days prior to the official testing and certification.
   d. Test the overall system across the full range of standard UHF and VHF channels. With main amplifier at 1/2 gain, provide fixed attenuators at the input or output of each splitter as required to achieve a signal level within 6-12 db at each outlet when measured with a signal strength meter. Provide bi-directional signal amplifiers at communications closets if/as required to achieve signal level at each outlet.
   e. With the normal levels in the system, the field strength meter shall be tuned to the picture carrier of each channel in turn and the reading obtained on the meter noted. The signal shall then be removed and the input to the head end amplifier shall be terminated in 75 ohms. With the field strength meter reading the level of the remaining noise in the absence of the signal and add a meter correction factor of 4 dB to the reading. The difference between the two readings will give the system’s signal to noise ratio and shall not be less than 43 dB.
   f. Complete log of attenuator values installed at each splitter output and the resulting db level at each outlet. Provide a copy of this log for all outlets with signature of technician in the cable test manual.

Sample “Outlet Tuning Log Form”

Bldg #	Comm Closet #	Outlet ID	Splitter ID	Attenuator Value	Signal Level	Signal/Noise Ratio	Picture Quality

g. Connect a standard TV receiver to each outlet and observe picture quality. Test across the full range of uhf and vhf channels. No visible components of cross channel inter-modulation (windshield wiper effects), ghosting, or beat interference shall appear in the screen of a receiver tuned to a normal signal across the entire range of system channels. Verify picture quality 'OK' on "outlet tuning log form".

h. Perform an operational test of all headend components. The test shall include the simultaneous use of all components and simultaneous distribution of all channels over the system. This test shall be performed for a minimum of 8 hours.

i. Should such a demonstration of performance show that the contractor has not properly balanced the system and that picture degradation is present or that output gain is not as specified, the contractor shall make all necessary changes or adjustments and a second performance demonstration shall be scheduled.

j. Coordinate all work with Cable system provider.

2.5 Coaxial Cable Hardware:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Blonder Tongue.
2. Toner.

B. Coaxial-Cable Connectors: Type F, 75 ohms. Connectors for RG-6 shall be F compression fitting, Toner, or Blonder Tongue.

C. Video Cabling Splitters, Taps, Amplifiers, etc.:

1. Shall be as specified on the drawings or equal. Cap all unused ports of all splitters. Ground each TVSS device, splitter, tap, amplifier, etc. with a #6AWG to the local TGB.

2.6 Patch Cords:

A. Category 6A UTP modular patch cable:

1. Assembly shall meet TIA/EIA-568-C.2 Category 6A standard, factory assembled and tested.
2. 23 AWG stranded, 4 pair.
3. Gold plated plug contacts
4. Universal T568A/B compatibility.
5. Modular and snag-less 8 position plug (RJ45) on each end.
6. PVC jacket.
7. No protective boot.
8. Panduit TX6 plus, or Belden or approved connective manufacture’s patch cables.

2.7 Other Equipment:

A. In-Ceiling Consolidation Point:

1. The enclosure is a termination/distribution/consolidation access point for low voltage communication applications within a ceiling grid system.
2. Shall consist of a termination box that fits in a standard 2' x 2' ceiling grid space. It shall have a lockable hinged front that swings down allowing access to a 19" rack housing a high-density copper patch panel (see above description for patch panel). It shall be independently supported to the building structure by a threaded rod at each of the four corners.

B. Grounding Products:

1. All grounding products used shall comply with J-STD-607A.
2. Cables shall be insulated (green) with stranded copper conductors.

C. Fire-stopping Products:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. S.T.I.
3. 3M.
4. Wiremold.

D. Cable Ties:

1. Provide hook and loop cable ties. Provide plenum rated where required.

2.8 Identification Products:

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 Wiring Methods:

A. Wiring Method: Install cables in raceways except within TRs. Conceal raceway and cables except in unfinished spaces.

B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 Installation of Pathways:

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.

B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius elbows whenever possible.

D. Pathway Installation in TRs:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays around perimeter of room.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.3 Installation of Cables:

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 12 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In TRs, install a 10-foot-long service loop on each end of cable.
11. Support all cable not installed in conduit or cable tray using cable support brackets and D-rings installed on 12” centers minimum.
12. All cables shall be bundled, and cable tie wrapped together. Cables shall be separately bundled with like cables (e.g., multimode fiber, single mode fiber, voice backbone, horizontal cables). Velcro tie wrapping shall occur on 12-inch (6 inch for vertical cable runs) intervals throughout the TRs unless noted otherwise. Tie wraps should not bite into the cable insulation but should form securely around the cables so as not to depress the cable.

13. All cables shall be neatly bundled, and cable tie wrapped down to the racks and patch panels. Group horizontal cables with not more than 24 cables per bundle.
14. Route cables along cable rack trays in a neat and straight order in 24 cable bundles. Use drop out shields to protect cables as they drop out of cable trays or cable rack trays. Use rear of vertical cable management rails at racks to support and manage cables terminated to rear of patch panels. Maintain a neat and straight order of the cables inside the cable management rails. Adjust length of cables terminating on the rear of patch panels so that cables exit out of vertical cable management rail, fan into the proper port and are punched down in the proper order.
15. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 2 inch from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

E. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 Firestopping:

A. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 Grounding:

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor. Do not loop grounds. Ground all racks, punchdown block towers, etc. individually from busbar. Route along rack rear across runway and to busbar.

3.6 Identification:

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.

1. Administration Class: 3.
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. See Division 27 Section Backbone Cabling System for additional identification requirements. See Evaluations for discussion about TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 3 level of administration including optional identification requirements of this standard.

C. Comply with requirements in Division 27 Section Backbone Cabling System.

D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

F. Labels shall have an adhesive backing for permanent attachment where required.

G. All labels shall be of sufficient size. All labels shall be easily readable from floor level when viewing a backboard, panel, or communications outlet from the front.

H. All labels shall be installed straight.

I. Provide temporary labels on all horizontal cables as they are roughed in.

J. Text shall be as large and as bold as possible.

K. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

L. The following items shall receive labeling:

1. Cables.
2. Raceways (both ends).
3. Patch panels.
4. Patch panel ports.
5. Firestop locations.

M. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
5. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
6. Label each unit and field within distribution racks and frames.
7. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

3.7 Constructing Names:

A. Example name for equipment:

1. 0053-2C-CPL1A
2. This element starts in building 0053 TR2C and is a copper twisted pair patch panel located in rack 1 and is index A.

B. The following is a list of equipment elements:

1. WAO = work area outlet.
2. CPL = copper twisted pair panel.

C. Example name for horizontal cable:

1. 0053-1A-2D38
2. This horizontal cable terminates in building 0053 TR1A, in pathway rack #2, in horizontal patch panel D, port 38.

3.8 Field Quality Control:

A. Perform the following tests and inspections.

1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment, and patch cords, and labeling of all components.

B. UTP Performance Field Tests:

1. Test for each outlet. Perform the following tests according to TIA/EIA-568-C.1 and TIA/EIA-568-C.2:
   a. Wire map.
   b. Length (physical vs. electrical, and length requirements).
   c. Insertion loss.
   d. Near-end crosstalk (NEXT) loss.
   e. Power sum near-end crosstalk (PSNEXT) loss.
   f. Equal-level far-end crosstalk (ELFEXT).
   g. Power sum equal-level far-end crosstalk (PSELFEXT).
   h. Return loss.
   i. Propagation delay.
   j. Delay skew.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.9 Patch Cord Delivery:

A. Deliver all patch cords to the Owner along with a typed inventory of the patch cords broken down by type and length as scheduled on the drawings. The Contractor shall provide a copy of the inventory, signed by the Owner, in the O&M Manuals.

3.10 Owner Personnel Training:

A. After Substantial Completion but before Final Completion, provide on-site training to Owner personnel on the operation and use of the system. Provide one copy of the training material.

B. The Engineer shall be notified prior to training and may participate in training at their discretion.

C. The instruction shall be presented in an organized and professional manner by personnel who are thoroughly familiar with the structured cabling system installation and who have demonstrated knowledge in the data equipment specified for installation under the project.

D. Training shall include a "walk-through" of the systems to identify and locate closets, panels, and important system components, a discussion of overall system concepts and configuration, specific instruction in labeling, a review of the as-built drawings, a review of the system verification and acceptance documentation, and guidelines for basic trouble-shooting and operation of the structured cabling system.

E. Engage a factory-authorized service representative to train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets. Include training in cabling administration software.

F. The Contractor shall provide documentation of training (including names of personnel present at each training session) to the Engineer at the Final Completion Inspection. The documentation shall be signed-off by the Owner. The documentation shall be three-hole punched and ready for insertion in the O&M manuals.

END OF SECTION

SECTION 280000 - ELECTRONIC SAFETY & SECURITY GENERAL 05/2022

PART 1 - GENERAL

1.1 The work covered by this division consists of providing all labor, equipment and materials and performing all operations necessary for the installation of the electronic safety & security work as herein called for and shown on the Drawings.

1.2 Related Documents:

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

B. This is a Basic Electronic Safety & Security Requirements Section. Provisions of this Section apply to work of all Division 28 Sections.

C. Review all project Drawings to be aware of conditions affecting work herein.

D. Definitions:

1. Provide: Furnish, install, and test, complete and ready for intended use.
2. Furnish: Supply and deliver to project site, ready for subsequent requirements.
3. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, test complete ready for intended use, and similar requirements.

1.3 Permits and Fees: Contractor shall obtain all necessary permits, meters, and inspections required for his work and pay all fees and charges incidental thereto.

1.4 Verification of Owner's Data: Prior to commencing work the Contractor shall satisfy himself as to the accuracy of all data indicated on the Drawings and/or provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Engineer. Commencement of work by the Contractor shall be held as an acceptance of the data by him after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions, or inaccuracies of the said data.

1.5 Delivery and Storage of Materials: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. All material shall be stored to provide protection from the weather and damage.

1.6 Extent of work is indicated in the Drawings, Schedules, and Specification. Singular references shall not be construed as requiring only one device if multiple devices are shown on the Drawings or are required for proper system operation.

1.7 Field Measurements and Coordination:

A. The intent of the Drawings and Specifications is to obtain a complete and satisfactory installation. Separate divisional Drawings and Specifications shall not relieve the Contractor from full compliance of work indicated on any of the Drawings or in any Section of the Specifications. Report conflicts prior to start of work.

B. Verify all field dimensions and locations of equipment to insure close, neat fit with other trades' work. Make use of all Contract Documents and approved shop drawings to verify exact dimension and locations. Do not scale electronic safety & security drawings, rely on dimensions shown on architectural or structural drawings.

C. Coordinate work in this Division in proper sequence to ensure that the total work is completed within Contract time schedule and with minimum cutting and patching.

D. Locate all equipment, materials, and apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on electronic safety & security drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others.

E. Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings, and passageways. Cut no structural members without written approval from Engineer or Architect.

F. Carefully examine any existing conditions, piping, and premises. Compare Drawings with existing conditions. Report any observed discrepancies. Written instructions will be issued by the Engineer to resolve discrepancies.

G. Because of the small scale of the Drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members, wall and partition locations, trusses, and room dimensions and take actual measurements on the job. Locate material, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment or material will not fit, the Engineer shall be consulted. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

1.8 Guarantee and Service:

A. Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving Contractor of his responsibilities during guarantee period.

B. The Contractor shall guarantee labor, materials, and equipment for a period of one (1) year from Substantial Completion, or from Owner's occupancy, whichever is earlier. Contractor shall make good any defects and shall include all necessary adjustments to and replacement of defective items without expense to the Owner.

1.9 Approval Submittals:

A. When approved, the submittal control log and submittals shall be an addition to the specifications herewith and shall be of equal force in that no deviation will be permitted except with the approval of the Architect/Engineer.

1. Shop drawings, product literature, and other approval submittals will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions and Division 1 Specification sections and the following.
   a. Submittals shall be properly organized in accordance with the approved submittal control log.
   b. Submittals shall include all applicable items referenced in each specification section, and not include items from more than one specification section in the same submittal.
   c. Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control number, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approval stamps. A sample cover sheet is included at the end of this section.
   d. Submittals shall have been reviewed and approved by the General Contractor (or Prime Contractor). Evidence of this review and approval shall be an "Approved" stamp with a signature and date on the cover sheet.
   e. Submittals shall be combined into a single submittal package with a table of contents. Submittals shall not be issued as multiple individual submittal packages.
   f. Submittals that include a series of fixtures or devices (such as lighting fixtures) shall be organized by the fixture number and be marked accordingly. Each fixture must include all items associated with that fixture regardless of whether or not those items are used on other fixtures.
   g. The electronic safety & security design shown on the drawings supports the mechanical equipment basis of design specifications at the time of design. If mechanical equipment is submitted with different electronic safety & security requirements, it is the responsibility of the mechanical contractor to resolve all required electronic safety & security design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electronic safety & security design on the mechanical submittal with a written statement that this change will be provided at no additional cost. Mechanical submittals made with no written reference to the electronic safety & security design will be presumed to work with the electronic safety & security design. Any corrections required will be at no additional cost.

B. If the shop drawings show variation from the requirements of contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variation in writing in his letter of transmittal and on the submittal cover sheet in order that, if acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the contract.

C. Review of shop drawings, product literature, catalog data, or schedules shall not relieve the Contractor from responsibility for deviations from contract drawings or specifications, unless he has in writing called to the attention of the Architect/Engineer each such deviation in writing at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop

drawings, product literature, catalog data, or schedules. Any feature or function specified but not mentioned in the submittal shall be assumed to be included per the specification.

D. Submit shop drawings as called for in other sections after award of the contract and before any material is ordered or fabricated. Shop drawings shall consist of plans, sections, elevations, and details to scale (not smaller than ¼" per foot), with dimensions clearly showing the installation. Direct copies of small-scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other sections and shall show space allotted for it. Include construction details and materials.

1.10 Test Reports and Verification Submittals: Submit test reports, certifications, and verification letters as called for in other sections. Contractor shall coordinate the required testing and documentation of system performance such that sufficient time exists to prepare the reports, submit the reports, review the reports and take corrective action within the scheduled contract time.

1.11 O&M Data Submittals: Submit Operation and Maintenance data as called for in other sections. When a copy of approval submittals is included in the O&M Manual, only the final "Approved" or "Approved as Noted" copy shall be used. Contractor shall organize these data in the O&M Manuals tabbed by specification number. Prepare O&M Manuals as required by Division 1 and as described herein. Submit O&M Manuals on CD-ROM in addition to required hard bound copies. Submit manuals at the Substantial Completion inspection.

PART 2 - PRODUCTS

2.1 All materials shall be new or Owner-supplied reused as shown on the drawings, the best of their respective kinds, suitable for the conditions and duties imposed on them at the building and shall be of reputable manufacturers. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following sections.

2.2 Equipment and Materials:

A. Shall be new and the most suitable grade for the purpose intended. Equipment furnished under this division shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of three years. Where practical, all of the components shall be products of a single manufacturer in order to provide proper coordination and responsibility. Where required, Contractor shall furnish proof of installation of similar units or equipment.

B. Each item of equipment shall bear a name plate showing the manufacturer's name, trade name, model number, serial number, ratings and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated or painted.

C. The label of the approving agency, such as UL or NEMA, by which a standard has been established for the particular item shall be in full view. Materials shall be UL-listed for the application specified or indicated on the Drawings or Specifications.

D. The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be a product of the manufacturer's latest design.A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

E. Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.

F. Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material, and type of construction desired. Manufacturer's products shown on the Drawings have been used as basis for design; it shall be the Contractor's responsibility to ascertain that alternate manufacturer's products meet detailed specifications, and that size and arrangement of equipment are suitable for installation.

G. Model Numbers: Catalog numbers and model numbers indicated in the Drawings and Specifications are used as a guide in the selection of the equipment and are only listed for the Contractor's convenience. The Contractor shall determine the actual model numbers for ordering equipment and materials in accordance with the written description of each item and with the intent of the Drawings and Specifications.

H. All equipment and material shall be manufactured and assembled in the United States.

2.3 Requests for Substitution:

A. Where a particular system, product or material is specified by name, consider it as standard basis for bidding, and base proposal on the particular system, product or material specified.

B. Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

C. Required product cannot be supplied in time for compliance with Contract time requirements.

D. Required product is not acceptable to governing authority, or determined to be non-compatible, or cannot be properly coordinated, warranted, or insured, or has other recognized disability as certified by Contractor.

E. Substantial cost advantage is offered Owner after deducting offsetting disadvantages including delays, additional compensation for redesign, investigation, evaluation and other necessary services and similar considerations.

F. All requests for substitution shall contain a "Comparison Schedule" and clearly and specifically indicate any and all differences or omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include but shall not be limited to data as follows for both the specified and substituted products:

1. Principal of operation.
2. Materials of construction or finishes.
3. Thickness of gauge of materials.

4. Weight of item.
5. Deleted features or items.
6. Added features or items.
7. Changes in other work caused by the substitution.
8. Performance curves.

G. If the approved substitution contains differences or omissions not specifically called to the attention of the Architect/Engineer, the Owner reserves the right to require equal or similar features to be added to the substituted products (or to have the substituted products replaced) at the Contractor's expense.

2.4 Prior Approval

A. Prior Approval shall be required for any manufacturer other than those listed for all specified items in the Drawings and Specifications. Submit all requests for approval of the alternate manufacturer's products two weeks prior to bid opening. Approval will be in the form of an Addendum to the Specifications and Drawings. Clearly indicate all differences between the specified and proposed product following the guidelines for "Request for Substitution" herein. This requirement may be waived if, in the opinion of the engineer, it is in the best interest of the Owner. Submittals received after the award of the bid for equipment that has not been Prior Approved is subject to immediate rejection.

PART 3 - EXECUTION

3.1 Workmanship: All materials and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat and/or workmanlike appearance, or do not allow adequate space for maintenance, shall be removed, and replaced when so directed by the Architect/Engineer.

3.2 Coordination:

A. The Contractor shall be responsible for full coordination of the electronic safety & security systems with shop drawings of the building construction so the proper openings and sleeves or supports etc., are provided for conduit, devices, or other equipment passing through slabs or walls.

B. Any additional steel supports required for the installation of any electronic safety & security equipment, fixtures or conduit shall be provided by the Contractor.

C. It shall be the Contractor's responsibility to see that all equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the Drawings.

D. All connections to fixtures and equipment shown on the Drawings shall be considered diagrammatic unless otherwise indicated by a specific detail on the Drawings. The actual

connections shall be made to fully suit the requirements of each case and adequately provide for servicing.

E. The Contractor shall protect equipment and fixtures at all times during storage and construction. He shall replace all equipment and fixtures which are damaged as a result of inadequate protection.

F. Prior to starting and during progress of work, examine work and materials installed by others as they apply to work in this division. Report conditions which will prevent satisfactory installation.

G. Start of work will be construed as acceptance of suitability of work of others.

3.3 Construction Electronic Safety & Security Utilities: Provide all temporary wiring for power and light required for construction purposes and remove such temporary wiring when use is no longer required.

3.4 Service Coordination: Prior to commencing any work, coordinate with utility/service provider to ensure proper services are available to project when needed.

3.5 Interruption of Service: Before any equipment is shut down for disconnecting or tie-ins, arrangements shall be made with the Architect/Engineer and this work shall be done at the time best suited to the Owner. This will typically be on weekends and/or holidays and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this work shall be included in the base bid.

3.6 Cutting and Patching: Contractor shall provide all cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under this section. Utilize experienced trades for cutting and patching. Obtain permission from Architect/Engineer before cutting any structural items.

3.7 Equipment Setting: Bolt equipment directly to concrete pads or foundations, using hot-dipped galvanized anchor bolts, nuts, and washers. Level equipment.

3.8 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 28. Obtain matched color coatings from the manufacturer and apply as directed by manufacturer. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.

3.9 Clean-up: Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials and remove all oil and grease spots. Repaint or touch up as required to look like new. During progress of work, Contractor is to carefully clean and leave premises free from debris and in a safe condition.

3.10 Start-up and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, start-up shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety, and operating control shall be included in start-up check.

3.11 Record Drawings:

A. During the progress of the work the Contractor shall record on their field set of Drawings the corrections, variations, and deviations for systems which are not installed exactly as shown on the Contract Drawings.

B. Upon completion of the work, record drawings shall be prepared as described in the General Conditions, Supplementary Conditions, and Division 1 Sections.

3.12 Acceptance:

A. Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.

B. Instructions: At completion of the work, provide a competent and experienced person who is thoroughly familiar with the project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems.

C. Operation and Maintenance Manuals: Furnish four complete manuals bound in ring binders with Table of Contents, organized, and tabbed by specification section. Manuals shall contain:

1. Detailed operating instructions and instructions for making minor adjustments.
2. Complete wiring and control diagrams.
3. Routine maintenance operations.
4. Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.
5. Copies of approved submittals.
6. Copies of all manufacturers’ warranties.
7. Copies of test reports and verification submittals.

D. Test together and separately to determine that:

1. System is free from short circuits and other faults.
2. All equipment operates correctly and as specified.

E. Record Drawings: Submit "Record Drawings".

F. Install engraved metal or plastic nameplates or tags on controls, panels, switches, starters, timers, and similar operable equipment, keyed by number to operating instructions. Dymo type labels are not acceptable.

G. Acceptance will be on the basis of tests and inspections of the work. A representative of the firm which performed the testing shall be in attendance to assist during inspection. Contractor shall furnish necessary electricians to operate system, make any necessary adjustments and assist with final inspection.

H. Control Diagrams: Frame under glass and mount on equipment room wall.

This is a sample cover sheet. Use one for each shop drawing.

PROJECT NAME
PROJECT NUMBER

SAMPLE

ARCHITECT/ENGINEER: Dell Consulting LLC

CONTRACTOR: XYZ Construction

SUBCONTRACTOR: ABC Electrical Contractor

SUPPLIER: Jones Supply Co.

MANUFACTURER: Various

DATE: 2/12/07

Use whatever standard headings you want here

SECTION: 280000 / Electronic Safety & Security General

1. Type A
2. Type B
3. Type C
4. Type D
5. Type E

List each item separately

Typical - list mfr name & model number

General Contractor's APPROVAL stamp must be on this sheet.

END OF SECTION

SECTION 280010 - CODES AND STANDARDS

PART 1 - GENERAL

1.1 All work under Division 28 shall be constructed in accordance with the codes and standards listed herein. The design has been based on the requirements of these codes and standards. While it is not the responsibility of the Contractor to verify that all work called for complies with these codes and standards, he shall be responsible for calling to the Engineer's attention any details on the Drawings and/or Specifications that are not in conformance with these or other codes and standards. Current issue of code applies unless specifically noted otherwise.

1.2 Comply with regulations and codes of suppliers of utilities.

1.3 Where no specific method or form of construction is called for in the Contract Documents, the Contractor shall comply with code requirements when carrying out such work.

1.4 Where code conflict exists, generally the most stringent requirement applies.

1.5 Codes or standards applying to a specific part of the work may be included in that section.

PART 2 - CODES AND STANDARDS

2.1 Codes:

A. Florida Building Code – Building – 2023

B. National Electrical Code (NFPA-70) – 2020

C. National Fire Alarm Code (NFPA-72) – 2019

D. Uniform Fire Code (NFPA 1) – 2021 Florida Edition

E. National Electrical Safety Code (NESC)

F. Life Safety Code (NFPA 101) – 2021 Florida Edition

G. Standard for Health Care Facilities (NFPA-99) - 2021

H. FAC 69A-47 The Uniform Fire Safety Standard for Elevators

I. FAC 676-5 Florida Elevator Safety Code

J. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

2.2 Standards:

A. All electrical materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments:

1. American National Standard Institutes (ANSI)
2. Illuminating Engineering Society (IES).
3. Institute of Electrical and Electronics Engineers (IEEE)
4. National Electrical Manufacturer's Associations (NEMA)
5. National Fire Protection Association (NFPA)
6. Occupational Safety and Health Act (OSHA)
7. Underwriter's Laboratories, Inc. (UL)

PART 3 - EXECUTION

3.1 Not Used

END OF SECTION

SECTION 280500 - ELECTRONIC SAFETY & SECURITY RELATED WORK

PART 1 - DIVISION 1 - GENERAL REQUIREMENTS

1.1 All Division 1 Sections apply to all Division 28 Sections.

1.2 Coordinate for all cutting and patching. Contractor shall review all cutting and patching required prior to bidding and shall coordinate installation.

PART 2 - DIVISION 2 - SITEWORK

2.1 Specific requirements for excavation and backfill for underground conduit are contained in Section 260543.

2.2 The following is part of Division 28 work.

A. Underground electronic safety & security utilities.

PART 3 - DIVISION 3 - CONCRETE

3.1 Perform the following as part of Division 28 work, complying with the requirements of Division 3, Concrete.

A. Curbs, foundations and pads for electronic safety & security equipment.

B. Encasement of electronic safety & security work.

C. Underground structural concrete to accommodate electronic safety & security work.

D. Rough grouting in and around electronic safety & security work.

E. Patching concrete cut to accommodate electronic safety & security work.

PART 4 - DIVISION 4 – MASONRY

4.1 Refer to Division 4, Masonry for:

A. Patching openings to accommodate electronic safety & security work.

PART 5 - DIVISION 5 – METALS

5.1 Refer to Division 5, Metals for:

A. Supports for electronic safety & security work.

B. Framing openings for electronic safety & security equipment.

PART 6 - DIVISION 6 – WOOD

6.1 Refer to Division 6, Wood for:

A. Supports for electronic safety & security work.

B. Framing openings for electronic safety & security equipment.

PART 7 - DIVISION 7 - THERMAL & MOISTURE PROTECTION

7.1 Refer to Division 7, Thermal and Moisture Protection for:

A. Installation of all supports for electronic safety & security work.

B. Caulking and waterproofing of all wall and roof mounted electronic safety & security work.

7.2 Perform the following as part of Division 28 work, complying with Division 7 requirements.

A. Fire barrier penetration seals.

B. Caulking and related shielding around ducts and pipes for sound isolation and attenuation.

PART 8 - DIVISION 8 - DOORS AND WINDOWS

8.1 Refer to Division 8, Doors & Windows for:

A. Installation of all access doors for electronic safety & security work.

PART 9 - DIVISION 9 - FINISHES

9.1 Refer to Division 9, Finishes for:

A. Painting exposed conduit and equipment.

B. Painting structural metal and concrete for electronic safety & security work.

C. Painting access panels.

9.2 Colors shall be selected by the Architect for all painting of exposed electronic safety & security work unless specified herein.

9.3 Perform the following as part of Division 28 work.

A. Touch up painting of factory finishes.

PART 10 - DIVISION 22 - PLUMBING

PART 11 - DIVISION 23 –HEATING, VENTILATING & AIR CONDITIONING

PART 12 - DIVISION 26 – ELECTRICAL

12.1 Wiring Raceways and cabling as indicated on the electronic safety & security drawings shall be furnished and installed by the electronic safety & security contractor, complying with the requirements of Division 26 specifications.

PART 13 - DIVISION 27 - COMMUNICATIONS

END OF SECTION

SECTION 283100 - FIRE ALARM SYSTEM

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. This Section includes fire alarm systems.

1.3 Definitions

A. FACP: Fire alarm control panel.

B. LED: Light-emitting diode.

C. NAC: Notification Appliance Circuit.

D. NICET: National Institute for Certification in Engineering Technologies.

E. SLC: Signaling Line Circuit.

F. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.4 System Description

A. Noncoded, analog-addressable system; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.

1.5 Performance Requirements

A. This project shall comply with the Codes and Standards as defined in Specification Section 280010 CODES AND STANDARDS.

B. Fire alarm signal initiation shall be by one or more of the following devices:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Automatic sprinkler system water flow.
5. Fire extinguishing system operation.
6. Fire standpipe system.

C. Fire alarm signal shall initiate the following actions:

1. Alarm notification appliances shall operate continuously.
2. Identify alarm at the FACP and remote annunciators.
3. De-energize electromagnetic door holders.
4. Transmit an alarm signal to the remote alarm receiving station.
5. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
6. Close smoke dampers in air ducts of system serving zone where alarm was initiated.
7. Record events in the system memory.
8. Record events by the system printer where provided.

D. Supervisory signal initiation shall be by one or more of the following devices or actions:

1. Operation of a fire-protection system valve tamper switch.

E. System trouble signal initiation shall be by one or more of the following devices or actions:

1. Duct mounted smoke detectors.
2. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
3. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
4. Loss of primary power at the FACP.
5. Ground or a single break in FACP internal circuits.
6. Abnormal ac voltage at the FACP.
7. A break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at the FACP or annunciator.
10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

F. System Trouble and Supervisory Signal Actions: Ring trouble bell and annunciate at the FACP and remote annunciators. Record the event on system printer.

G. Air Handling Units: Air handling units shall shut down only in the area where the fire is detected, or the area actually alarmed (floor above and below). Other air handling equipment shall remain online. This shall not supersede any code requirements.

1.6 Submittals

A. Product Data: Submit manufacturer’s technical product data, specifications, and installation instructions for each type of device provided.

B. Calculations:

1. Battery size calculations.
2. NAC circuit cable voltage drop calculations.

C. Qualification Data: For installer.

D. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract

Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Engineer for review.

E. Shop Drawings:

1. Shop Drawings shall be prepared by persons with the following qualifications:
   a. Trained and certified by manufacturer in fire alarm system design.
   b. Fire alarm certified by NICET, minimum Level III.
2. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
3. Device Address List: Coordinate with final system programming.
4. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
5. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
6. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
7. Floor Plans: Submit a “point-to-point” wiring diagram showing the connections to equipment and terminal cabinets, indicate the equipment numbers, terminal numbers, wire numbers, address numbers, and wire colors. Include the connections for the mechanical systems. The submittal shall be made for approval prior to the installation of wiring in the raceway. Indicate final outlet locations showing address of each addressable device, conduit sizes and cable and wire types and sizes.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.

H. Documentation:

1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner and Engineer.
2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner and Engineer. Format of the written sequence of operation shall be the optional input/output matrix.
   a. Hard copies on paper to Owner and Engineer.
   b. Electronic media may be provided to Engineer.

1.7 O & M Data Submittals:

A. Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approval submittals (product data & shop drawings) in O&M manual.

B. Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.

1.8 Quality Assurance

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project. The fire alarm system shall be installed by a state certified fire alarm system installation contractor. The fire alarm system installation contractor shall have an unlimited electrical license (Type EC) or a fire alarm specialty license (Type EF).

1. The fire alarm contractor shall be an experienced firm regularly engaged in the layout and installation of automatic fire alarm systems. The contractor shall have successfully completed the installation, testing, and warranty of systems of the scope of the largest system on this project at least one year prior to bid and have regularly engaged in the business of fire alarm systems contracting continuously since.
2. The fire alarm contractor shall have been NICET Level III certified and certified by an approved equipment manufacturer to perform installation, testing, adjustment, maintenance, and repair on the approved manufacturer's equipment prior to the date of bid. The proposed fire alarm contractor shall commence no work on the project until he furnishes evidence, satisfactory to the aforementioned certifications and receives notice to proceed with the installation from the Engineer.
3. Firms shall have a factory authorized service organization and stock spare parts.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. All equipment shall be UL listed.

1.9 Extra Materials

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Smoke and Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.
2. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.
3. Keys and Tools: One extra set for access to locked and tamper proofed components.
4. Audible and Visual Notification Appliances: One of each type installed.
5. Fuses: Two of each type installed in the system.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. FACP and Equipment:
   a. Edwards Systems Technology Inc.

b. NOTIFIER; a GE-Honeywell Company.
c. Siemens Building Technologies, Inc.; a Cerberus Division.
d. SimplexGrinnell LP; a Tyco International Company.

2. Wire and Cable:
a. Comtran Corporation.
b. Helix/HiTemp Cables, Inc.; a Draka USA Company.
c. Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.
d. West Penn Wire/CDT; a division of Cable Design Technologies.

2.2 FACP

A. General Description:

1. Modular, power-limited design with electronic modules, UL 864 listed.
2. Addressable initiation devices that communicate device identity and status.
a. Smoke sensors shall additionally communicate sensitivity setting.
b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, two lines of 40 characters each, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Electronic Loop Controller: Electronic Loop Controller shall be provided in each Fire Alarm Control Panel, to interface between the main panel, expansion modules, and the Analytical Microprocessor-based Detectors and modules. No electronic loop controller shall be loaded to more than 50% of the maximum allowable number of devices which can be connected to the electronic loop.

D. Circuits:
1. Signaling Line Circuits: NFPA 72, Class X.
2. Notification-Appliance Circuits: NFPA 72, Class B.
3. Actuation of alarm notification appliances, emergency voice communications where provided, annunciation, elevator recall shall occur within 10 seconds after the activation of an initiating device.
4. Electrical monitoring for the integrity of wiring external to the FACP for mechanical equipment shutdown and magnetic door-holding circuits is not required, provided a break in the circuit will cause doors to close and mechanical equipment to shut down.

E. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm verification" signal at the FACP.
2. Activate a listed and approved "alarm verification" sequence at the FACP and the detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel FACP indication and system reset if the alarm is not verified.

F. Notification-Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41 60 beats per minute, march-time pattern. All visual appliances shall be synchronized. Do not load any NAC more than 75% of its rated amperage.

G. Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.

H. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP and remote annunciators, after initiating devices are restored to normal.

1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

I. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.

J. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory and make a print-out of the final adjusted values on the system printer.

K. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.

L. Service Modem: Ports shall be RS-232 for system printer and for connection to a dial-in terminal unit.

1. The dial-in port shall allow remote access to the FACP for programming changes and system diagnostic routines. Access by a remote terminal shall be by encrypted password algorithm.

M. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble), and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including the same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

N. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines and trouble signal shall be powered by the 24-V dc source.

1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
2. Power supply shall have a dedicated fused safety switch for this connection at the service entrance equipment. Paint the switch box red and identify it with "FIRE ALARM SYSTEM POWER."

O. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.

1. Batteries: Shall be capable of providing power to the system for a minimum of 24 hours.
2. Battery and Charger Capacity: Comply with NFPA 72.

P. Surge Protection:

1. Install surge protection on normal ac power for the FACP and its accessories.
2. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.
3. Install surge protection inside the FACP on all incoming and outgoing initiating, notification, and control circuits.

Q. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.3 Manual Fire Alarm Boxes

A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box. Mount 48” AFF to center of device.

1. Single-action mechanism requiring one action to initiate an alarm, pull lever type with integral addressable module, arranged to communicate manual-station status (normal, alarm, trouble) to the FACP.
2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation. Provide on all manual fire alarm stations.

2.4 System Smoke Detectors

A. General Description:

1. UL 268 listed, operating at 24-V dc, nominal.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

3. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring. Removal of the respective detector shall not affect electronic loop communications with other detectors on that loop.
4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
5. Integral Visual-Indicating Light: LED type.
6. In the event of a loss of communications of the smoke detector with the Electronic Loop Controller, the smoke detector will automatically revert to the "Standalone Conventional" operation, and Fire Alarm / Life Safety system functions shall not be compromised.
7. Shall be capable of transmitting pre-alarm and alarm signals to the Fire Alarm Control Panel via the Electronic Loop Controller. It shall be possible to program Fire Alarm Control Panel activity and response to each of the following signal levels: Normal, Pre-Alarm, Alarm, Trouble, Detector need cleaning.
8. Shall contain an environmental compensation algorithm, which identifies and sets ambient "Environmental Thresholds" continually and periodically. In this manner, the environmental impact of temperature, humidity, environmental contaminates as well as detector aging shall be automatically monitored. This process shall employ digital compensation techniques to adapt the detector to both long term and short-term changes in the environment in which they are installed. The microprocessor shall monitor this environmental compensation value and alert the system operator when the detector 80% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the derived base line sensitivity that the detector has sensed in its environment. The base line sensitivity information shall be automatically and periodically updated and permanently stored in the detector.
9. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
    a. Rate-of-rise temperature characteristic shall be selectable at the FACP for 15 or 20 deg F (8 or 11 deg C) per minute.
    b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at the FACP to operate at 135 or 155 deg F (57 or 68 deg C).
    c. Provide a minimum of 5 levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector Sensitivity: Between 1.0 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.

C. Duct Smoke Detectors:

1. Photoelectric Smoke Detectors:
    a. Sensor: LED or infrared light source with matching silicon-cell receiver.
    b. Detector Sensitivity: Between 1.0 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
2. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
    a. Duct Housing Enclosure: UL listed for use with the supplied detector.

3. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
4. Integral Visual-Indicating Light: LED type. Provide remote status and alarm indicator and test station where indicated.
5. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
6. Each sensor shall have multiple levels of detection sensitivity.
7. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
8. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit. Shall be addressable.

2.5 Heat Detectors

A. General: UL 521 listed.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or rate-of-rise of temperature that exceeds 15 deg F (8 deg C) per minute, unless otherwise indicated.

1. Mounting: Plug-in base, interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.6 Notification Appliances

A. Description: Equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3m) from the horn. Devices shall have a minimum of two (2) field selectable settings for dBA levels and shall have a choice of continuous or temporal (Code 3) audible outputs.

C. Visible Alarm Devices: LED strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

1. Rated Light Output: 75 candela synchronized flash outputs. In rooms exceeding 30’X30’, a 110-candela strobe shall be used to comply with visual coverage.
2. Devices shall have 4 field selectable settings at 15, 30, 75, and 110 candela. The selector switch shall be tamper resistant.
3. The candela settings shall show the candela selection in a visible location on the device at all times when installed.
4. Strobe Leads: Factory connected to screw terminals.

2.7 Sprinkler System Remote Indicators

A. Remote status and alarm indicator and test stations, with LED indicating lights. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single-gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

2.8 Remote Annunciator

A. Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also, duplicate manual switching functions of the FACP, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Class 1.

B. Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

2.9 Addressable Interface Device

A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall and to a circuit-breaker shunt trip for power shutdown.

2.10 Digital Alarm Communicator Transmitter

A. Listed and labeled according to UL 632.

B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.

D. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.11 Guards For Physical Protection

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by manufacturer of the device.
2. Finish: Paint of color to match the protected device.

2.12 Wire And Cable

A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG. Color shall be red.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 14 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.

PART 3 - EXECUTION

3.1 Equipment Installation

A. Detector Mounting:

1. Smooth ceiling spacing shall not exceed 30 feet.
2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.

B. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct. Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.

C. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

D. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

E. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

F. NAC Devices: Install 80” AFF to bottom of strobe lens if wall mounted. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Ceiling mounted devices shall be coordinated with all other trades work.

G. Device Location-Indicating Lights: Locate in public space near the device they monitor.

H. FACP: Surface mount with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

I. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

3.2 Wiring Installation

A. Install wiring according to the following:

1. NECA 1.
2. TIA/EIA 568-A.

B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes."

1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable. Minimum raceway size for all fire alarm circuits is ¾".

C. Wiring Method:

1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
2. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved pressure-type terminal blocks.

E. Cable Taps: Not allowed.

F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

G. Color coding shall comply with Owner Standards.

a. Horns = Red +/ Black -
b. Strobes (if separate) = White +/ Purple -
c. Alarms = Blue +/ Yellow -
d. A/C Ventilation = Shut Down Brown +/ Orange -
e. Magnetic Doors = Pink +/ Grey -
f. Misc. Circuits = Violet +/ Tan -

H. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum 1-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

3.3 Identification

A. Identify system components, wiring, cabling, and terminals according to Division 26 Section “Basic Electrical Materials and Methods” & “Cable Identification.”

B. Install instructions frame in a location visible from the FACP.

C. Label power-supply circuit breaker "FIRE ALARM."

3.4 Grounding

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.5 Field Quality Control

A. Training: Submit a letter verifying that Owner training has been received by factory representative.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

C. Perform the following field tests and inspections and prepare test reports:
   1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
   2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
   3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
   4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
      a. Detectors that are outside their marked sensitivity range shall be replaced.
   5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

3.6 Adjusting

A. Occupancy Adjustments: 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 two visits to Project outside normal occupancy hours for this purpose.

3.7 Demonstration

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices.

END OF SECTION

Affidavit of True and Correct As-Built Drawings

County of _____
State of Florida

Whereas, the undersigned Installing Contractor having been heretofore employed by [Owner] directly or as a sub-contractor to furnish certain material and services, to wit:

Fire Alarm Equipment, panels, switches and/or controls, wires and cables, electrical race ways, conduit fixtures in boxes, wiring devices, lighting fixtures and/or other electrical materials, supplies, goods, wares, merchandise and equipment along with labor and appropriate services to install.

On the following described real property:_____

Now, therefore, the undersigned, in requesting final inspection and acceptance, does submit ___ number of true and correct as-built drawings consisting of _____ number of sheets, dated _____. The enclosed as-built drawings show every raceway, junction box, notification appliance, alarm initiating device, terminal cabinet, electrical branch circuit, conductor type, conductor purpose, conductor size and fiber-optic cable. Furthermore, if it is ever discovered that the as-built drawings submitted here unto are in error and not completely accurate, corrections will be made at the expense of the contractor or sub-contractor who is responsible for the mistake or omission.

Signed, sealed and delivered this ___day of _____, _____.

By_____ Installing Contractor

Qualifying Agent _____ FL Lic. No._____ Title _____

Now, therefore, the undersigned Fire Alarm Equipment Manufacture/Authorized Fire Alarm Equipment Distributor, in requesting final inspection and acceptance, does submit ___ number of true and correct as-built drawings consisting of _____ number of sheets, dated _____. The enclosed as-built drawings show every device, connection, address, termination, power supply, annunciator, dip-switch, and jumper setting of each device provided for this contract, or an electronic as-built drawing produced by each individual SLC, of the system, showing device type, assigned address, serial number, and detector base type. Furthermore, if it is ever discovered that the as-built drawings submitted here unto are in error and not completely accurate, corrections will be made at the expense of the contractor or sub-contractor who is responsible for the mistake or omission.

Signed, sealed and delivered this ___day of _____, _____.

By_____ Manufacture/Authorized Distributor

Qualifying Agent _____ FL Lic. No._____ Title _____

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

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. Section Includes:
   1. Decorative steel fences.
   2. Swing gates.

B. Related Sections:

   1. Division 31 Section "Earth Moving" for site excavation, fill, and backfill where decorative metal fences and gates are located.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

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

   1. Wiring Diagrams: For power, signal, and control wiring.

C. Samples: For each fence material and for each color specified.

   1. Provide Samples 12 inches (300 mm) in length for linear materials.

D. Welding certificates.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for decorative metallic-coated steel tubular picket fences, including finish, indicating compliance with referenced standard.

F. Maintenance Data: For gate operators to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. UL Standard: Provide gate operators that comply with UL 325.

D. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators on gates that must provide emergency access.

E. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 STEEL AND IRON

A. Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

C. Tubing: ASTM A 500, cold formed steel tubing.

D. Castings: Either gray or malleable iron unless otherwise indicated.

1. Gray Iron: ASTM A 48/A 48M, Class 30.
2. Malleable Iron: ASTM A 47/A 47M.

2.2 COATING MATERIALS

A. Epoxy Zinc-Rich Primer for Steel: Complying with MPI #20 and compatible with coating specified to be applied over it.

1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

a. <Insert manufacturer's name; product name or designation>.

2. Use primer with a VOC content of [420 g/L] [400 g/L] [340 g/L] <Insert VOC limit> or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.

2.3 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Division 03 Section "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi (20 MPa), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum aggregate size.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 and specifically recommended by manufacturer for exterior applications.

2.4 DECORATIVE STEEL FENCES

A. Decorative Steel Fences: Fences made from steel tubing and shapes, hot-dip galvanized.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. A & T Iron Works, Inc.
   b. Ametco Manufacturing Corporation.
   c. BarnettBates Corporation.

B. Posts: Square steel tubing.

1. Line Posts: 3 by 3 inches (76 by 76 mm) with 3/16-inch (4.76-mm) wall thickness.
2. End and Corner Posts: 3 by 3 inches (76 by 76 mm) with 3/16-inch (4.76-mm) wall thickness.
3. Swing Gate Posts: 3 by 3 inches (76 by 76 mm) with 3/16" wall thickness.

C. Post Caps: Aluminum castings.

D. Rails:

1. Steel Tube Rails: Square steel tubing 2 by 2 inches (50 by 50 mm) with 1/8-inch (3.2-mm) wall thickness.
2. Steel Channel Rails: Steel channels 2 by 1 inch (50 by 25 mm).

E. Pickets: 3/4-inch- (19-mm-) square steel bars

1. Terminate tops of pickets at top rail for flush top appearance
2. Picket Spacing: 4 inches (101.6 mm), maximum.

F. Fasteners: Stainless-steel carriage bolts and tamperproof nuts.

G. Fabrication: Assemble fences into sections by welding pickets to rails.

1. Fabricate sections with clips welded to rails for fastening to posts in field.
2. Drill posts and clips for fasteners before finishing to maximum extent possible.

H. Fabrication: Fabricate bar grating infill into sections of size indicated.

1. Fabricate rails with clips welded to rails for fastening to posts in field.
2. Drill posts, clips, and bar grating for fasteners before finishing to maximum extent possible.

I. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

J. Finish for Steel Items: Primed and Shop painted.

2.5 SWING GATES

A. Gate Configuration: Double leaf.

B. Gate Frame Height: As indicated.

C. Gate Opening Width: As indicated.

D. Steel Frames and Bracing: Fabricate members from square steel tubing 2 by 2 inches (50 by 50 mm with [1/8-inch (3.2-mm) wall thickness.

E. Frame Corner Construction: Welded.

F. Additional Rails: Provide as indicated, complying with requirements for fence rails.

G. Infill: Comply with requirements for adjacent fence.

H. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.

I. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet (1.52 m) wide. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

J. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.

1. Function: 39 - Full surface, triple weight, antifriction bearing.
2. Material: Wrought steel, forged steel, cast steel, or malleable iron.

K. Steel Finish: Primed and Shop painted.

2.6 STEEL FINISHES

A. Surface Preparation: Clean surfaces according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning."

1. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

2. Color and Gloss: As selected by Architect from manufacturer's full range.

B. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils (0.05 mm) per applied coat, to surfaces that will be exposed after assembly and installation, and to concealed surfaces.

C. Shop-Painted Finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Division 01 Section "Execution"

3.3 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches (600 mm) plus 3 inches (75 mm) for each foot (300 mm) or fraction of a foot (300 mm) that fence height exceeds 4 feet (1200 mm).

C. Post Setting: Set posts in concrete.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
   a. Concealed Concrete: Top 2 inches (50 mm) elow grade to allow covering with surface material. Slope top surface of concrete to drain water away from post.

3. Posts Set in Concrete: Extend post to within 6 inches (150 mm) of specified excavation depth, but not closer than 3 inches (75 mm) to bottom of concrete.
4. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch (20 mm) larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.

   a. Extend posts at least 5 inches (125 mm) into sleeve.

b. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.

5. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch (20 mm) larger than outside diagonal dimension of post.

a. Extend posts at least 5 inches (125 mm) into concrete.
b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet (450 m) except as follows:

1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).

a. Gates and Other Fence Openings: Ground fence on each side of opening.

1) Bond metal gates to gate posts.

2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location.

E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

F. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

G. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.
1. that may affect test results.

3.6 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION 323119

APPENDIX A – GEOTECHNICAL REPORT

SOUTHERN EARTH SCIENCES
Geotechnical | Environmental | Materials Testing

Proposed Paradise Beach Fire Station

Bauer Road

Escambia County, FL

Report of Subsurface Investigation and

Geotechnical Engineering Evaluation

Prepared for:
FORREST DANIELL & ASSOCIATES, PC
SES Project No: M26-078
April 1, 2026

SOUTHERN EARTH SCIENCES
Geotechnical | Environmental | Materials Testing

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Tel: (251) 344-7711
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April 1, 2026

FORREST DANIELL & ASSOCIATES, PC
8007 American Way
Daphne, AL 36526

ATTENTION: Mr. Jeff Jordan

REFERENCE: Report of Subsurface Investigation and Geotechnical Engineering Evaluation
Proposed Paradise Beach Fire Station
Bauer Road
Escambia County, FL
SES Project No: M26-078

Dear Mr. Jordan:

Southern Earth Sciences, Inc. (SESI) has completed the authorized scope of subsurface investigation and geotechnical evaluation for the referenced project. This report presents our understanding of the available project information and outlines our soil related recommendations and comments regarding subsurface conditions expected to be encountered during construction of the proposed fire station.

We appreciate this opportunity to be of service and look forward to our continued involvement throughout the construction phases of the project. Please do not hesitate to contact us if you have any questions.

Sincerely,

SOUTHERN EARTH SCIENCES, INC.

Ethan Billeaud, E.I.
Project Engineer

Matt Coaker, P.E.
Vice President
Registered, Florida 73448

CN/mc/eb

Attachments

This item has been digitally signed and sealed by Robert Matthew Coaker, P.E. on the date adjacent to the seal.

Printed Copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

FORREST DANIELL & ASSOCIATES, PC

Report of Subsurface Investigation and Geotechnical Engineering Evaluation
Proposed Paradise Beach Fire Station
Escambia County, FL
SES Project No: M26-078
April 1, 2026

1.0 Project Information and Site Description ..... - 1 -

2.0 Field Investigation ..... - 1 -

3.0 Laboratory Testing ..... - 2 -

4.0 Generalized Subsurface Conditions ..... - 2 -

5.0 Groundwater ..... - 3 -

6.0 Foundation Considerations and Conclusions ..... - 4 -

6.1 Site Preparation ..... - 4 -

6.2 Shallow Foundations ..... - 5 -

7.0 Pavement Evaluation ..... - 6 -

7.1 Flexible Pavements ..... - 7 -

7.2 Rigid Concrete Pavements ..... - 8 -

7.3 Pavement Subgrade Preparation ..... - 10 -

7.4 Moisture Control ..... - 10 -

8.0 Proposed Detention Pond Areas ..... - 10 -

9.0 General Comments and Limitations ..... - 12 -

APPENDIX 1

Test Location Plans

APPENDIX 2

CPT Soundings

Soil Boring Logs

APPENDIX 3

Laboratory Test Results

APPENDIX 4

Provided Plans

1.0 PROJECT INFORMATION AND SITE DESCRIPTION

Based on our understanding of the provided information, the project will consist of the construction of a new fire station approximately 11,000 ft^2 in plan area. The proposed fire station is planned to be a single-story steel frame structure supported by shallow footings and a slab on grade foundation. The project will also include asphalt or concrete access drive and parking areas. Structural loading information was not available at this time. For reporting purposes, we assumed loadings on the order of 6 kips/lf and 50 kips for wall and isolated column loads, respectively. Based on our conversations, we understand that grades will not be raised more than 4 feet. No grading plans or topographic survey map were available at this time. A stormwater management pond is planned within the northern portion of the project site. Based on our correspondence, we understand that the pond bottom is planned to be 4 to 6 feet below existing grade. Based on review of Escambia County GIS elevation contour map (available to the public online), the project site is relatively flat, ranging from Elevation (EL) +17 to EL +18.

The project site is located off Bauer Road in Escambia County, Florida and is currently an undeveloped, wooded parcel. Clearing was provided by the client to provide access to our drilling equipment for our field investigation. No additional detailed project information was available at the writing of this report.

2.0 FIELD INVESTIGATION

Four (4) Cone Penetrometer Test (CPT) soundings and eight (8) manual auger borings and two (2) soil borings with Standard Penetration Tests (SPTs) were performed within the proposed building, pavement, and stormwater management areas. The test sounding locations were selected by Forrest Daniell & Associates personnel and located by SES personnel in the field using an overlay of the conceptual site plan, reference to site features, and a handheld GPS coordinates with an accuracy of ±25 feet. Test Location Plans depicting the approximate test locations are attached in **Appendix 1**.

The CPT_u soundings were performed in general accordance with ASTM Specification D-5778 using a truck mounted Hogentogler Electronic CPT rig. The CPT soundings were advanced to depths ranging from approximately 30 to 50 feet below the existing ground surface. Correlations between Cone Resistance values and Standard Penetration Testing "N" values were performed according to the methods developed by Robertson, Campanella and Wightman. The soil behavior types and stratigraphy shown on the CPT Log sheets are based on correlation to material parameters measured and recorded as the cone is advanced. The CPT Log sheets graphically showing measured cone tip resistance, sleeve resistance, pore pressure, and correlated N60-value and interpreted soil behavior type at the sounding locations are attached in **Appendix 2**.

Soil borings with Standard Penetration Tests (SPTs) within the stormwater pond area were advanced to depths of approximately 14 to 16 feet below the existing ground surface using truck mounted drilling equipment. Soil sampling and penetration testing in the soil test borings were performed in general accordance with ASTM Specification D 1586 using flight auger drilling techniques. At regular intervals during the process, the drill rods were removed, and soil samples were obtained with a standard 2-inch split tube sampler. Soils were sampled at 2 ft intervals to boring termination. Representative portions of soil samples obtained during the investigation were transported to our laboratory for classification testing. Samples were examined by an engineer and classified in accordance with the Unified Soil Classification System. Soil descriptions, penetration resistances and lab testing results are shown on the appropriate Soil Boring Log sheets attached in **Appendix 2**.

The manual auger borings were advanced at each test location by manually twisting a sharpened auger to a depth of approximately 4 feet beneath the ground surface. Representative portions of soil samples obtained during the investigation were transported to our laboratory for classification testing. Samples were examined by an engineer and received visual classification in accordance with the Unified Soil Classification System. Soil descriptions are shown on the Soil Boring Log sheets attached in **Appendix 2**.

3.0 LABORATORY TESTING

Laboratory testing included physical examination and general classification testing of samples obtained from the soil test borings in SES laboratories. Testing included Moisture Content Determination (ASTM D 2216), No. 200 Sieve Washes (ASTM D 1140), Sieve Analysis (ASTM D6913) Atterberg Limits Tests (ASTM D 4318) and Permeability Testing (ASTM D2434). Test results are included on Soil Boring Logs attached in **Appendix 2** and on Laboratory Test Data Summary Sheets attached in **Appendix 3**.

4.0 GENERALIZED SUBSURFACE CONDITIONS

The subsurface descriptions below are generalized to highlight the major subsurface stratigraphy encountered across the site. The CPT Sounding Logs attached in **Appendix 2** present specific information at individual CPT locations including correlated soil behavior type, stratification, ground water level, and penetration resistance. This information is representative of conditions encountered at the CPT locations. Variations may occur and should be expected between test locations. The stratification represents the approximate boundary between subsurface materials as the actual transition may be gradual. Reference to depth has been made with respect to the existing ground surface at the time of our field investigation.

Topsoil thickness at the boring locations ranged from approximately 6 to 30 inches. Detailed descriptions of soils encountered at each test location are shown on the appropriate CPT Sounding and soil boring logs included in **Appendix 2**. Generalized subsurface soil conditions are summarized in **Table 1** below.

TABLE 1

GENERALIZED SUBSURFACE SOIL CONDITIONS

Approximate Depth from Existing ground Surface (ft)	Consistency or Relative Density	Soil Descriptions	Special Remarks
0 to 2-3	Loose to Med. Dense	Silty Sands / Sands with Silt	Topsoil depths varied from 6 to 30 inches below ground surface
2-3 to 15-20	Med. Dense to Dense	Silty Sands / Sands	
15-20 to 30-50*	Medium Dense to Very Dense	Silty Sands / Sands	

***Termination depth of the deepest CPT Sounding.**

5.0 GROUNDWATER

Groundwater was encountered at many manual auger boring locations between depths of 3 to 4 feet at the time of our investigation. Direct groundwater measurements were not possible at the CPT locations at the time of our investigation due to the CPT sounding holes collapsing upon rod removal. The CPT sounding holes collapsed at depths ranging from approximately 3 to 4 feet below the existing ground surface. The CPT sounding hole caved in upon removal of the CPT rods with no free water being observed at the cave-in depth. A hole collapse often occurs at or slightly above groundwater or saturated soil level but can also occur due to the presence of loose soil without the presence of groundwater. Depth to sounding collapse at each test location at the time of our investigation are shown on the appropriate CPT sounding sheet attached in **Appendix 2**.

Estimation of static groundwater levels using measured porewater pressures in the sands at depths below approximately 10 feet indicate that a hydrostatic water level exists at depths ranging from approximately 2.5 to 4 feet below ground surface. Fluctuation in the groundwater table will occur due to variances in

rainfall, elevation, drainage, types of soil encountered and other factors not evident at the time measurements were made. Groundwater levels should be verified prior to construction. Reference to depth has been made with respect to the existing ground surface at the time of our field investigation.

6.0 FOUNDATION CONSIDERATIONS AND CONCLUSIONS

Our evaluation of subsurface conditions and foundation alternatives for this project has been based on the project information previously described in this report and subsurface data obtained during the investigation. In evaluating the CPT soundings and soil boring data, we have used empirical correlations previously established between standard penetration resistances, cone tip and side resistance values, soil index properties and foundation stability. Soil parameters used in the evaluation were derived from the CPT sounding data using the interpretation software RAPID CPT® by Dataforensics.

Beneath approximately 6 to 30 inches of topsoil and surface organics, subsurface conditions encountered within the upper 2 to 3 feet of the site generally consist of loose to medium dense silty sands and sands with silt. With proper foundation design and subgrade improvement (i.e., limited undercutting, replacement, thorough compaction, and raising grade to provide separation), these materials will be capable of supporting the anticipated structural loading using conventional shallow foundations. General subgrade preparation and foundation recommendations are provided in the following sections.

6.1 Site Preparation

The initial step in site preparation should be the complete removal of all topsoil, surficial organics, debris, etc. extending laterally to at least 5 feet outside the construction area. Excavated topsoil and organic materials should be wasted and not reused in structural areas.

Excavations should extend to depths as required to completely remove all topsoil, surface organics or otherwise unsuitable material and to allow placement of at least 12 inches of compacted Select Structural Fill (insitu or imported) beneath foundation and slab subgrade elevation. Exposed surfaces should be leveled and compacted to at least 95 percent of the soil's Modified Proctor maximum dry density as determined by ASTM D 1557. Care should be taken to ensure that any soft or excessively yielding soils not improved by compaction are undercut to firmer materials and backfilled with well compacted fill. Deeper isolated excavations may be needed to remove excessively loose soils that cannot be improved by compaction or debris that may be discovered during site grading.

Any isolated areas of loose, soft, debris filled or otherwise unsuitable soils should be locally excavated. Excavations should extend laterally to a minimum of 3 feet beyond the edge of the footing. We recommend the site preparation be observed by an experienced soils technician under the direct supervision of the project professional geotechnical engineer.

If groundwater or saturated soils are encountered, the initial lifts should consist of clean sand with less than about 10 percent (by weight) passing the No. 200 mesh sieve and 70 percent or less (by weight) passing the No. 40 mesh sieve. Below and within one foot of the groundwater/saturated soil level, in lieu of measured compaction tests, Clean Sand Fill should be thoroughly compacted with heavy tracked equipment to achieve some compaction and fill voids. Above the groundwater and saturated soil level, Clean Sand Fill should be compacted to at least 98 percent of the Standard Proctor maximum dry density as determined by ASTM D698 with a moisture content between 1 percentage point below and 3 percentage point above the optimum moisture content.

Imported Select Structural Fill soil should consist of a sandy material with less than about 30 percent of the soil particles (by weight) passing the No. 200 mesh sieve, less than 80 percent passing the No. 40 sieve, and a Liquid Limit less than 25. The insitu sandy soils and/or Imported Select Structural Fill material should be compacted in 12-inch (maximum) lifts to at least 95 percent of the soil's Modified Proctor maximum dry density as determined by ASTM D 1557. In place density tests should be made at frequent intervals to measure the effectiveness of the compaction operations.

6.2 Shallow Foundations

Shallow foundations bearing at a depth of at least 18 inches below surrounding grade may be designed for an allowable soil bearing pressure of up to 2,000 psf. Minimum footing widths of 18 inches for continuous (wall) and 24 inches isolated (column) should be observed. The bottom of all footing excavations should be observed by an experienced soil technician and compacted to the above specifications.

The bottom of the foundation excavations must be dry, clean and free of loose, soft materials and construction debris prior to placement of steel or concrete. Excavations should be observed by a qualified inspector prior to steel or concrete placement. Concrete shall be poured as quickly as possible to avoid exposure of the footing materials to moisture changes (wetting or drying). Surface run-off water should be channeled away from the excavation and not be allowed to pond. If for any reason foundation excavations are required to be open for an extended period or if inclement weather is imminent, excavations should be protected to minimize moisture loss/gain. The bottom

of all footing excavations should be stable, free of water, debris and should be compacted 95 percent of the Modified Proctor maximum dry density as determined by ASTM D1557 with moisture content between 1 percentage points below and 3 percentage points above the optimum moisture content.

Assuming that the site will be prepared as previously outlined and structural loads will be consistent with our stated assumptions, footing settlements are expected to be less than approximately 1.0 inch. SES should be notified if our assumptions of foundation loadings are not consistent with final design loads.

7.0 PAVEMENT EVALUATION

Our evaluation of site paving has been based on subsurface information obtained from the site, references to empirical correlations previously established between soil index properties and pavement/subgrade stability observed in soil conditions similar to those encountered at the subject site. Traffic loading and volume information for this project was not available at the writing of this report. Recommendations for various pavement areas have been based on the assumptions of traffic usage for a 20-year design life summarized in the following table. Preliminary flexible and rigid pavement recommendations are summarized in the following sections. SES should be consulted to evaluate traffic information specific to this project so that we may determine how changes may affect the design.

TABLE 2

PARKING AND DRIVE AREAS - DESIGN TRAFFIC ASSUMPTIONS

Paved Area	Design Daily Traffic Assumptions	Maximum Design Equivalent Single Axle Loadings (ESALs)
Light Duty - Automobile Parking Areas	Up to 500 Passenger Cars Up to 250 Light Pick-Up Trucks or Vans	<10,000
Medium Duty Access Drives	Various Daily Light Duty Pick-Up Trucks or Vans 1 Garbage/Dumpster Truck 1 Delivery Truck (AASHTO H-20 Loading) and 1 Fire Truck (AASHTO HS20-44 Tandem Axle Loading)	<100,000
Heavy Duty Access Drives	Various Daily Light Duty Pick-Up Trucks or Vans 1 Garbage/Dumpster Truck 15 Delivery Trucks (AASHTO H-20 Loading) 15 Fire Truck Passes (AASHTO HS20-44 Tandem Axle Loading)	<1,000,000

7.1 Flexible Pavements

Pavement design and analysis for the proposed new pavement construction was performed using the 1993 AASHTO Flexible Pavement Structural Design Method. A Resilient Modulus (M_R) design value of 8,500 psi was conservatively selected for imported fill soils since new pavements will be constructed over improved roadbed fill soils after excavating to design grade and removal of the insitu soils. Based on the provided general traffic information and our experience with similar developments in this geographic area having similar soil and site conditions, the minimum flexible pavement sections we would recommend to consider for use are shown below in **Table 3**. These recommended minimum sections are based on the completion of the recommended site preparation. Heavy duty pavements as might be required for frequent heavy truck traffic or on a public road have not been evaluated. Rigid concrete pavements are recommended to be used in areas where trucks will frequently maneuver, turn or brake.

TABLE 3

RECOMMENDED MINIMUM FLEXIBLE PAVEMENT SECTION

Paved Area	Compacted Select Structural Fill	Graded Aggregate Base Course (FDOT SSRBC Section 204) or Limerock Base Course (FDOT SSRBC Sections 200 and 911)	Asphalt (FDOT SSRBC Section 334)
Automobile Parking Areas	As required - 12 inches minimum (95% of ASTM D 1557)	6 inches (100% Modified Proctor Density-ASTM D1557)	2.0 inches Type SP-12.5 (92% of lab max SG per FM 1-T209)
Medium Duty Access Drives	As required - 12 inches minimum (95% of ASTM D 1557)	6 inches (100% Modified Proctor Density-ASTM D1557)	3.5 inches Type SP-12.5 (92% of lab max SG per FM 1-T209)
Heavy Duty Access Drives	As required - 12 inches minimum (95% of ASTM D 1557)	10 inches (100% Modified Proctor Density-ASTM D1557)	5.25 inches Type SP-12.5 (92% of lab max SG per FM 1-T209)

Note 1: Crushed Aggregate Base or Limerock Base Course should extend at least one (1) foot beyond edge of pavement area
Note 2: Select Structural Fill should extend at least one (1) foot beyond edge of aggregate surfacing

7.2 Rigid Concrete Pavements

Asphalt pavements are not recommended in heavy truck traffic areas due to the potential for rutting and shoving, particularly during periods of extreme summer heat. Rigid pavements are recommended specifically in areas where frequent maneuvering (i.e., turning and braking) of truck traffic is expected. Rigid pavements will provide better distribution of surface loads to the subgrade without causing deformation of the paved surface.

Proper finishing of concrete pavement requires the use of appropriate construction joints to reduce cracking. Construction joints should be designed in accordance with the current Portland Cement

Association and the American Concrete Institute guidelines. Joints should be sealed to reduce the potential for water infiltration into the supporting soils. Rigid concrete pavements should be constructed with load transfer mechanisms between panels.

Rigid pavements should be designed and constructed in accordance with applicable FDOT specifications. Concrete pavements should be constructed in accordance with FDOT specifications Section 350. The concrete for pavements should meet FDOT specifications Section 346, Class I (Pavement) concrete having a minimum 28-day compressive strength of 3,000 psi. Limerock Base should be placed and compacted per FDOT specifications Section 200 with the material meeting FDOT specifications section 911.

TABLE 4

RECOMMENDED MINIMUM RIGID PAVEMENT SECTION

Paved Area	Compacted Select Structural Fill	Graded Aggregate Base Course (FDOT SSRBC Section 204) or Limerock Base Course (FDOT SSRBC Sections 200 and 911)	Cement Concrete (FDOT SSRBC Section 346, Class I (Pavement) Concrete – 3,000 psi)
Light Duty/ Automobile Parking Areas	As required - 12 inches minimum (95% of ASTM D 1557)	4 inches (100% Modified Proctor Density-ASTM D1557)	6 inches
Medium Duty Access Drives	As required - 12 inches minimum (95% of ASTM D 1557)	4 inches (100% Modified Proctor Density-ASTM D1557)	7 inches
Heavy Duty Access Drives	As required - 12 inches minimum (95% of ASTM D 1557)	6 inches (100% Modified Proctor Density-ASTM D1557)	8 inches

Note 1: Crushed Aggregate Base or Limerock Base Course should extend at least one (1) foot beyond edge of pavement area
Note 2: Select Structural Fill should extend at least one (1) foot beyond edge of aggregate surfacing

7.3 Pavement Subgrade Preparation

Subgrade preparation and structural fill requirements for pavement areas should generally be the same as described in previous sections of this report for the building areas to include complete removal of all topsoil, organics, and debris. At a minimum, regardless of final grades, excavations should extend to depths as required to completely remove all topsoil, surface organics or otherwise unsuitable material and to allow placement of at least 12 inches of compacted Select Structural Fill (insitu or imported) beneath final pavement subgrade elevation.

Excavation bottoms should be leveled and compacted to at least 95 percent of the soil's Modified Proctor maximum dry density as determined by ASTM D1557. Any soft, loose or yielding areas should be undercut to firmer materials and backfilled with well compacted fill. Imported fill soils should be consistent with the fill material recommendation for the building area.

7.4 Moisture Control

One of the most destructive elements that a pavement will be subjected to in its design lifetime is the presence of excess moisture. The pavement sections presented in the following sections of this report are based on the assumption that effective site and subgrade drainage will be established and maintained during construction and throughout the design life of the pavement.

Pavements should be adequately sloped, and sufficient drainage provided such that excess water is allowed to run off before it can migrate into the pavement system. Sprinkler systems, if utilized in landscaped areas, should be properly installed and aimed such that they do not continually wet the paved surfaces. The use of silty and clayey soils as backfill in nonstructural landscape islands and areas adjacent to pavements may be considered to help reduce moisture infiltration of rainfall and irrigation water into subgrade soils.

8.0 PROPOSED DETENTION POND AREAS

Based on our correspondence, we understand that the pond bottom is planned to be 4 to 6 feet below existing grade. This depth corresponds closely to or is below the groundwater level encountered at the time of our exploration. The following information is provided for consideration by the designers during project planning.

The test locations within the pond area encountered groundwater at depths of approximately 3 to 4 feet below the existing ground surface at the time of our investigation. Water levels fluctuate over time and seasonally with climate and rainfall and can be influenced by changes in the water levels in neighboring

water bodies. Construction and development activities can result in temporary or permanent changes to groundwater levels and flow patterns.

Beneath the upper 8 to 30 inches of topsoil and surface organics, soils consist of silty sands (SM) to approximately 4 feet below existing ground surface followed by sands with silt (SP-SM). Laboratory permeability tests were performed on remolded soil samples obtained from the upper 8 feet of the soil borings within the proposed detention system area to estimate hydraulic conductivity or permeability. Permeability testing was performed on samples remolded to a medium dense state to simulate as closely as possible the insitu soil characteristics. Results of the permeability tests can be seen below in **Table 5.**

TABLE 5

RE-MOLDED CONSTANT HEAD-RIGID WALL PERMEABILITY TEST RESULTS

Soil Test Location	Sample Depth (ft)	Soil Description	Saturated Vertical Hydraulic Conductivity K (cm/sec)
S-1	2.5 – 4.0	Tan Silty Sand	2.2×10^{-3}
S-2	2.0 – 4.0	Tan Sand with Silt	6.6×10^{-3}
S-2	4.0 – 6.0	Tan Sand with Silt	9.2×10^{-3}
S-3	2.0 – 4.0	Brown Silty Sand	3.3×10^{-3}
S-3	4.0 – 6.0	Brown Sand with Silt	1.2×10^{-2}
S-3	6.0 – 8.0	Dark Brown and Black Sand with Silt	1.0×10^{-2}

These results are laboratory test data only. The detention designer should consider the groundwater level, appropriate design manuals, design criteria and laboratory test data for the basis of their design. These permeability values are approximate and should be used with an appropriate factor of safety. The permeability values should not be considered the infiltration rate. The infiltration rate is a 3-dimensional

phenomenon dependent upon numerous factors including system geometry, depth of water, drainage of the surrounding vicinity, vertical and horizontal infiltration rates, groundwater mounding, and other factors.

9.0 GENERAL COMMENTS AND LIMITATIONS

While the Manual Auger Borings, CPT Soundings and soil borings with SPT are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and may be encountered. The delineation between soil types shown on the logs is approximate and the description represents our interpretation of subsurface conditions at the designated test locations and on the particular date explored.

This report has been prepared in order to aid in the evaluation of this project and to assist the engineers in the project planning and structural design. At the time of writing, changes were still being considered to site grading and other aspects of the project that could have a significant impact on the applicability or relevance of the recommendations provided in this report. SESI should be consulted as the design process continues to ensure that the recommendations provided in this report are still applicable, and that they are being properly interpreted.

This report is intended for use with regard to the specific project discussed herein as we understand it at this time, and any substantial changes in the project, loads, locations, or assumed grades should be brought to our attention so that we may determine how such changes may affect our conclusions and recommendations. We would appreciate the opportunity to review the plans and specifications for construction to ensure that our conclusions and recommendations are interpreted correctly.

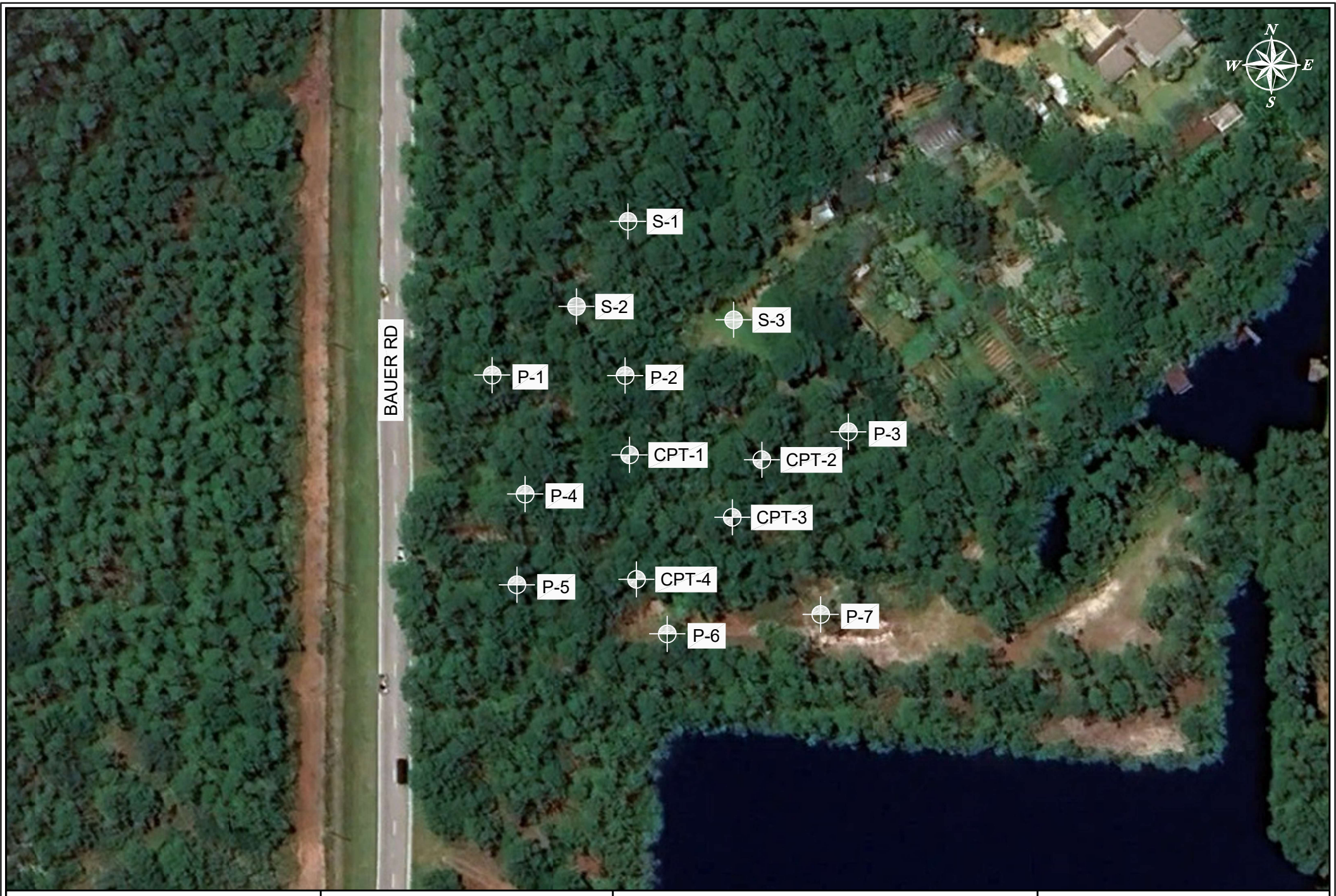
Professional judgments on design alternatives and criteria are presented in this report. These are based partly on our evaluations of technical information gathered, partly on our understanding of the characteristics of the project being planned, and partly on our general experience with subsurface conditions in the area. We do not guarantee performance of the project in any respect, only that our engineering work and judgments rendered meet the standard of care of our profession.

The Geotechnical Engineer of Record should be retained by the Owner in the construction phase of the project so they can observe subsurface conditions revealed during construction, confirm that design assumptions are still applicable or provide revised recommendations based on conditions encountered during construction, and to help ensure that our recommendations are properly interpreted. We

recommend that Southern Earth Sciences, Inc. be retained to perform observation and field-testing services during the site preparation and foundation construction.

APPENDIX 1

Test Location Plans



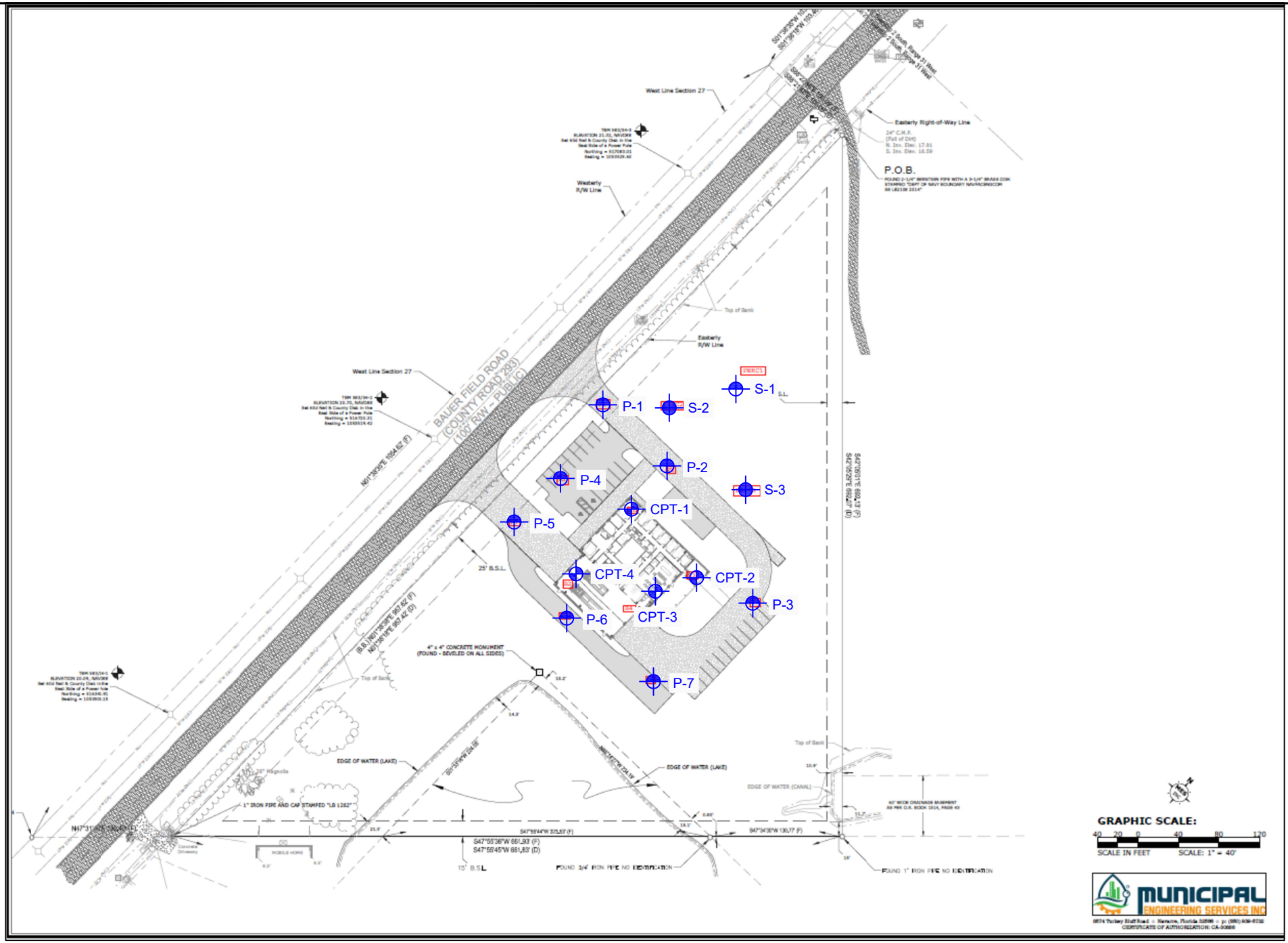
NOT TO SCALE

- HAND AUGER
- CPT SOUNDING
- SOIL TEST BORING

PARADISE BEACH FIRE STATION
ESCAMBIA COUNTY, FL

SOUTHERN EARTH SCIENCES
Geotechnical | Environmental | Materials Testing

TEST LOCATION PLAN
SESI JOB #: M26-078



NOT TO SCALE

- HAND AUGER
- CPT SOUNDING
- SOIL TEST BORING

PARADISE BEACH FIRE STATION
ESCAMBIA COUNTY, FL

SOUTHERN EARTH SCIENCES
Geotechnical | Environmental | Materials Testing

TEST LOCATION PLAN
SESI JOB #: M26-078

APPENDIX 2

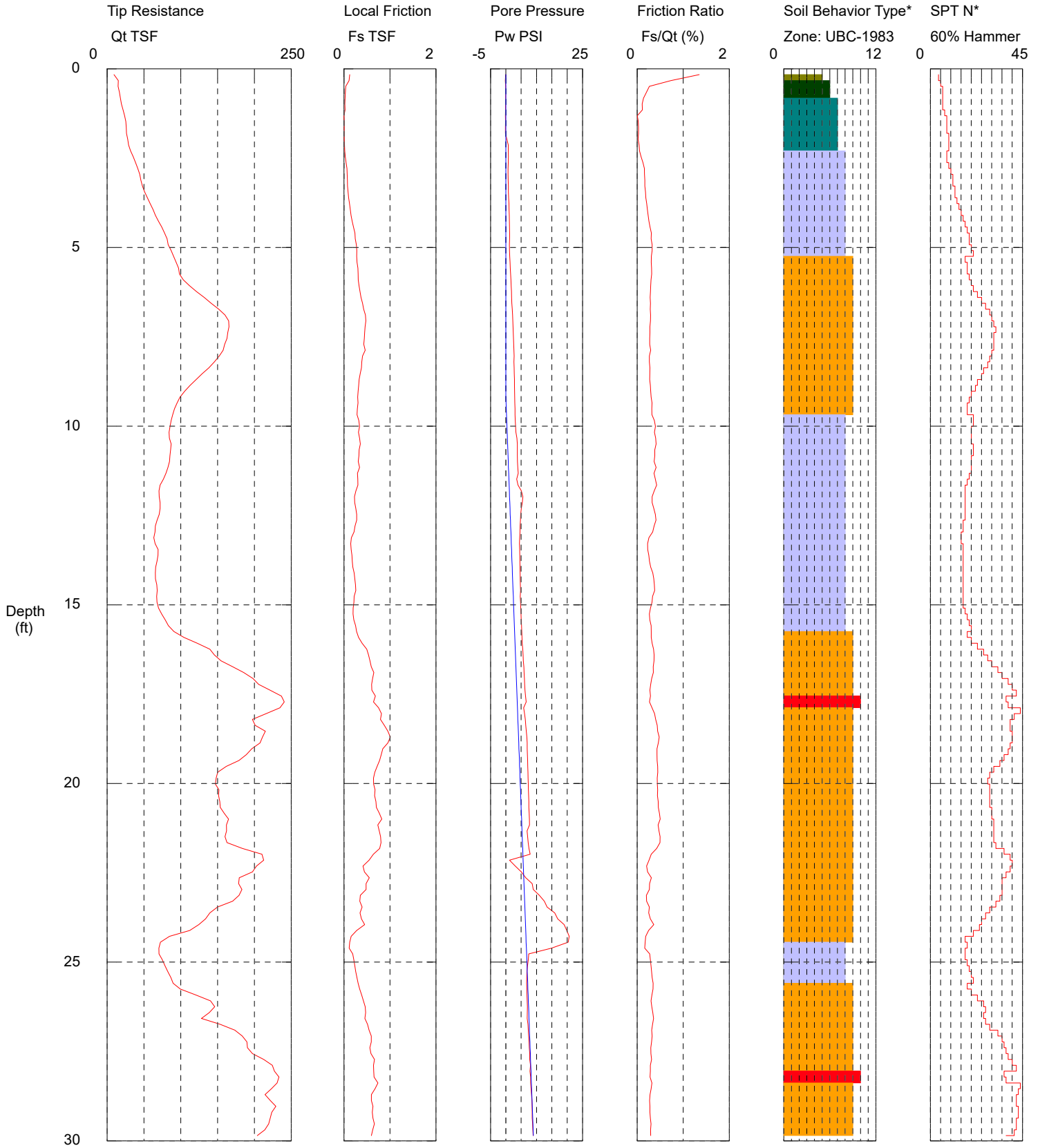
CPT Soundings

Soil Boring Logs

Southern Earth Sciences

Operator: D. Harris
Sounding: CPT-1
Cone Used: DDG1294
GPS Data: N30.38910 W087.40159

CPT Date/Time: 2/18/2026 10:07:37 AM
Location: Paradise Beach Fire Department
Job Number: M26-078
Groundwater: Collapsed and dry at 2.9-ft.



Maximum Depth = 30.18 feet

Depth Increment = 0.164 feet

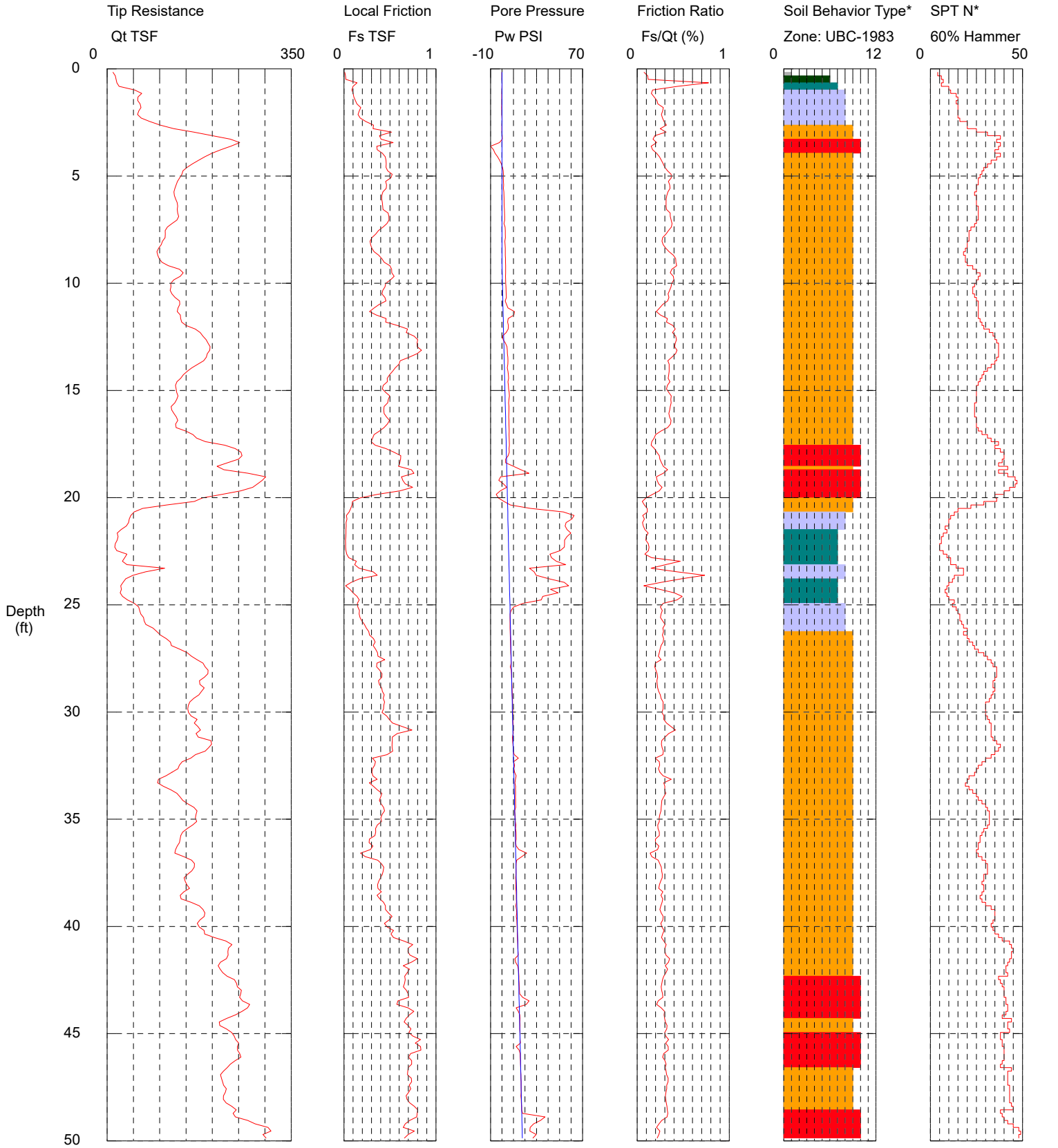
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Southern Earth Sciences

Operator: D. Harris
Sounding: CPT-2
Cone Used: DDG1294
GPS Data: N30.38909 W087.40127

CPT Date/Time: 2/18/2026 9:24:45 AM
Location: Paradise Beach Fire Department
Job Number: M26-078
Groundwater: Collapsed and dry at 3.0-ft.



Maximum Depth = 50.20 feet

Depth Increment = 0.164 feet

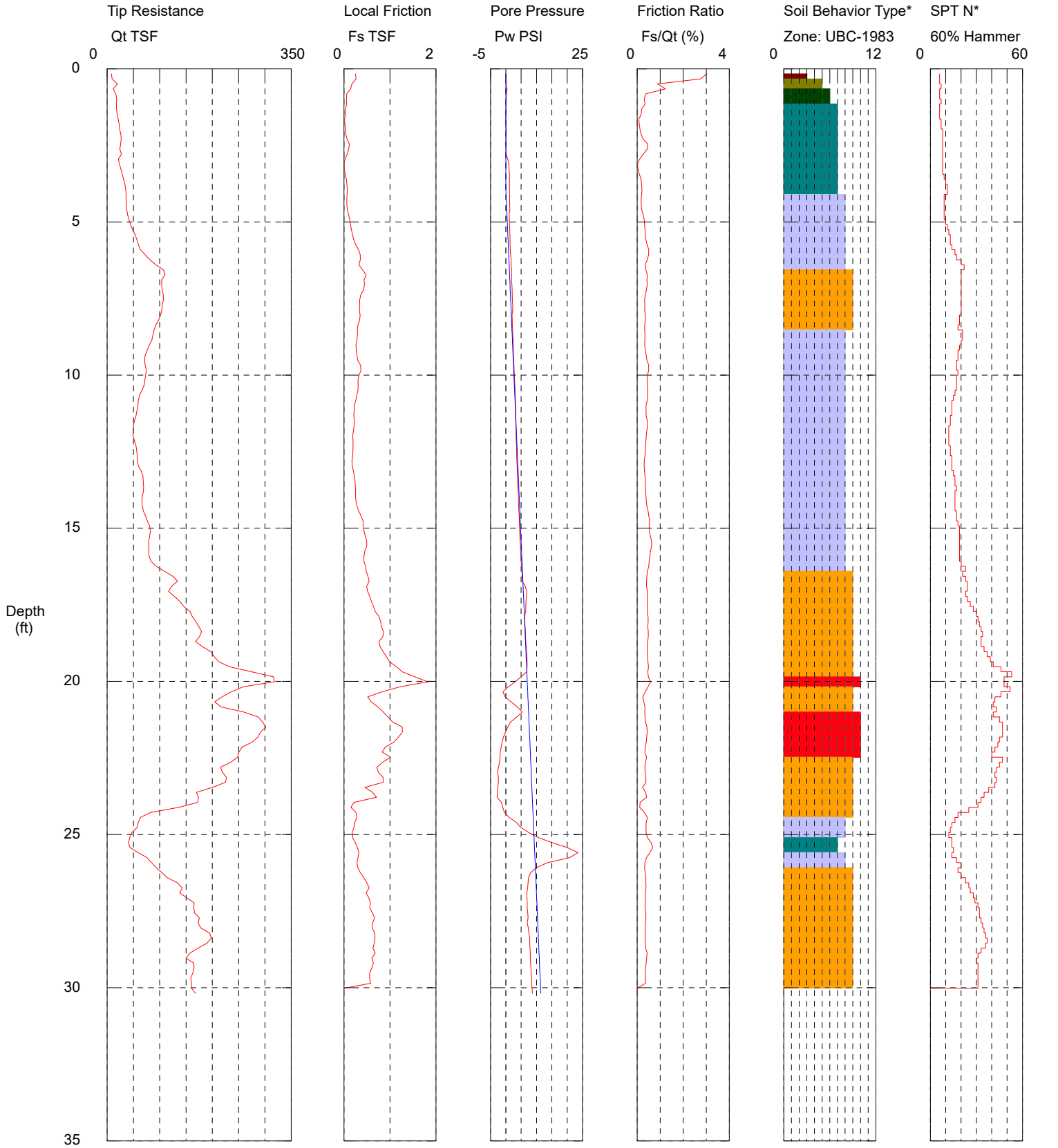
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Southern Earth Sciences

Operator: D. Harris
Sounding: CPT-3
Cone Used: DDG1294
GPS Data: N30.38897 W087.40134

CPT Date/Time: 2/18/2026 8:54:06 AM
Location: Paradise Beach Fire Department
Job Number: M26-078
Groundwater: Encountered at 3.5-ft.



Maximum Depth = 30.18 feet

Depth Increment = 0.164 feet

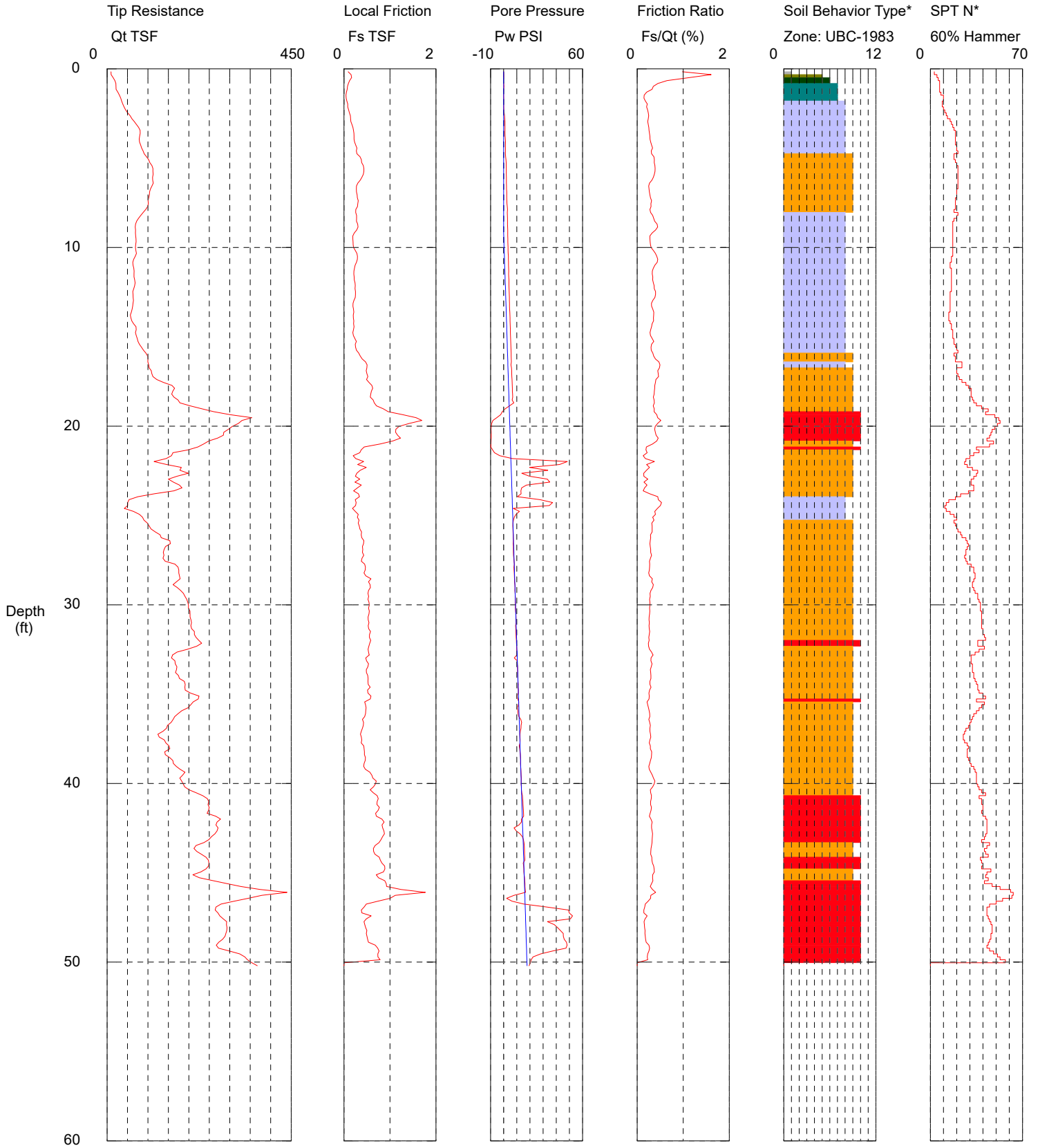
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Southern Earth Sciences

Operator: D. Harris
Sounding: CPT-4
Cone Used: DDG1294
GPS Data: N30.38884 W087.40157

CPT Date/Time: 2/18/2026 8:07:16 AM
Location: Paradise Beach Fire Department
Job Number: M26-078
Groundwater: Collapsed and dry at 3-ft.



Maximum Depth = 50.20 feet

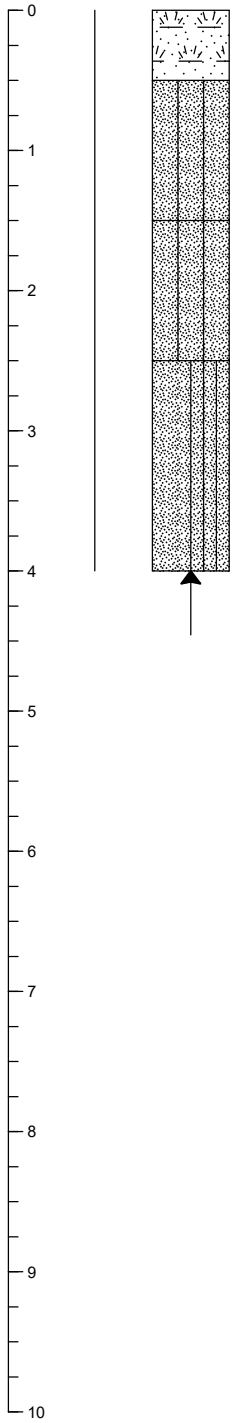
Depth Increment = 0.164 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

SOIL BORING LOG

BORING NO.: P-1
PROJECT: PARADISE BEACH FD
PROJECT NO.: M26-078
PROJECT LOCATION: PENSACOLA, FL
METHOD: HAND AUGER
BORING LOCATION: SEE TEST LOCATION PLAN
BORING ELEVATION: EXISTING GROUND
DATE DRILLED: 02/18/26
DATE COMPLETED: 02/18/26
WATER LEVEL: NOT ENCOUNTERED
WATER LEVEL DATE: 02/18/26
GEOL / ENGR: E. BILLEAUD
DRILLER: B. PEARS



Elevation / Depth	Soil Symbols Sampler Symbols and Field Test Data	USCS	Description
			TOPSOIL with Roots
		SM	Brown and Gray Silty SAND with Roots
		SM	Brown Silty SAND with Roots
		SP-SM	Tan SAND with Silt

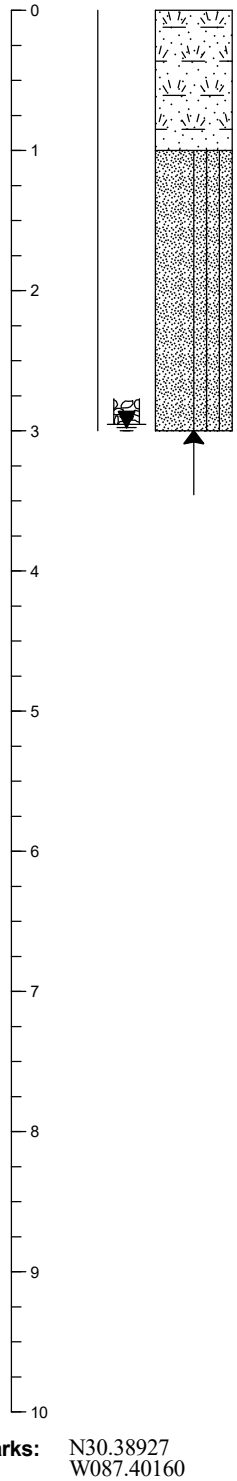
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SES SOUTHERN EARTH SCIENCES

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SOIL BORING LOG

BORING NO.: P-2
PROJECT: PARADISE BEACH FD
PROJECT NO.: M26-078
PROJECT LOCATION: PENSACOLA, FL
METHOD: HAND AUGER
BORING LOCATION: SEE TEST LOCATION PLAN
BORING ELEVATION: EXISTING GROUND
DATE DRILLED: 02/18/26
DATE COMPLETED: 02/18/26
WATER LEVEL: 3 ft
WATER LEVEL DATE: 02/18/26
GEOL / ENGR: E. BILLEAUD
DRILLER: B. PEARS

Elevation / Depth	Soil Symbols Sampler Symbols and Field Test Data	USCS	Description
0			TOPSOIL with Roots
1		SP-SM	Dark Tan SAND with Silt
2			
3			
4			
5			
6			
7			
8			
9			
10			

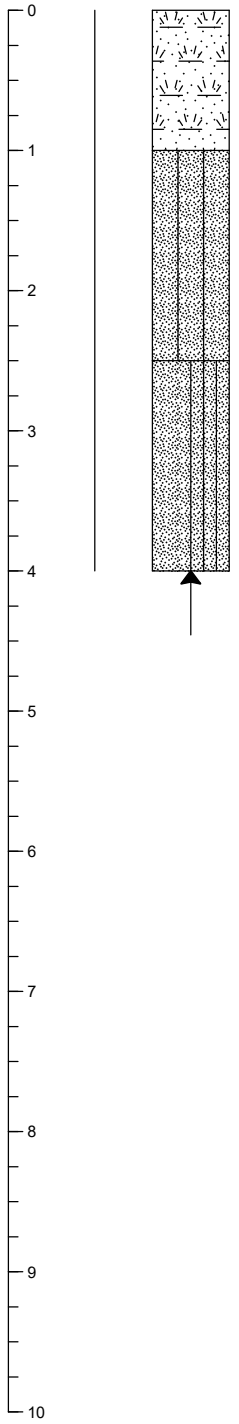
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SOIL BORING LOG

BORING NO.: P-3
PROJECT: PARADISE BEACH FD
PROJECT NO.: M26-078
PROJECT LOCATION: PENSACOLA, FL
METHOD: HAND AUGER
BORING LOCATION: SEE TEST LOCATION PLAN
BORING ELEVATION: EXISTING GROUND
DATE DRILLED: 02/18/26
DATE COMPLETED: 02/18/16
WATER LEVEL: NOT ENCOUNTERED
WATER LEVEL DATE: 02/18/26
GEOL / ENGR: E. BILLEAUD
DRILLER: B. PEARS



Elevation / Depth	Soil Symbols Sampler Symbols and Field Test Data	USCS	Description
			TOPSOIL with Roots
		SM	Gray and Brown Silty SAND
		SP-SM	Tan SAND with Silt

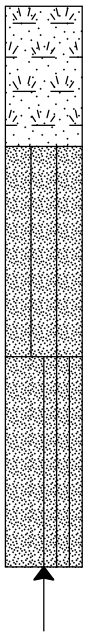
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SES SOUTHERN EARTH SCIENCES

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SOIL BORING LOG

BORING NO.: P-4
PROJECT: PARADISE BEACH FD
PROJECT NO.: M26-078
PROJECT LOCATION: PENSACOLA, FL
METHOD: HAND AUGER
BORING LOCATION: SEE TEST LOCATION PLAN
BORING ELEVATION: EXISTING GROUND
DATE DRILLED: 02/18/26
DATE COMPLETED: 02/18/26
WATER LEVEL: NOT ENCOUNTERED
WATER LEVEL DATE: 02/18/26
GEOL / ENGR: E. BILLEAUD
DRILLER: B. PEARS

Elevation / Depth	Soil Symbols Sampler Symbols and Field Test Data	USCS	Description
0			TOPSOIL with Roots
1		SM	Brown Silty SAND with Roots
2			
3		SP-SM	Tan SAND with Silt with Traces of Roots
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5			
6			
7			
8			
9			
10			

Remarks: N30.38902
W087.40184

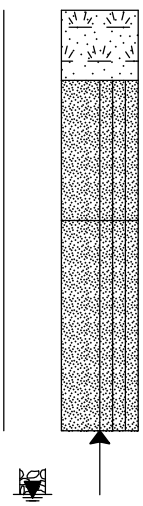
SES SOUTHERN EARTH SCIENCES

GEOLOG WITH PI 40SIEVE GFLIBRARY DSM REV7-6-21.GLB SO_EARTH.GDT F:\PROJECTS\JOB FOLDERS\2026\26-078 PARADISE BEACH FIRE STATION\GINT\M26-078 SOIL BORING LOGS.GPJ 4/2/26

SOIL BORING LOG

BORING NO.: P-5
PROJECT: PARADISE BEACH FD
PROJECT NO.: M26-078
PROJECT LOCATION: PENSACOLA, FL
METHOD: HAND AUGER
BORING LOCATION: SEE TEST LOCATION PLAN
BORING ELEVATION: EXISTING GROUND
DATE DRILLED: 02/18/26
DATE COMPLETED: 02/18/26
WATER LEVEL: 3.5 ft
WATER LEVEL DATE: 02/18/26
GEOL / ENGR: E. BILLEAUD
DRILLER: B. PEARS

Elevation / Depth	Soil Symbols Sampler Symbols and Field Test Data	USCS	Description
0			TOPSOIL with Roots
		SP-SM	Dark Tan SAND with Silt with Traces of Roots
1			
2		SP-SM	Light Tan SAND with Silt
3			
4			
5			
6			
7			
8			
9			
10			



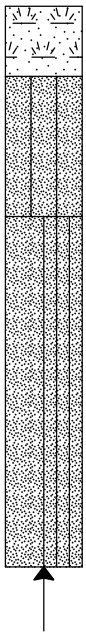
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SES SOUTHERN EARTH SCIENCES

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SOIL BORING LOG

BORING NO.: P-6
PROJECT: PARADISE BEACH FD
PROJECT NO.: M26-078
PROJECT LOCATION: PENSACOLA, FL
METHOD: HAND AUGER
BORING LOCATION: SEE TEST LOCATION PLAN
BORING ELEVATION: EXISITNG GROUND
DATE DRILLED: 02/18/26
DATE COMPLETED: 02/18/26
WATER LEVEL: NOT ENCOUNTERED
WATER LEVEL DATE: 02/18/26
GEOL / ENGR: E. BILLEAUD
DRILLER: B. PEARS

Elevation / Depth	Soil Symbols Sampler Symbols and Field Test Data	USCS	Description
0			TOPSOIL with Roots
1		SM	Brown Silty SAND
2		SP-SM	Tan SAND with Silt
3			
4			
5			
6			
7			
8			
9			
10			

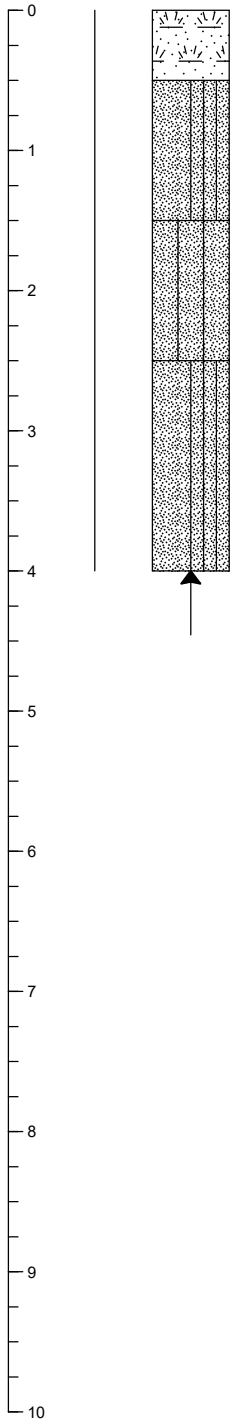
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SES SOUTHERN EARTH SCIENCES

GEOLOG WITH PI 40SIEVE GFLIBRARY DSM REV7-6-21.GLB SO_EARTH.GDT F:\PROJECTS\JOB FOLDERS\2026\26-078 PARADISE BEACH FIRE STATION\GINT\M26-078 SOIL BORING LOGS.GPJ 4/2/26

SOIL BORING LOG

BORING NO.: P-7
PROJECT: PARADISE BEACH FD
PROJECT NO.: M26-078
PROJECT LOCATION: PENSACOLA, FL
METHOD: HAND AUGER
BORING LOCATION: SEE TEST LOCATION PLAN
BORING ELEVATION: EXISTING GROUND
DATE DRILLED: 02/18/26
DATE COMPLETED: 02/18/26
WATER LEVEL: NOT ENCOUNTERED
WATER LEVEL DATE: 02/18/26
GEOL / ENGR: E. BILLEAUD
DRILLER: B. PEARS



Elevation / Depth	Soil Symbols Sampler Symbols and Field Test Data	USCS	Description
			TOPSOIL with ROOTS
		SP-SM	Brown and Gray SAND with Silt
		SM	Dark Brown Silty SAND with Traces of Gravel
		SP-SM	Tan SAND with Silt

Remarks: N30.38877
W087.40113

SES SOUTHERN EARTH SCIENCES

GEOLOG WITH PI 40SIEVE GFLIBRARY DSM REV7-6-21.GLB SO_EARTH.GDT F:\PROJECTS\JOB FOLDERS\2026\26-078 PARADISE BEACH FIRE STATION\GINT\M26-078 SOIL BORING LOGS.GPJ 4/2/26

SOIL BORING LOG

BORING NO.: S-1
PROJECT: PARADISE BEACH FD
PROJECT NO.: M26-078
PROJECT LOCATION: PENSACOLA, FL
METHOD: HAND AUGER
BORING LOCATION: SEE TEST LOCATION PLAN
BORING ELEVATION: EXISTING GROUND
DATE DRILLED: 03/17/26
DATE COMPLETED: 03/17/26
WATER LEVEL: 3 ft
WATER LEVEL DATE: 03/17/26
GEOL / ENGR: E. BILLEAUD
DRILLER: B. PEARS

Elevation / Depth	Soil Symbols Sampler Symbols and Field Test Data	USCS	Description	Moist. %	LL %	PI %	% passing #200 / #40 sieve
0			TOPSOIL with Roots				
1							
2							
3		SM	Tan Silty SAND (Wet)	19.0	NP	NP	15 / 68
4							
5							
6							
7							
8							
9							
10							

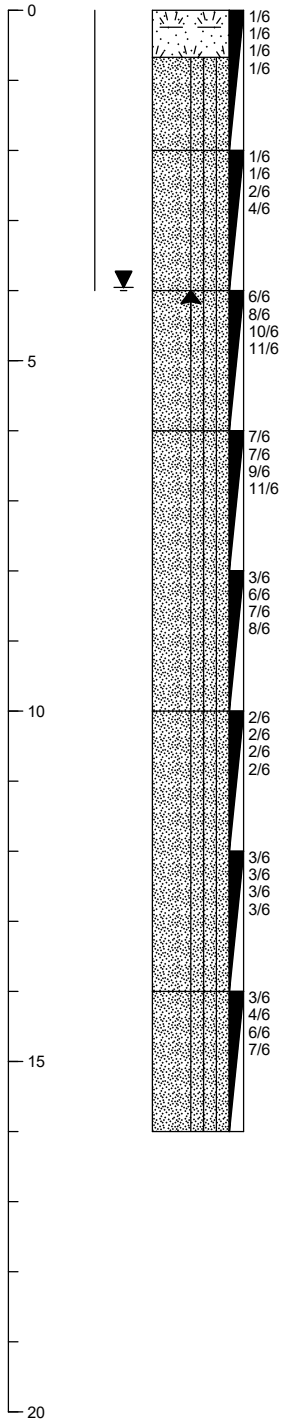
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SES SOUTHERN EARTH SCIENCES

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SOIL BORING LOG

BORING NO.: S-2
PROJECT: PARADISE BEACH FD
PROJECT NO.: M26-078
PROJECT LOCATION: PENSACOLA, FL
METHOD: CONTINOUS
BORING LOCATION: SEE TEST LOCATION PLAN
BORING ELEVATION: EXISTING GROUND
DATE DRILLED: 03/17/26
DATE COMPLETED: 03/17/26
WATER LEVEL: 4 ft
WATER LEVEL DATE: 03/17/26
GEOL / ENGR: E. BILLEAUD
DRILLER: B. PEARS



Elevation / Depth	USCS	Description	SPT N	Moist. %	LL %	PI %	% passing #200 / #40 sieve
		8" TOPSOIL					
	SP-SM	Very Loose Tan SAND with Silt	2				
	SP-SM	Very Loose Tan SAND with Silt	3	16.7	NP	NP	12 / 74
	SP-SM	Medium Dense Tan SAND with Silt	18	16.1	NP	NP	10 / 62
	SP-SM	Medium Dense Dark Brown SAND with Silt	16				
			13				
	SP-SM	Very Loose to Loose Dark Brown SAND with Silt	4				
			6				
	SP-SM	Loose Dark Brown SAND with Silt	10				

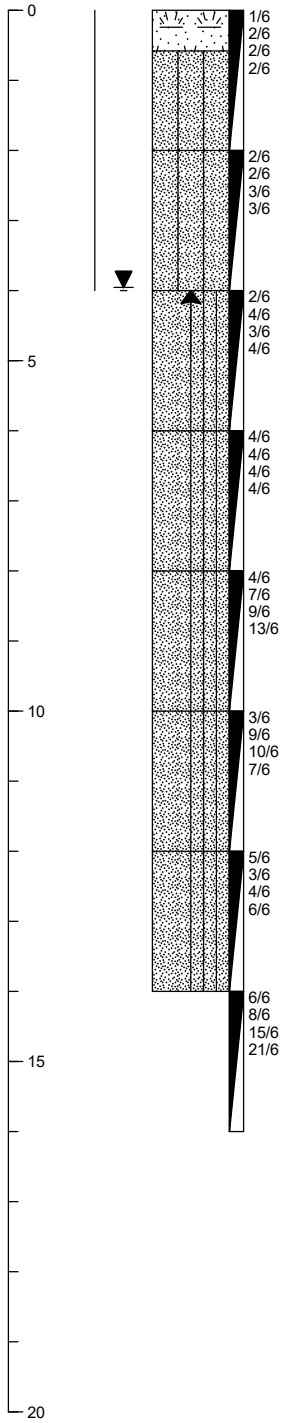
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SOUTHERN EARTH SCIENCES

GEOLOG WITH PI 40SIEVE GFLIBRARY DSM REV7-6-21.GLB SO_EARTH.GDT F:\PROJECTS\JOB FOLDERS\2026\26-078 PARADISE BEACH FIRE STATION\GINT\M26-078 SOIL BORING LOGS.GPJ 4/2/26

SOIL BORING LOG

BORING NO.: S-3
PROJECT: PARADISE BEACH FD
PROJECT NO.: M26-078
PROJECT LOCATION: PENSACOLA, FL
METHOD: CONTINOUS
BORING LOCATION: SEE TEST LOCATION PLAN
BORING ELEVATION: EXISTING GROUND
DATE DRILLED: 03/17/26
DATE COMPLETED: 03/17/26
WATER LEVEL: 4 ft
WATER LEVEL DATE: 03/17/26
GEOL / ENGR: E. BILLEAUD
DRILLER: B. PEARS



Elevation / Depth	USCS	Description	SPT N	Moist. %	LL %	PI %	% passing #200 / #40 sieve
		7" TOPSOIL					
	SM	Very Loose Brown Fine Silty SAND	4				
	SM	Loose Brown Silty SAND (Wet)	5	16.1	NP	NP	14 / 70
	SP-SM	Loose Brown SAND with Silt	7	19.5	NP	NP	7 / 63
	SP-SM	Loose Dark Brown and Black SAND with Silt	8	18.6	NP	NP	8 / 70
	SP-SM	Medium Dense Dark Brown and Black SAND with Silt	16				
	SP-SM	Medium Dense Dark Brown SAND with Silt	19				
	SP-SM	Loose to Medium Dense Dark Brown SAND with Silt	7				
			23				

Remarks: N30.38938
W087.40134

SOUTHERN EARTH SCIENCES

GEOLOG WITH PI 40SIEVE GFLIBRARY DSM REV7-6-21.GLB SO_EARTH.GDT F:\PROJECTS\JOB FOLDERS\2026\26-078 PARADISE BEACH FIRE STATION\GINT\M26-078 SOIL BORING LOGS.GPJ 4/2/26

APPENDIX 3

Laboratory Test Results

SOUTHERN EARTH SCIENCES
Geotechnical | Environmental | Materials Testing

Permability Test (Constant Head-Rigid Wall)

Project Name: Paradise Beach Fire Station

Project No: M26-078

Date: 3/24/2026

Sample:	S-2, S-3	Sample:	S-1, S-2	Sample:	S-3, S-4A	Sample:	S-2, S-2
Depth:	4.0'-6.0'	Depth:	2.5'-4.0'	Depth:	6.0'-8.0'	Depth:	2.0'-4.0'
Length (cm):	3.5	Length (cm):	4	Length (cm):	3.00	Length (cm):	3.50
Height (cm):	76.00	Height (cm):	76.00	Height (cm):	76.00	Height (cm):	76.00
Diameter (cm):	4.7	Diameter (cm):	4.7	Diameter (cm):	4.7	Diameter (cm):	4.7

	Q (cm^3)	t (sec)
	100	28
	200	56
	300	84
AVG	100	28

k= 9.2E-03 (cm/s)

	Q (cm^3)	t (sec)
	100	133
	200	266
	300	399
AVG	100	133

k= 2.2E-03 (cm/s)

	Q (cm^3)	t (sec)
	100	22
	200	43
	300	65
AVG	100	21.6667

k= 1.0E-02 (cm/s)

	Q (cm^3)	t (sec)
	100	40
	200	80
	300	117
AVG	100	39

k= 6.6E-03 (cm/s)

SOUTHERN EARTH SCIENCES
Geotechnical | Environmental | Materials Testing

Permability Test (Constant Head-Rigid Wall)

Project Name: Paradise Beach Fire Station Project No: M26-078

Date: 3/24/2026

Sample:	S-3, S-3	Sample:	S-3, S-2	Sample:		Sample:	
Depth:	4.0'-6.0'	Depth:	2.0'-4.0'	Depth:		Depth:	
Length (cm):	4	Length (cm):	3.4	Length (cm):		Length (cm):	
Height (cm):	76.00	Height (cm):	76.00	Height (cm):		Height (cm):	
Diameter (cm):	4.7	Diameter (cm):	4.7	Diameter (cm):		Diameter (cm):	

	Q (cm^3)	t (sec)
	100	24
	200	48
	300	72
AVG	100	24

k= 1.2E-02 (cm/s)

	Q (cm^3)	t (sec)
	100	76
	200	152
	300	228
AVG	100	76

k= 3.3E-03 (cm/s)

	Q (cm^3)	t (sec)
AVG		

k= (cm/s)

	Q (cm^3)	t (sec)
AVG		

k= (cm/s)

Laboratory Test Data Summary

SOUTHERN EARTH SCIENCES

Client: Forrest Daniell & Associates, PC | **Date:** 03/28/26

Project: Paradise Beach Fire Station | **Project No:** M26-078

Test Location	Sample	Sample Depth (ft)	USCS Classification	AASHTO Classification	Moisture Content (%)	Atterberg Limits		Passing No. 200 (%)	Passing No. 40 (%)
						LL	PI		
S-1	S-2	2.5-4.0	SM	A-2-4(0)	19.0	NV	NP	14.5	67.9
S-2	S-2	2.0-4.0	SP-SM	A-2-4(0)	16.7	NV	NP	11.6	74.4
S-2	S-3	4.0-6.0	SP-SM	A-3	16.1	NV	NP	10.1	61.5
S-3	S-2	2.0-4.0	SM	A-2-4(0)	16.1	NV	NP	14.4	69.6
S-3	S-3	4.0-6.0	SP-SM	A-3	19.5	NV	NP	6.9	63.0
S-3	S-4A	6.0-8.0	SP-SM	A-3	18.6	NV	NP	8.1	69.6

Particle Size Distribution Report

ASTM C136



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	32.1	53.4	14.5	

Test Results (ASTM C136)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/4"	100.0			
3/8"	100.0			
#4	100.0			
#10	100.0			
#40	67.9			
#100	16.3			
#200	14.5			

* (no specification provided)

Material Description

ORANGE SILTY SAND

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.8941 D_{85}= 0.7321 D_{60}= 0.3570
D_{50}= 0.3017 D_{30}= 0.2193 D_{15}= 0.1143
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Source of Sample: S-1 Depth: 2.5'-4.0'
Sample Number: S-2 Sample Date:

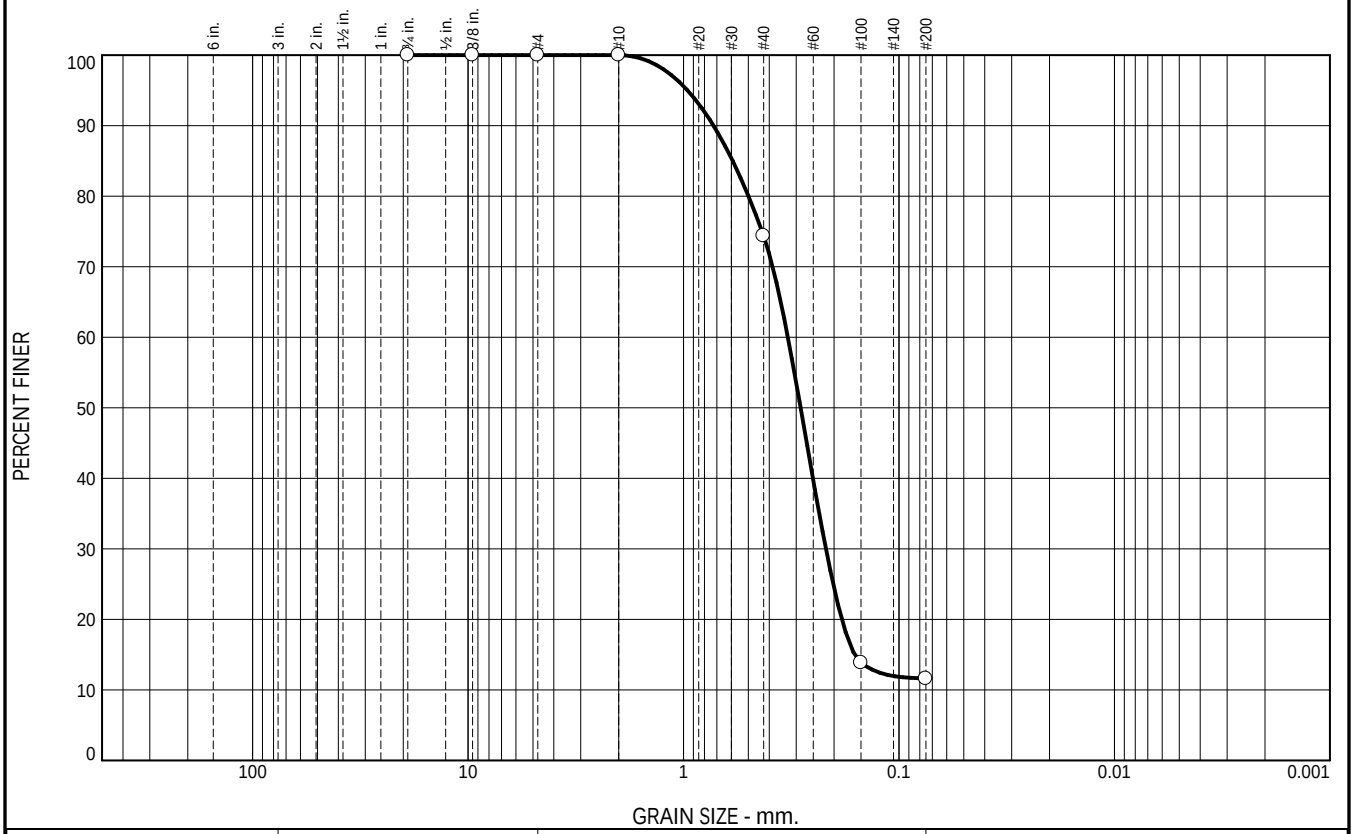
SOUTHERN EARTH SCIENCES
Mobile, Alabama

Client: FORREST DANIELL & ASSOCIATES, PC
Project: PARADISE BEACH FIRE STATION

Project No: M26-078 Figure

Particle Size Distribution Report

ASTM C136



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	25.6	62.8	11.6	

Test Results (ASTM C136)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/4"	100.0			
3/8"	100.0			
#4	100.0			
#10	100.0			
#40	74.4			
#100	13.8			
#200	11.6			

* (no specification provided)

Material Description

TAN SAND WITH SILT

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.7259 D_{85}= 0.5912 D_{60}= 0.3280
D_{50}= 0.2861 D_{30}= 0.2183 D_{15}= 0.1606
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO= A-2-4(0)

Test Remarks

Source of Sample: S-2 Depth: 2.0'-4.0'
Sample Number: S-2 Sample Date:

SOUTHERN EARTH SCIENCES
Mobile, Alabama

Client: FORREST DANIELL & ASSOCIATES, PC
Project: PARADISE BEACH FIRE STATION

Project No: M26-078 Figure

Particle Size Distribution Report

ASTM C136



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	38.5	51.4	10.1	

Test Results (ASTM C136)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/4"	100.0			
3/8"	100.0			
#4	100.0			
#10	100.0			
#40	61.5			
#100	11.3			
#200	10.1			

* (no specification provided)

Material Description

TAN SAND WITH SILT

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.9998 D_{85}= 0.8376 D_{60}= 0.4089
D_{50}= 0.3357 D_{30}= 0.2431 D_{15}= 0.1798
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO= A-3

Test Remarks

Source of Sample: S-2 Depth: 4.0'-6.0'
Sample Number: S-3 Sample Date:

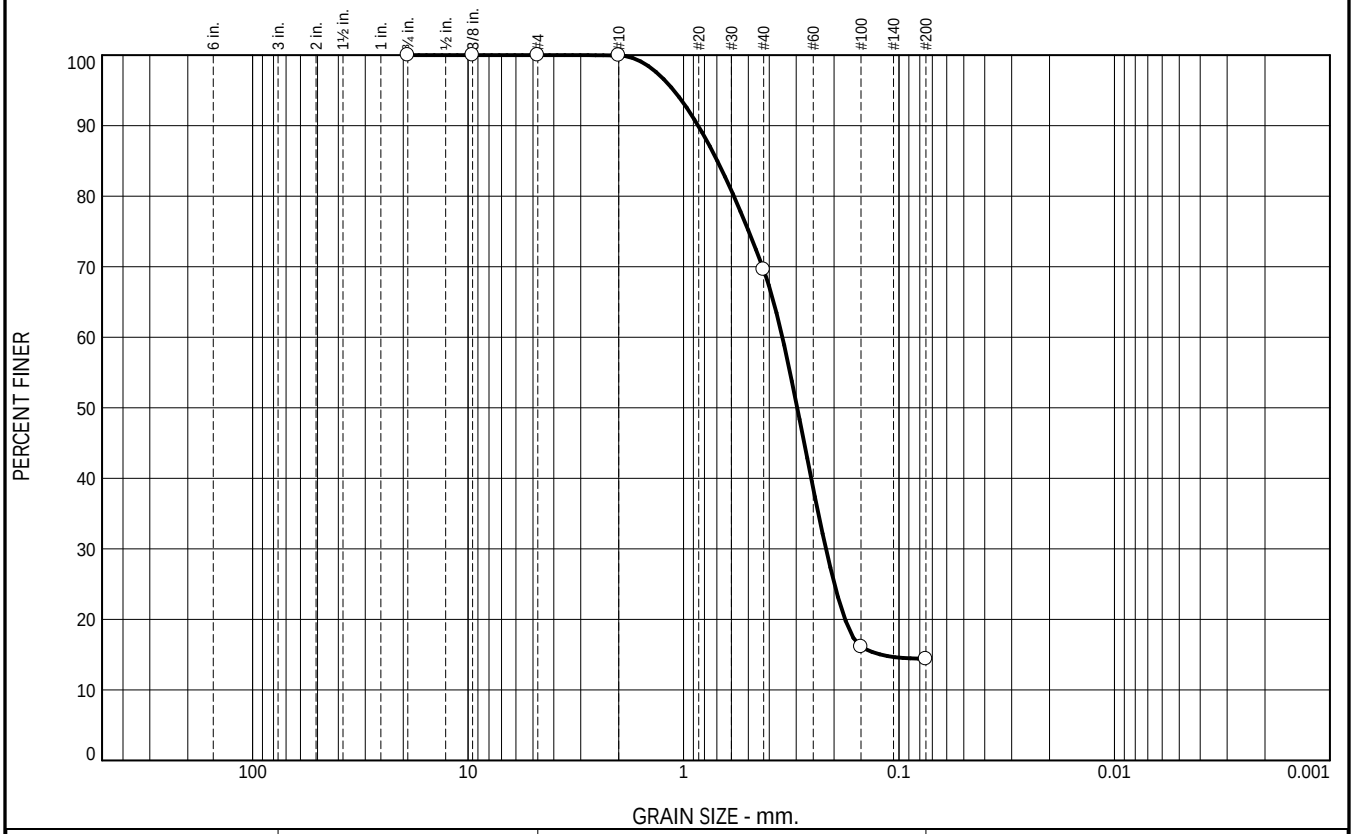
SOUTHERN EARTH SCIENCES
Mobile, Alabama

Client: FORREST DANIELL & ASSOCIATES, PC
Project: PARADISE BEACH FIRE STATION

Project No: M26-078 Figure

Particle Size Distribution Report

ASTM C136



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	30.3	55.2	14.4	

Test Results (ASTM C136)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/4"	100.0			
3/8"	100.0			
#4	100.0			
#10	99.9			
#40	69.6			
#100	16.1			
#200	14.4			

* (no specification provided)

Material Description

BROWN SILTY SAND

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.8555 D_{85}= 0.6969 D_{60}= 0.3478
D_{50}= 0.2966 D_{30}= 0.2182 D_{15}= 0.1212
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Source of Sample: S-3 Depth: 2.0'-4.0'
Sample Number: S-2 Sample Date:

SOUTHERN EARTH SCIENCES
Mobile, Alabama

Client: FORREST DANIELL & ASSOCIATES, PC
Project: PARADISE BEACH FIRE STATION

Project No: M26-078 Figure

Particle Size Distribution Report

ASTM C136



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	37.0	56.1	6.9	

Test Results (ASTM C136)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/4"	100.0			
3/8"	100.0			
#4	100.0			
#10	100.0			
#40	63.0			
#100	8.6			
#200	6.9			

* (no specification provided)

Material Description

TAN SAND WITH SILT

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.9643 D_{85}= 0.8034 D_{60}= 0.3963
D_{50}= 0.3314 D_{30}= 0.2457 D_{15}= 0.1891
D_{10}= 0.1638 C_u= 2.42 C_c= 0.93

Classification

USCS= SP-SM AASHTO= A-3

Test Remarks

Source of Sample: S-3 Depth: 4.0'-6.0'
Sample Number: S-3 Sample Date:

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Mobile, Alabama

Client: FORREST DANIELL & ASSOCIATES, PC
Project: PARADISE BEACH FIRE STATION

Project No: M26-078 Figure

Particle Size Distribution Report

ASTM C136



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	30.4	61.5	8.1	

Test Results (ASTM C136)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/4"	100.0			
3/8"	100.0			
#4	100.0			
#10	100.0			
#40	69.6			
#100	10.1			
#200	8.1			

* (no specification provided)

Material Description

TAN SAND WITH SILT

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.8295 D_{85}= 0.6786 D_{60}= 0.3529
D_{50}= 0.3049 D_{30}= 0.2325 D_{15}= 0.1801
D_{10}= 0.1486 C_u= 2.37 C_c= 1.03

Classification

USCS= SP-SM AASHTO= A-3

Test Remarks

Source of Sample: S-3 Depth: 6.0'-8.0'
Sample Number: S-4A Sample Date:

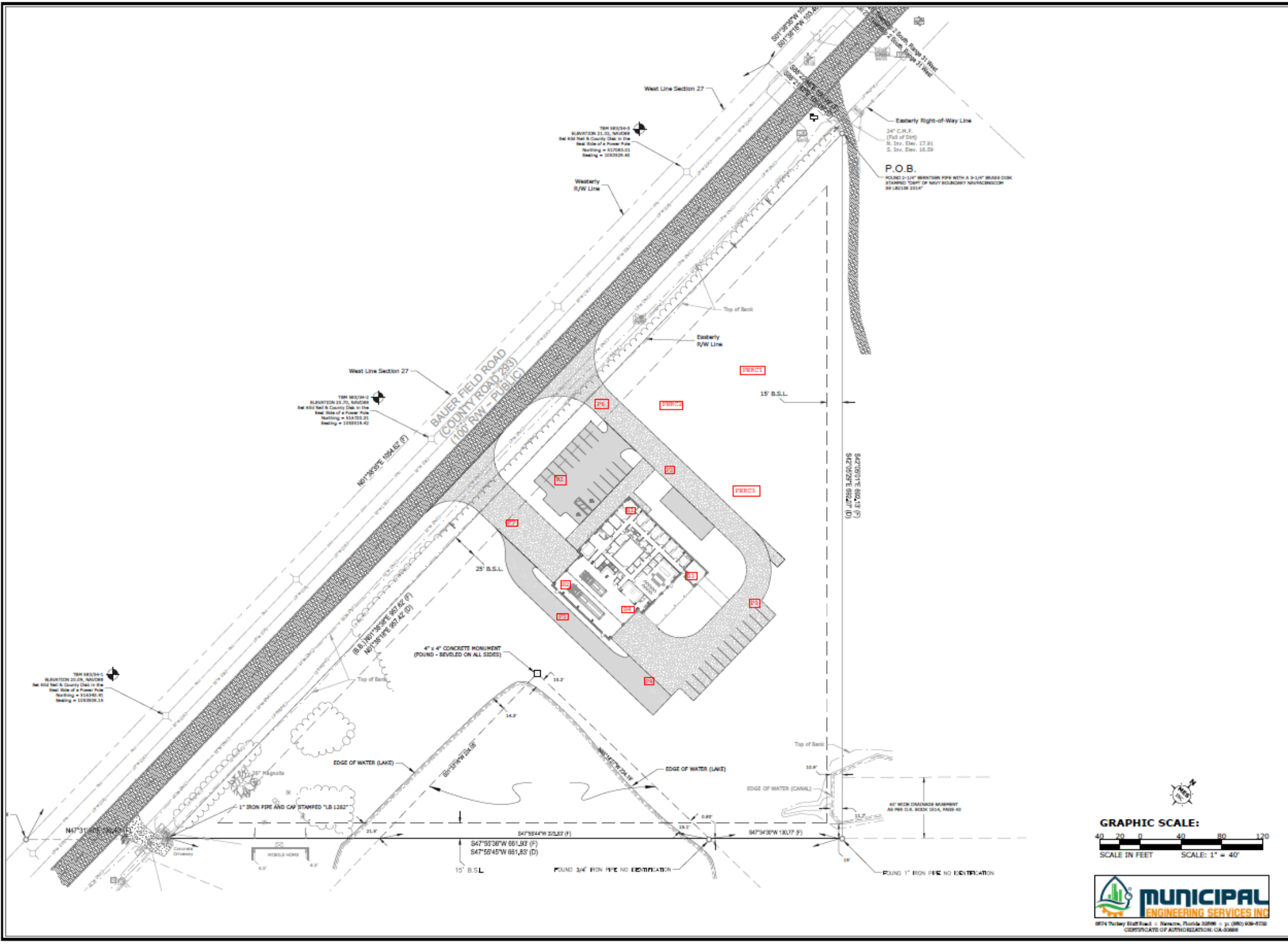
SOUTHERN EARTH SCIENCES
Mobile, Alabama

Client: FORREST DANIELL & ASSOCIATES, PC
Project: PARADISE BEACH FIRE STATION

Project No: M26-078 Figure

APPENDIX 4

Provided Plans



MUNICIPAL ENGINEERING SERVICES INC
8874 Turkey Bluff Road ○ Navarre, Florida 32566 ○ p: (850) 939-5732
CERTIFICATE OF AUTHORIZATION: CA-30866